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**ИНОСТРАННЫЙ ЯЗЫК
АНГЛИЙСКИЙ ЯЗЫК**

**ECONOMICS AND MANAGEMENT
FOR ENERGY ENTERPRISES**

Учебное пособие для I курса

**Санкт-Петербург
2026**

Министерство науки и высшего образования Российской Федерации

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«Санкт-Петербургский государственный университет

промышленных технологий и дизайна»

Высшая школа технологии и энергетики

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Утверждено Редакционно-издательским советом ВШТЭ СПбГУПТД

Санкт-Петербург
2026

УДК 802.0 (075)
ББК 81.2 Англ я7
К 947

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К 947 Иностранный язык. Английский язык: Economics and Management for Energy Enterprises: учебное пособие для I курса / В. А. Кустова, В. В. Кириллова, М. А. Васильева. — СПб.: ВШТЭ СПбГУПТД, 2026. — 202 с.
ISBN 978-5-91646-500-6

Учебное пособие соответствует программам и учебным планам дисциплины «Иностранный язык. Английский язык» для студентов, обучающихся по направлению подготовки 13.03.01 «Теплоэнергетика и теплотехника», профиль «Экономика и управление на предприятиях энергетики».

Пособие содержит 16 уроков с текстами для устного и письменного перевода, лексико-грамматическими и коммуникативными заданиями по темам I и II семестров, а также приложение с грамматическими таблицами и дополнительными упражнениями.

Учебное пособие предназначено для студентов 1 курса бакалавриата очной формы обучения.

УДК 802.0 (075)
ББК 81.2 Англ я 7

ISBN 978-5-91646-500-6

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ВВЕДЕНИЕ

Учебное пособие предназначено для студентов 1 курса очной формы обучения, обучающихся по программе бакалавриата по направлению подготовки 13.03.01 «Теплоэнергетика и теплотехника», профиль «Экономика и управление на предприятиях энергетики», соответствует государственному образовательному стандарту и требованиям программы по иностранным языкам для неязыковых вузов.

Учебное пособие охватывает темы I и II семестров, состоит из 16 уроков с текстами для устного и письменного перевода. К каждому уроку прилагается глоссарий, лексико-грамматические задания и упражнения, которые направлены на развитие коммуникативных навыков. Пособие также содержит грамматические таблицы и дополнительные упражнения для отработки полученных знаний.

ENTRY DIAGNOSTIC TEST

20–25 minutes. This test is not graded. Its purpose is to identify the grammar, reading and writing topics that may need additional revision at the beginning of the course.

A. Say the English alphabet and read the words aloud.

basic, data, line, total, unit, factory, energy, efficient

B. Read the text and answer the questions.

A small factory produces pumps. It has three workshops and employs sixty people. Engineers usually check the equipment every morning. At the moment, they are testing a new digital monitoring system. Last year, the company installed two energy-efficient machines. The managers believe that the new system will reduce energy costs. All employees must follow safety rules, and only trained operators can use the new equipment.

1. What does the factory produce?
2. What are the engineers testing at the moment?
3. What did the company install last year?
4. Who can use the new equipment?

C. Choose the correct form.

1. I **am** / **is** a first-year student.
2. The factory **has** / **have** several departments.
3. Engineers usually **check** / **are checking** the equipment every morning.
4. At the moment, the technicians **test** / **are testing** a new machine.
5. The company **installed** / **has installed** a new production line last year.
6. The new system **will reduce** / **reduces** energy costs next year.
7. The factory **has used** / **used** digital meters since 2024.
8. Trained operators **can use** / **can to use** this equipment.
9. All employees **must follow** / **must to follow** the safety rules.
10. The new machine is **more efficient** / **efficienter** than the old one.
11. This is **the most reliable** / **more reliable** system in the factory.

D. Put the words in the correct order.

1. factory / an organised system / is / a
2. every day / the factory / energy / uses
3. are testing / the engineers / a new machine / now
4. when / the company / did / install / the new line
5. operators / can / this equipment / use

E. Translate the sentences into English.

1. Завод использует энергию каждый день.
2. Сейчас инженеры проверяют новое оборудование.
3. В прошлом году компания установила новую производственную линию.
4. Работники должны соблюдать правила безопасности.
5. Новая машина более эффективна, чем старая.

F. Write four short sentences about your university, department or course.

Use:

- the Present Simple;
- one other tense;
- one modal verb;
- one comparative form.

LESSON 1. A FACTORY AND ITS RESOURCES

Discuss the questions before reading the text.

- Is a factory only a building?
- What people and departments are there in a factory?
- What resources does a factory need for its work?

1. Vocabulary for the lesson.

area (n)	'eəriə	зона, участок
available (adj)	ə'veɪləbəl	доступный, имеющийся
basic (adj)	'beɪsɪk	основной, базовый
boiler room (n)	'bɔɪlə ru:m	котельная
building (n)	'bɪldɪŋ	здание
control room (n)	kən'trəʊl ru:m	диспетчерская, помещение управления
costs (n pl)	kɒsts	затраты, издержки
data (n pl)	'deɪtə	данные
department (n)	dɪ'pɑ:tmənt	отдел, подразделение
decision (n) make a decision (phrase)	dɪ'sɪʒən	решение; принимать решение
economist (n)	ɪ'kɒnəməst	экономист
efficient (adj)	ɪ'fɪʃənt	эффективный
efficiently (adv)	ɪ'fɪʃəntli	эффективно
employee (n)	ɪm'plɔɪi:	сотрудник, работник
energy supply (n)	'enədʒi sə'plaɪ	энергоснабжение
equipment (n)	ɪ'kwɪpmənt	оборудование
exchange (v)	ɪks'tʃeɪndʒ	обмениваться
factory (n)	'fæktəri	завод, фабрика
function (n)	'fʌŋkʃən	функция, назначение
heating system (n)	'hi:tɪŋ 'sɪstəm	система отопления
machine (n)	mə'ʃi:n	машина, станок
maintenance (n)	'meɪntənəns	техническое обслуживание
management (n)	'mænɪdʒmənt	управление, руководство
manager (n)	'mænɪdʒə	руководитель, менеджер
need (n)	ni:d	потребность
operate (v)	'ɒpəreɪt	управлять, эксплуатировать
organisation (n)	ɔ:gənaɪ'zeɪʃən	организация
organise (v)	'ɔ:gənaɪz	организовывать
output (n)	'aʊtpʊt	выпуск продукции, объём производства
particular (adj)	pə'tɪkjələ	определённый, конкретный
production (n)	prə'dʌkʃən	производство
production line (n)	prə'dʌkʃən laɪn	производственная линия
record (v)	rɪ'kɔ:d	записывать, регистрировать
reliable (adj)	rɪ'laɪəbəl	надёжный
resource (n)	rɪ'zɔ:s	ресурс

responsible (adj)	ri'spɒnsəbəl	ответственный
responsibility (n)	ri'spɒnsə'bɪləti	обязанность, ответственность
safe (adj)	seɪf	безопасный
safety (n)	'seɪfti	безопасность
section (n)	'sekʃən	секция, участок, подразделение
task (n)	tɑ:sk	задача, задание
team (n)	ti:m	команда, рабочая группа
technician (n)	tek'nɪʃən	техник, технический специалист
workplace (n)	'wɜ:kpleɪs	рабочее место
workshop (n)	'wɜ:kʃɒp	цех, мастерская

2. Read and translate the text.

A Factory and Its Resources

A factory is more than a building with machines. It is an organised system. It has people, materials, equipment, energy, information and money. These are the main resources of a factory. Each resource has a particular function, and each department has its own responsibilities.

The production department is usually a central part of the factory. It has machines, production lines and workplaces. Operators and technicians do practical work. They operate equipment, check materials and record data. Engineers are responsible for equipment, maintenance and safety. With regular maintenance, the equipment is safe and reliable.

Energy is also an important production resource. A factory has electrical equipment and a heating system. It may also have a boiler room and a control room. Energy engineers use technical information about heat, fuel and electricity. They do regular checks and organise a reliable energy supply for the production process.

Managers and economists have different tasks. Managers organise people and departments. Economists have data about costs, output and budgets. They compare available resources with production needs. The company does not have unlimited money, energy or materials, so careful planning is necessary.

All departments are part of one organisation. They exchange information and work together. A factory is efficient when its people, equipment, energy and money are organised well.

3. Answer the questions on the text.

1. Why is a factory more than a building with machines?
2. What are the main resources of a factory?
3. What does the production department have?
4. What practical work do operators and technicians do?
5. What are engineers responsible for?
6. What do managers do, and what information do economists have?
7. Why is careful planning necessary?

4. True or False? Read the statements. Correct the false ones.

Example: *A factory is only a building with machines. – False. A factory is an organised system with people, equipment, energy, information and other resources.*

1. Every resource in a factory has a particular function.
2. The production department has no machines or workplaces.
3. Engineers are responsible for equipment, maintenance and safety.
4. Energy is not a production resource.
5. Economists have data about costs, output and budgets.
6. Factory departments work independently and do not exchange information.

5. Find in the text the English equivalents of the following expressions.

1. организованная система;
2. основные ресурсы завода;
3. иметь определённую функцию;
4. производственный отдел;
5. выполнять практическую работу;
6. отвечать за оборудование, техническое обслуживание и безопасность;
7. надёжное энергоснабжение;
8. данные о затратах, выпуске продукции и бюджетах;
9. сравнивать имеющиеся ресурсы с производственными потребностями;
10. обмениваться информацией и работать вместе.

6. Fill in the gaps with the correct prepositions from the list: *about, for, in, of, to* or *with*. Some prepositions may be used more than once.

1. Engineers are responsible _____ equipment and safety.
2. Operators work _____ machines and production lines.
3. Economists have information _____ costs and budgets.
4. All departments are part _____ one organisation.
5. Employees often work _____ teams.
6. The control room is _____ the production area.
7. The energy department supplies heat _____ the workshops.
8. Managers compare available resources _____ production needs.

7. Match the words to make collocations from the lesson.

1. energy	a) work
2. production	b) information
3. control	c) resources
4. technical	d) supply
5. available	e) room
6. practical	f) line
7. make	g) for safety
8. be responsible	h) a decision

8. Match the terms with their definitions.

1. department	a) a person who operates a machine or controls a process
2. employee	b) the work needed to keep equipment in good condition
3. equipment	c) a division of an organisation with a particular function
4. maintenance	d) a person who organises the work of other people
5. manager	e) machines, devices and tools used for a particular purpose
6. operator	f) a person who works for a company or organisation
7. resource	g) a place in a factory where practical or production work is done
8. workshop	h) something such as people, money, materials or energy that is available for use

9. Complete the table with the missing words from the same word family.

The dash shows that a person noun is not required in this lesson.

Verb	Abstract Noun	Person
manage	_____	manager
	operation	operator
organise	organisation	
produce	_____	producer
	employment	employee
maintain	maintenance	—

10. Translate the sentences into English using the vocabulary of the lesson.

1. Завод – это организованная система.
2. У него есть люди, оборудование, материалы, энергия и информация.
3. Производственный отдел имеет машины и производственные линии.
4. Инженеры отвечают за оборудование, техническое обслуживание и безопасность.
5. Экономисты имеют данные о затратах, выпуске продукции и бюджетах.
6. Сотрудники работают вместе и выполняют разные задачи.
7. Энергетический отдел имеет диспетчерскую и систему отопления.
8. Компания не имеет неограниченных ресурсов.

Grammar focus 1: sentence structure; to be, to have, to do

Порядок слов в английском языке относительно фиксированный. Простое предложение обычно содержит подлежащее и сказуемое. Глаголы to be, to have и to do особенно важны, поскольку они имеют широкий спектр функций.

Table 1.1. Basic sentence patterns (Порядок слов в английском предложении)

Pattern (Схема)	Use (Употребление)	Example (Пример)
Подлежащее + глагол-связка <i>to be</i> + именная часть сказуемого или обстоятельство места	выражение идентификации, состояния или местонахождения подлежащего	The factory <u>is</u> an organised system. – Завод представляет собой организованную систему. The control room <u>is</u> near the workshop. – Диспетчерская находится рядом с цехом.
Подлежащее + глагол <i>to have</i> (в личной форме) + прямое дополнение	выражение обладания или характеристики подлежащего	The factory <u>has</u> several departments. – Завод имеет несколько отделов. The energy system <u>has</u> a control room. – В энергосистеме есть диспетчерская.
Подлежащее + сказуемое (глагол в личной форме) + прямое дополнение	выражение действия, направленного на объект	Engineers <u>check</u> the equipment. – Инженеры проверяют оборудование.
Подлежащее + сказуемое + прямое дополнение + обстоятельство места + обстоятельство времени	нейтральный порядок слов в распространённом предложении	Technicians <u>check</u> the boilers in the workshop every morning. – Техники проверяют котлы в цехе каждое утро.
Наречие частотности (adverb of frequency)	после глагола <i>to be</i> в составном именном сказуемом; перед смысловым глаголом.	The energy supply is usually reliable. – Энергоснабжение обычно надёжное. Managers usually work in the office. – Менеджеры обычно работают в офисе.
Наречие образа действия (adverb of manner)	обычно после прямого дополнения	Engineers use resources efficiently . – Инженеры используют ресурсы эффективно .

Table 1.2. Forms of the verb “to be” (Формы глагола “to be”)

Subject / Подлежащее	Affirmative / Утверждение	Negative / Отрицание	Question / Вопрос	Short answer / Короткий ответ
I	am	am not	Am I ...?	Yes, I am. / No, I am not.
He / She / It	is	is not / isn't	Is he / she / it ...?	Yes, he / she / it is. / No, he / she / it isn't.
You / We / They	are	are not / aren't	Are you / we / they ...?	Yes, you / we / they are. / No, you / we / they aren't.

11. Put the words in the correct order. Identify the subject and the predicate in the sentences you make.

1. factory / an organised system / is / a
2. has / the production department / machines / several
3. employees / practical tasks / do / every day
4. in the control room / the engineers / work
5. usually / reliable / the energy supply / is
6. technical information / managers / carefully / use
7. has / the factory / a boiler room / and / a heating system
8. every morning / technicians / the equipment / in the workshop / check

12. Open the brackets and use the correct form of the verb “to be”.

1. I _____ (be) a first-year student.
2. A factory _____ (be) an organised system.
3. The machines _____ (be) in the workshop.
4. The control room _____ (be) near the production area.
5. Engineers _____ (be) responsible for equipment and safety.
6. The equipment _____ (not / be) new.
7. _____ (be) the energy supply reliable?
8. _____ (be) the managers in the office?

Table 1.3. Functions of the verbs “to be”, “to have”, “to do” (Функции глаголов “to be”, “to have”, “to do”)

Verb and Present Simple Form (Глагол и форма Present Simple)	Function (Функция)	Example (Пример)
to be I – am he/she/it – is you / we / they – are	1. Глагол-связка (linking verb) – перед существительными и прилагательными.	A factory is more than a building with machines. – Завод – это больше, чем здание с машинами.
	2. Смысловый глагол (main verb) – перед обстоятельством места.	The control room is near the workshop. – Диспетчерская находится рядом с цехом.
	3. Вспомогательный глагол (auxiliary verb) – образует времена группы Continuous и Passive Voice.	Regular checks are done by engineers. – Регулярные проверки выполняются инженерами. They are maintaining the equipment. – Они обслуживают оборудование.
	4. Эквивалент модального глагола (modal equivalent) – выражение долженствования.	The technician is to check the equipment every month. – Техник должен проверять оборудование каждый месяц.

Verb and Present Simple Form (Глагол и форма Present Simple)	Function (Функция)	Example (Пример)
to have I/you/we/they – have he/she/it – has	1. Смысловой глагол (main verb) – владение, обладание.	Each resource has a particular function. – Каждый ресурс имеет определённую функцию.
	2. Вспомогательный глагол (auxiliary verb) – образование времён группы Perfect	The engineers have checked the equipment. – Инженеры проверили оборудование.
	3. Эквивалент модального глагола (modal equivalent): <i>have to</i> – вынужденность, внешнее долженствование	Engineers have to do regular maintenance. — Инженеры должны проводить регулярное техническое обслуживание.
to do I/you/we/they – do he/she/it – does	1. Смысловой глагол (main verb) – выполнение действия, задачи или деятельности	They do regular checks. – Они проводят регулярные проверки.
	2. Вспомогательный глагол (auxiliary verb) – образование вопросительных и отрицательных форм смысловых глаголов в Present Simple и Past Simple	Do engineers work in teams? – Работают ли инженеры в командах? Does the factory have a heating system? – Есть ли на заводе система отопления?
	3. Эмфатический do (emphatic do): усиление утверждения	The factory does operate efficiently. – Завод действительно работает эффективно. Engineers do check the equipment regularly. – Инженеры действительно проверяют оборудование регулярно.

13. Practise *to have* and *to do*.

A. Complete the sentences with *have*, *has*, *do* or *does*. Use them as main verbs.

1. The factory _____ several departments.
2. The production department _____ machines and production lines.
3. Engineers _____ regular safety checks.
4. Economists _____ information about costs and budgets.
5. Each department _____ its own function.

B. Complete the questions and the negative sentence. Use *do* or *does* as an auxiliary verb and *do* or *have* as the main verb.

1. What _____ the energy department _____?
2. _____ the factory _____ a boiler room?
3. The engineers _____ not _____ administrative work.

14. Practice identifying the functions of the verbs *to be*, *to have* and *to do*.

A. Identify the functions of the verb *to be*.

1. The engineer is in the control room.
2. All departments are part of one organisation.
3. The managers are to meet and discuss the new energy strategy.
4. A factory is efficient when all resources are used properly.
5. The engineers are testing the new equipment.

B. Identify the functions of the verb *to have*.

1. Managers have data about costs and budgets.
2. The factory has reduced its energy costs this year.
3. The department has its own responsibilities.
4. The manager has to make a decision about the new equipment.
5. The economists have analysed the costs of the production process.

C. Identify the functions of the verb *to do*.

1. Economists do calculations to support planning.
2. The company does not waste energy.
3. Does the control room operate 24 hours a day?
4. The new system does improve productivity.

Grammar focus 2: personal and possessive forms, basic noun group

Table 1.4. The system of pronouns (Система местоимений)

Subject pronouns (Личные местоимения)	Object pronoun (В объектном падеже)	Possessive adjectives (Притяжательные прилагательные)	Possessive pronouns (Притяжательные местоимения)
I	me	my	mine
you	you	your	yours
he	him	his	his
she	her	her	hers
it	it	its	—
we	us	our	ours
they	them	their	theirs

Запомните: *its* означает пишется без апострофа: *The factory has its own energy system.* — *На заводе есть своя собственная энергосистема.*

Table 1.5. Basic noun group (Основная именная группа)

Determiner / Определяющее слово	Adjective / Прилагательное	Noun or noun group / Существительное или именная группа	Example / Пример
a	modern	factory	a modern factory
the	main	production line	the main production line
its	reliable	energy supply	its reliable energy supply
—	technical	information	technical information
their	practical	tasks	their practical tasks

15. Practise pronouns and noun groups.

A. Replace the repeated nouns with the correct pronouns or possessive adjectives.

1. The engineers work in the energy department. _____ check _____ equipment every day.
2. The factory has a control room. _____ control room is near the workshop.
3. Mr Green is the manager. _____ has a budget, and _____ uses _____ carefully.
4. The employees work in teams. _____ tasks are different.
5. The production line is new. _____ is in Workshop 2.
6. The company gives the engineers technical data. It gives _____ new information every week.

B. Put the words in the correct order to make noun groups.

1. factory / a / modern
2. energy / reliable / supply / a
3. main / the / production / line
4. technical / information
5. their / practical / tasks
6. factory / safety / rules

16. Pair work.

Work in pairs. You are new employees at a factory. **Student A** chooses one department and describes what it is, what it has and what its employees do. **Student B** asks questions. Then swap roles and choose a different department.

Departments:

- production department;
- energy department;
- maintenance department;
- management and economics department.

Use at least four words or phrases from the lesson and include:

- one sentence with to be;
- one sentence with have / has;
- one sentence with do / does;
- one subject pronoun and one possessive adjective.

Useful language: describing a department

- The ... department is responsible for ...
- It has ...
- Its employees do ...
- They work with ...
- Is it responsible for ...?
- Does it have ...?
- What do its employees do?
- I think this department is important because ...

17. Case study.

Organising a Small Factory

A small factory has 25 employees, one production line, a boiler room, a small office and one control room. It has no separate maintenance department. Two engineers are responsible for equipment, energy and safety. The manager has limited information about energy use and maintenance costs. Employees sometimes do tasks outside their main responsibilities.

Discuss the questions. Use the verbs *to be*, *to have* and *to do* and the active vocabulary of the lesson.

1. What resources does the factory have?
2. What departments or functions are already present?
3. What are the two engineers responsible for?
4. What information does the manager need?
5. Is the organisation of work effective? Why or why not?
6. What new department or responsibility is necessary? Explain your answer.

18. Writing.

Write 5–6 sentences answering the question: **What is a factory and what resources does it have?**

Use at least four words or expressions from the lesson: *factory, department, employee, equipment, energy supply, production line, resource, responsibility, work together, be responsible for.*

Use:

- the verb *to be* at least twice;
- *have / has* at least twice;
- *do / does* at least once;
- at least one subject pronoun and one possessive adjective;
- the correct basic word order.

Prompts:

- A factory is ...
- It has ...
- The production department is ...
- Engineers are responsible for ...
- Employees do ...
- All departments work together because ...

19. Translate the text into Russian in writing, using a dictionary.

People, Equipment and Energy

A factory is an organisation with people, equipment and resources. Each department has its own function. The production department has machines and production lines. Engineers are responsible for maintenance, safety and the energy system.

Managers have information about budgets and production plans. Employees do different tasks, but they work as one team. A factory also has materials, electricity and heat. These resources are important for production. When departments exchange information and work together, the factory is safe and efficient.

LESSON 2. WHAT IS ECONOMICS?

Discuss the questions before reading the text.

- What resources does a factory need to produce goods?
- Why can't a company do all its projects at the same time?
- Is time an economic resource? Why?

1. Vocabulary for the lesson.

allocate (v)	'æləkeɪt	распределять, выделять
allocation (n)	ˌælə'keɪʃən	распределение, выделение
as a whole (phrase)	əz ə 'həʊl	в целом
behave (v)	bɪ'heɪv	вести себя
behaviour (n)	bɪ'heɪvjə	поведение
buyer (n)	'baɪə	покупатель
carefully (adv)	'keəfəli	тщательно
choice (n)	tʃɔɪs	выбор
choose (v)	tʃuːz	выбирать
cost (n, v)	kɒst	стоимость, затрата, издержки; стоить, обходиться в
deal with (phr v)	di:l wɪð	иметь дело с, рассматривать
decide (v)	dɪ'saɪd	решать, принимать решение
decision (n) make a decision (phrase)	dɪ'sɪʒən	решение; принимать решение
economic growth (n)	ˌi:kə'nɒmɪk grəʊθ	экономический рост
economic system (n)	ˌi:kə'nɒmɪk 'sɪstəm	экономическая система
economy (n) command economy market economy mixed economy	ɪ'kɒnəmi kə'mɑːnd ɪ'kɒnəmi 'mɑːkɪt ɪ'kɒnəmi mɪkst ɪ'kɒnəmi	экономика; командная экономика; рыночная экономика; смешанная экономика
factory (n)	'fæktəri	завод, фабрика
firm (n)	fɜːm	фирма
give up (phr v)	ɡɪv ʌp	отказываться от чего-либо
goods (n pl)	ɡʊdz	товары, материальные блага
government (n)	'ɡʌvənmənt	правительство
household (n)	'haʊshəʊld	домашнее хозяйство
human (adj, n)	'hjuːmən	человеческий; человек
labour (n)	'leɪbə	труд, рабочая сила
limited (adj)	'lɪmɪtɪd	ограниченный
macroeconomics (n)	ˌmækrəʊɪ:kə'nɒmɪks	макроэкономика
market (n)	'mɑːkɪt	рынок
microeconomics (n)	ˌmaɪkrəʊɪ:kə'nɒmɪks	микроэкономика
need (n)	niːd	потребность
once (adv)	wʌns	один раз
opportunity cost (n)	ˌɒpə'tjuːnəti kɒst	альтернативная стоимость

option (n) the next best option (phrase)	'ɒpʃən	вариант; следующий по предпочтительности вариант
particular (adj)	pə'tɪkjələ	конкретный, определённый
price (n)	praɪs	цена
produce (v)	prə'dju:s	производить
production (n)	prə'dʌkʃən	производство, выпуск продукции
research (n, v)	rɪ'sɜ:tʃ	исследование; исследовать
resource (n)	rɪ'zɔ:s	ресурс
satisfy (v)	sætɪsfaɪ	удовлетворять
scarce (adj)	skeəs	дефицитный, ограниченный
scarcity (n)	'skeəsəti	дефицит, нехватка
seller (n)	'selə	продавец
service (n)	'sɜ:vɪs	услуга
shape (v)	ʃeɪp	формировать
society (n)	sə'saɪəti	общество
unemployment (n)	ˌʌnɪm'plɔɪmənt	безработица
unit (n)	'ju:nɪt	единица, элемент, экономический субъект
unlimited (adj)	ʌn'lɪmɪtɪd	неограниченный
value (n, v)	'vælju:	ценность, стоимость; ценить, оценивать
want (n)	wɒnt	желание, потребность

2. Read and translate the text.

What Is Economics?

Economics is the social science that studies how people use limited resources to satisfy their needs and wants. The central problem of economics is scarcity. Scarcity means that resources – land, labour, capital and time – are limited, while human wants are almost unlimited. Because resources are scarce, every society must decide how to use them. People cannot have everything they want, so they have to make choices.

Every choice has a cost. When we choose one thing, we give up another. Economists call this the opportunity cost: the value of the next best option that we do not choose. For example, if a firm uses its money to build a new factory, it cannot use the same money for research at the same time. Time, money and materials can be used only once, so they must be allocated carefully.

Economics is usually divided into two large parts. Microeconomics studies the behaviour of individual units, such as households and firms. It explains how they make decisions and how prices are formed in particular markets. Macroeconomics studies the economy as a whole. It deals with large questions: economic growth, inflation, unemployment and the role of the government.

Although these two parts look at different things, they both address the same basic questions. What goods and services should a society produce? How should it

produce them? And for whom? Every economic system has to answer these questions, and the way it answers them shapes the life of the whole society.

3. Answer the questions on the text.

1. What does economics study?
2. What is the central problem of economics?
3. Why does every society have to make choices?
4. What is opportunity cost? Give an example.
5. What is the difference between microeconomics and macroeconomics?
6. What basic questions does every economic system try to answer?

4. True or False? Read the statements. Correct the false ones.

Example: *Resources are unlimited. – False. Resources are not unlimited. They are limited.*

1. Human wants are almost unlimited.
2. Resources are unlimited, but wants are scarce.
3. Every choice has an opportunity cost.
4. Microeconomics studies the economy as a whole.
5. Time, money and materials can be used only once.

5. Find in the text the English equivalents of the following expressions.

1. использовать ограниченные ресурсы;
2. удовлетворять потребности и желания;
3. делать выбор;
4. отказываться от другого варианта;
5. ценность следующего наилучшего варианта;
6. должны тщательно распределяться;
7. поведение отдельных экономических субъектов;
8. экономика в целом;
9. экономический рост, инфляция и безработица;
10. формировать жизнь всего общества.

6. Fill in the gaps with the correct prepositions from the list: of, for, in, to or on. Some prepositions may be used more than once.

1. The cost ____ production depends ____ many factors.
2. Scarce resources must be allocated ____ different needs.
3. Economics is important ____ the efficient use of resources.
4. There is a growing interest ____ the efficient use ____ resources.
5. Every society has to decide how ____ use its resources in the best way.
6. The opportunity cost ____ a choice is the value ____ the next best option.
7. Microeconomics focuses ____ the behaviour of households and firms.

7. Match the words to make collocations from the lesson.

1. to make	a) needs and wants
2. to satisfy	b) resources
3. to allocate	c) a choice / a decision
4. opportunity	d) questions
5. to answer	e) cost

8. Match the terms with their definitions.

1. factory	a) the value of the best alternative that you give up when you make a choice
2. goods	b) the situation when people who are able and willing to work cannot find jobs
3. household	c) the branch of economics that studies the behaviour and performance of an economy as a whole
4. labour	d) a situation in which resources are limited while human wants are almost unlimited
5. macroeconomics	e) an activity or work done for others in exchange for money
6. microeconomics	f) the work, especially physical work, that people do to produce things
7. opportunity cost	g) a group of people, usually a family, who live together in one home
8. scarcity	h) physical products that people buy or sell (e.g. a machine, food, or fuel)
9. service	i) a branch of economics that analyses the market behaviour of individuals and businesses to understand their decision-making processes
10. unemployment	j) a building or group of buildings where goods are produced using machines

9. Complete the table with the missing parts of speech.

Noun	Verb
decision	
	allocate
production	
_____	research
cost	_____
	value
choice	
	behave

10. Translate the sentences into English using the vocabulary of the lesson.

1. Каждое домашнее хозяйство и фирма должны принимать решения о том, как распределять свои деньги.
2. Альтернативная стоимость – это ценность следующего наилучшего варианта, который вы не выбираете.
3. Макроэкономика изучает экономику в целом.
4. Поведение покупателей на рынке формирует цены на товары и услуги.
5. Общество должно решить, какие товары производить и для кого.
6. Когда ресурсы ограничены, люди не могут иметь всё, что они хотят.
7. Фирмы исследуют поведение покупателей на рынке перед принятием решений.
8. Дефицит ресурсов формирует экономические решения каждого общества.

Grammar focus: word order, Present Simple and general questions

Table 2.1. Present Simple formation and word order (Образование Present Simple и порядок слов)

Word order (Порядок слов)	Subject - Verb - Object - Adverbial Modifier (Подлежащее – сказуемое – дополнение – обстоятельство)
Examples (Примеры)	<u>Firms</u> (S) <u>allocate</u> (V) <u>resources</u> (O) <u>carefully</u> (A). <u>Economics</u> (S) <u>studies</u> (V) <u>resources</u> (O).
Adverbial Modifier (Обстоятельство)	Обстоятельство образа действия стоит за дополнением: A firm allocates its resources <i>carefully</i> . Обстоятельство частоты стоит перед глаголом: Consumers <i>usually</i> buy less. Обстоятельство времени и места обычно стоит в конце предложения: Buyers and sellers <i>meet in particular</i> markets. Consumers buy less when the price is <i>high</i> .
Affirmative (Утверждение)	I / you / we / they + V1: I study. Buyers create demand. He / she / it + V-s/-es: An economist <i>studies</i> the market.
Negative (Отрицание)	I / you / we / they don't + V1: Buyers <i>don't</i> create supply. He / she / it / doesn't + V1: A firm <i>doesn't</i> have unlimited resources.
General question Yes/No question (Общий вопрос)	Do + I / you / we / they + V1?: <i>Do</i> buyers create demand? Does + he / she / it + V1?: <i>Does</i> a firm produce goods?
Markers (Маркеры)	<i>usually, always, often, sometimes, regularly, hardly ever, every day / month / week.</i> Consumers <i>usually</i> buy less when the price is high. A firm <i>always</i> allocates resources carefully.

11. Put the words in the correct order. Find the subject and the predicate in the sentences you make.

1. microeconomics / households / studies / firms / and
2. macroeconomics / as / economy / whole / the / a / at / looks
3. the / opportunity / cost / is / the / value / of / the / next / best / option
4. economists / parts / two / into / economics / divide / main
5. studies / macroeconomics / growth / inflation / unemployment / economic / and
6. answer / a / must / questions / society / basic / three / economic
7. carefully / resources / allocate / must / firms / their
8. goods / society / to / produce / what / decide / must / a

12. Complete the sentences with the correct form of the verb in the Present Simple. Then write the negative and general question forms of the sentences you make.

allocate, deal with, decide, shape, study, mean, call

1. Economics _____ how people use limited resources.
2. Scarcity _____ that resources are limited, but human wants are unlimited.
3. Every society _____ how to use its scarce resources.
4. Economists _____ the value of the next best option "opportunity cost."
5. A firm _____ its money carefully because it can be spent only once.
6. Macroeconomics _____ large questions such as unemployment and inflation.
7. The way an economic system answers basic questions _____ the life of the whole society.

13. Put the words in the correct order and use the correct Present Simple form. The type of sentence is given in brackets.

1. economics / how / resources / people / use / study (affirmative)
2. scarcity / mean / resources / that / limited / are (affirmative)
3. microeconomics / the behaviour of firms / study (general question)
4. a firm / not / spend / the same money / on two projects / at once (negative)
5. a household / decide / how to spend its income (general question)

14. Pair work.

Work in pairs. **Discuss** the questions using the words **scarcity, choice, opportunity cost, resources and firm**. Use at least three expressions from the Useful language section.

1. Why do students also face scarcity in everyday life?
2. What is the opportunity cost of studying at university?
3. Give one example of opportunity cost in a factory.
4. Which resource is most important for a firm: land, labour, capital or time?

Useful language: discussing choices

- *In my opinion, ...*
- *A firm has to choose between ... and ...*
- *The opportunity cost of ... is ...*
- *... is more important because ...*
- *When a firm chooses ..., it gives up ...*

15. Case study.

A small factory has a limited budget. The manager can either buy a new machine or repair the old heating system. The new machine will increase output, but the old heating system wastes a lot of energy. The factory cannot do both projects this year.

Discuss:

1. What scarce resources does the factory have?
2. What are the two possible choices?
3. What is the opportunity cost of buying the new machine?
4. What decision would you recommend? Explain your answer.

16. Writing.

Write 4–5 sentences answering the question: **How do you deal with scarcity and make choices in your everyday life?**

Use at least four words or expressions from the lesson:

scarcity, limited, resources, choice, opportunity cost, decide, allocate, value.

Use:

- the **Present Simple** to describe your regular choices;
- at least two linking words or phrases.

Prompts:

- In everyday life, I also face scarcity because my time and money are limited.
- Every day, I have to decide how to allocate ...
- The opportunity cost of ... is ...
- For example, when I choose to ..., I give up ...

Linking words and phrases:

because, so, that is why, for example, however

17. Translate the text into Russian in writing, using a dictionary.

Economic Systems

Every society has to answer three basic economic questions: what to produce, how to produce, and for whom to produce. The way a society answers them depends on its economic system. In a market economy, these decisions are made by buyers and sellers, and prices act as signals. In a command economy, the government makes the main decisions. Most modern countries have a mixed economy, in which both the market and the state play an important role.

LESSON 3. SUPPLY AND DEMAND

Discuss the questions before reading the text.

- What makes the price of a product go up or down?
- Why do shops sometimes lower their prices?
- Name a product whose price changes often.

1. Vocabulary for the lesson.

agree (v)	ə'gri:	соглашаться; совпадать
allocate (v)	'æləkeɪt	распределять, выделять
amount (n)	ə'maʊnt	количество, объём
appear (v)	ə'piə	появляться, возникать
balance (n)	'bæləns	равновесие
bring together (phr v)	brɪŋ tə'geðə	объединять, сводить вместе
buy (v)	baɪ	покупать
buyer (n)	'baɪə	покупатель
create (v)	kri'eɪt	создавать, формировать
creation (n)	kri'eɪʃən	создание, формирование
demand (n, v)	dɪ'mɑ:nd	спрос; требовать, предъявлять спрос
depend on (phr v)	dɪ'pend ɒn	зависеть от
determine (v)	dɪ'tɜ:mɪn	определять, устанавливать
earn (v)	ɜ:n	зарабатывать, получать доход
equal (v, adj)	'i:kwəl	равняться, быть равным; равный
equilibrium price (n)	'i:kwɪ'libriəm praɪs	равновесная цена
fall (v, n)	fɔ:l	падать, снижаться; падение, снижение
force (n)	fɔ:s	сила, фактор
good (n), goods (n pl)	ɡʊd, ɡʊdz	товар, благо; товары, блага
market (n)	'mɑ:kɪt	рынок
price (n)	praɪs	цена
produce (v)	prə'dju:s	производить
producer (n)	prə'dju:sə	производитель
production (n)	prə'dʌkʃən	производство, выпуск продукции
profit (n, v)	'prɒfɪt	прибыль, выгода; получать прибыль
quantity demanded (n)	'kwɒntəti dɪ'mɑ:ndɪd	величина спроса
quantity supplied (n)	'kwɒntəti sə'plaɪd	величина предложения
rise (v, n)	raɪz	расти, повышаться; рост, повышение
sale (n)	seɪl	продажа
sell (v)	sel	продавать
seller (n)	'selə	продавец

shortage (n)	'ʃɔ:tɪdʒ	нехватка, дефицит
supply (n, v)	sə'plai	предложение; поставлять, предлагать
surplus (n)	'sɜ:pləs	излишек, профицит
other things being equal (phrase)	'ʌðə θɪŋz 'bi:ɪŋ 'i:kwəl	при прочих равных условиях
the law of demand (phrase)	ðə lɔ: əv dɪ'mɑ:nd	закон спроса
the law of supply (phrase)	ðə lɔ: əv sə'plai	закон предложения
willing and able to buy / sell (phrase)	'wɪlɪŋ ənd 'eɪbəl tə baɪ / sel	готовый и способный купить / продать

2. Read and translate the text.

Supply and Demand

In a market economy, the prices of goods and services are determined by supply and demand. A market is a group of buyers and sellers of a particular product. Buyers create the demand for a product, and sellers create the supply.

The quantity demanded is the amount of a good that buyers are willing and able to buy. The law of demand states that, other things being equal, when the price of a good rises, the quantity demanded falls. When the price falls, the quantity demanded rises. People usually buy less of a product when it becomes more expensive.

The quantity supplied is the amount of a good that sellers are willing and able to sell. The law of supply states that, other things being equal, when the price of a good rises, the quantity supplied also rises. Producers want to sell more when the price is high, because they can earn a larger profit.

The market brings these two forces together. The price at which the quantity demanded equals the quantity supplied is called the equilibrium price. At this price, the plans of buyers and sellers agree, and the market is in balance.

Prices play a key role in a market economy. They act as signals: a high price tells producers to make more of a good, while a low price tells them to make less. In this way, supply and demand help society to allocate its scarce resources.

3. Answer the questions on the text.

1. What determines prices in a market economy?
2. Who creates the demand and who creates the supply?
3. What does the law of demand state?
4. What does the law of supply state?
5. What is the equilibrium price?
6. What role do prices play in a market economy?

4. True or False? Read the statements. Correct the false ones.

Example: A market is a group of producers only. – False. A market is a group of buyers and sellers of a particular product.

1. Buyers create the supply of a product.
2. According to the law of demand, when the price rises, the quantity demanded falls.
3. Producers want to sell less when the price is high.
4. At the equilibrium price, the market is in balance.
5. A high price tells producers to make less of a good.

5. Find in the text the English equivalents of the following expressions.

1. группа покупателей и продавцов определённого товара;
2. формировать спрос / предложение;
3. величина спроса / величина предложения;
4. при прочих равных условиях;
5. быть готовым и способным купить / продать;
6. получать более высокую прибыль;
7. объединять эти две силы;
8. быть в равновесии;
9. выступать в качестве сигналов;
10. распределять ограниченные ресурсы.

6. Fill in the gaps with the correct prepositions from the list: *in, at, on, to or between*. Some prepositions may be used more than once.

1. There is a close relationship _____ price and quantity.
2. Producers sell goods _____ different prices.
3. A change _____ income can affect demand.
4. The price depends _____ supply and demand.
5. The market is _____ balance at the equilibrium price.
6. Demand for a product falls when the price rises _____ a high level.

7. Match the terms with their definitions.

1. demand	a) the price at which the quantity demanded equals the quantity supplied
2. supply	b) the amount of a good that buyers are willing and able to buy at a given price
3. equilibrium price	c) money earned in trade or business after the costs of producing and selling goods or services have been paid
4. quantity demanded	d) the willingness and ability of sellers to sell a product
5. quantity supplied	e) the willingness and ability of buyers to buy a product
6. profit	f) the amount of a good that sellers are willing and able to sell at a given price
7. surplus	g) the situation when the quantity supplied is greater than the quantity demanded
8. shortage	h) the situation when the quantity demanded is greater than the quantity supplied

8. Complete the table with the missing parts of speech.

Noun	Verb
production	
	supply
creation	
	demand
sale	
	profit
rise	
	fall

9. Translate the sentences into English using the vocabulary of the lesson.

1. Спрос и предложение определяют цены на товары и услуги.
2. Равновесная цена – это цена, при которой величина спроса равна величине предложения.
3. Покупатели формируют спрос на товар, а продавцы формируют предложение.
4. Величина спроса на товар зависит от его цены.
5. При прочих равных условиях, когда цена товара растёт, величина предложения также растёт.

Grammar focus: Present Simple vs Present Continuous

Table 3.1. Comparison of Present Simple and Present Continuous (Сравнение Present Simple и Present Continuous)

Present Simple	Используется для описания фактов, регулярных и повторяющихся действий. Форма: V1 / V-s/-es. The law of demand states that... Sellers create the supply.
Markers (Маркеры)	Present Simple: <i>usually, always, often, sometimes, rarely, never, every day / week / month.</i> Consumers <i>usually</i> buy more when the price is low.
Present Continuous	Используется для описания действий, происходящих в текущий момент, вокруг момента речи, временных действий и тенденций. Форма: <i>am/is/are + V-ing.</i> The price of oil <i>is rising today.</i>
Markers (Маркеры)	Present Continuous: <i>now, currently, at the moment, today, this week, this month.</i> <i>At the moment,</i> the company <i>is analysing</i> demand.
General question / Yes/No question (Общий вопрос)	Present Simple: Do / Does + subject + V1? <i>Do consumers buy more when the price is low?</i> Present Continuous: Am / Is / Are + subject + V-ing? <i>Is the price rising now?</i>
Special question / Wh-question (Специальный вопрос)	Present Simple: Wh-word + do/does + subject + V1? <i>What does the law of supply state?</i> Present Continuous: Wh-word + am/is/are + subject + V-ing? <i>Why is the price rising?</i>
Subject question (Вопрос к подлежащему)	Present Simple: Who / What + V-s/-es? <i>Who creates the supply? What determines prices?</i> Present Continuous: Who / What + am/is/are + V-ing? <i>Who is analysing demand now? What is rising today?</i>
Запомните: в вопросах к подлежащему используется прямой порядок слов, подлежащее заменяется на Who/What: <i>Who creates the supply? What is making the factory more efficient now?</i>	

10. Choose the correct form of the verb in each sentence. Use the Present Simple or Present Continuous.

- The law of supply **states** / **is stating** a general rule.
- At present, the demand for electric cars **is increasing** / **increases** very fast.
- Producers usually **earn** / **are earning** more when the price is high.
- At the moment, the company **analyses** / **is analysing** the demand for its new product.
- When the price falls, the quantity demanded **rises** / **is rising**.
- Currently, many firms increase / are increasing production.

11. Open the brackets and use the correct Present Simple or Present Continuous form of the verbs.

1. The law of supply _____ (state) that when the price rises, the quantity supplied rises.
2. The price of oil _____ (rise) sharply today due to a shortage.
3. Sellers _____ (create) the supply of a product in any market.
4. Usually, people _____ (buy) less of a product when it becomes more expensive.
5. At present, the company _____ (allocate) more resources to production.
6. At the moment, producers _____ (earn) large profits because demand is high.
7. The quantity demanded _____ (depend) on the price of a good.
8. This week, the firm _____ (test) a new production method.

12. Ask a special question about the words in bold. Use the Present Simple or the Present Continuous.

Example: *Buyers create **the demand**. – What do buyers create?*

1. Supply and demand determine **prices**. (*What*)
2. Producers want to sell more **because the price is high**. (*Why*)
3. **Sellers** create the supply of a product. (*Who*)
4. The company is analysing **the demand for its new product** at the moment. (*What*)
5. The price of oil is rising **because of a shortage**. (*Why*)
6. Buyers usually buy less **when the price is high**. (*When*)

13. Find and correct the mistakes in the Present Simple forms. Pay attention to singular and plural subjects. One sentence is correct.

1. Supply and demand determines the price of a good.
2. Prices acts as signals in a market economy.
3. A single buyer don't create the whole demand for a product.
4. Producers sells more when the price is high.
5. The quantity supplied depends on the price.
6. Buyers and sellers meets in the market.
7. A shortage appear when demand is higher than supply.
8. Higher prices tells sellers to produce more.

14. Put the words in the correct order and use the correct form of the verb. The type of sentence and tense are given in brackets.

1. supply and demand / prices / determine (*affirmative, Present Simple*)
2. the demand for electricity / at the moment / rise (*affirmative, Present Continuous*)
3. a single buyer / the whole demand for a product / not create (*negative, Present Simple*)
4. the company / its prices / this month / not change (*negative, Present Continuous*)
5. the quantity supplied / when the price rises / rise (*general question, Present Simple*)
6. producers / more goods / this week / produce (*general question, Present Continuous*)
7. why / buyers / less / when the price is high / buy (*special question, Present Simple*)
8. who / the demand for the new product / currently / analyse (*subject question, Present Continuous*)

15. Pair work.

Work in pairs. **Discuss** the questions using the words **demand, supply, price and equilibrium price**. Use at least three expressions from the Useful language section.

1. What happens to the demand for ice cream in hot weather?
2. What happens to the price of a product when many new sellers enter the market?
3. Give an example of a product whose price is currently rising or falling. Explain the change in terms of supply and demand.

Useful language: describing changes

- *The demand for ... rises / falls when ...*
- *The supply of ... increases / decreases because ...*
- *A rise in demand leads to ...*
- *A fall in supply leads to ...*
- *At the moment, the price of ... is rising / falling.*
- *As a result, the equilibrium price rises / falls.*

16. Case study.

A bakery sells bread in a small town. This summer, the price of flour is rising sharply because of a poor harvest. At the same time, a new bakery is opening on the same street.

Discuss the questions. Use **the Present Continuous** to describe the current situation and **the Present Simple** to explain general relationships between supply, demand and price.

1. How is the rising price of flour affecting the bakery's costs?
2. How is the new bakery affecting the supply of bread in the town?
3. How can these two changes affect the price of bread? Explain your answer in terms of supply and demand.
4. What action can the owner of the first bakery take in this situation?

17. Writing.

Write 4–5 sentences answering the question: **Why does the price of a product rise or fall?**

Choose one particular product, such as ice cream, oil, bread or flowers. Explain the change in its price in terms of supply and demand.

Use at least four words or expressions from the lesson:

demand, supply, price, equilibrium price, quantity demanded, quantity supplied, rise, fall.

Use:

- the **Present Simple** at least once to describe a general market relationship;
- the **Present Continuous** at least once to describe a current change;
- at least two linking words or phrases.

Prompts:

- The price of a product rises or falls because of supply and demand.
- For example, in summer, the demand for ice cream rises, so ...
- At the moment, the price of ... is rising / falling because ...

- When many new sellers enter the market, the supply ...
- As a result, the price ...

Linking words and phrases: *because, so, when, as a result, that is why*

18. Translate the text into Russian in writing, using a dictionary.

Surplus and Shortage

When the price of a good is higher than the equilibrium price, sellers cannot sell all their goods. The quantity supplied is greater than the quantity demanded, and a surplus appears. When the price is lower than the equilibrium price, buyers want more than sellers can offer, and a shortage appears. In both cases the market is not in balance, and the price tends to move back towards the equilibrium level.

LESSON 4. COSTS, REVENUE AND PROFIT

Discuss the questions before reading the text.

- What costs does your university have?
- Which of these costs change every month, and which stay the same?
- Why does a company want to keep its costs low?

1. Vocabulary for the lesson.

average (adj)	'ævərɪdʒ	средний
calculate (v)	'kælkjuleɪt	рассчитывать, вычислять
calculation (n)	,kælkju'leɪʃən	расчёт, вычисление
cheap (adj)	tʃi:p	дешёвый, недорогой
coal (n)	kəʊl	уголь
cost (n, v) energy costs (phrase) fixed costs (phrase) cost per kilowatt-hour (kWh) production cost (phrase) total cost (phrase) variable costs (phrase)	kɒst 'enədʒi kɒsts fɪkst kɒsts kɒst pə 'kɪləwɒt ,aʊə prə'dʌkʃən kɒst 'təʊtəl kɒst 'veəriəbəl kɒsts	затрата, издержки; стоить; затраты на энергию; постоянные затраты; стоимость одного киловатт-часа; производственные затраты, общие затраты, совокупные издержки; переменные затраты, переменные издержки
divide (v)	dɪ'vaɪd	делить, разделять
division (n)	dɪ'vɪʒən	деление, разделение
efficiency (n)	ɪ'fɪʃənsi	эффективность, КПД
efficient (adj)	ɪ'fɪʃənt	эффективный
expensive (adj)	ɪk'spensɪv	дорогой, дорогостоящий
grow (v)	grəʊ	расти, увеличиваться
growth (n)	grəʊθ	рост, увеличение
in order to (phrase)	ɪn 'ɔ:də tə	для того чтобы
increase (v, n)	ɪn'kri:s / 'ɪnkri:s	увеличивать(ся), возрастать; увеличение, рост
indicator (n)	'ɪndɪkeɪtə	показатель, индикатор
industry (n)	'ɪndəstri	отрасль, промышленность
labour (n)	'leɪbə	труд, рабочая сила
level (n)	'levəl	уровень
loss (n) make a loss (phrase)	lɒs meɪk ə lɒs	убыток, потеря; нести убыток
manufacturing (n)	,mænjʊ'fæktʃərɪŋ	производство, обрабатывающая промышленность

output (n)	'aʊtpʊt	выпуск продукции, объём производства
pay (v)	peɪ	платить, оплачивать
payment (n)	'peɪmənt	платёж, оплата
per cent (n)	pə 'sent	процент
produce (v)	prə 'dju:s	производить
production (n)	prə 'dʌkʃən	производство, выпуск продукции
profit (n, v); earn / make a profit (phrase)	'prɒfɪt z:n ə 'prɒfɪt / meɪk ə 'prɒfɪt	прибыль, получать прибыль; получать прибыль
profitable (adj)	'prɒfɪtəbl	прибыльный, рентабельный
quantity (n)	'kwɒntəti	количество, объём
raw materials (n pl)	rɔ: mə'tɪəriəlz	сырьё
receive (v)	rɪ'si:v	получать
reduce (v)	rɪ'dju:s	сокращать, уменьшать
reduction (n)	rɪ'dʌkʃən	сокращение, уменьшение
remain (v)	rɪ'meɪn	оставаться
rent (n)	rent	арендная плата
revenue (n) total revenue (phrase)	'revənju: 'təʊtəl 'revənju:	выручка, доход; общая выручка, совокупный доход
rise (v, n)	raɪz	расти, повышаться; рост
sale (n)	seɪl	продажа
spend (v)	spend	тратить, расходовать
thermal power plant (n)	'θɜ:məl 'paʊə plɑ:nt	тепловая электростанция
unit (n)	'ju:nɪt	единица

2. Read and translate the text.

Costs, Revenue and Profit

Every firm produces goods or services in order to make a profit. To understand how a firm works, economists look at three important ideas: total revenue, total cost and profit.

Total revenue is the amount of money that a firm receives from the sale of its products. It depends on the price of the product and the quantity that the firm sells. If a firm sells more units or raises its price, its total revenue usually grows.

Total cost is the amount of money that a firm spends in order to produce its goods. Economists divide costs into two groups. Fixed costs do not change with the quantity of output; a firm has to pay them even when it produces nothing. Rent for a building is a typical fixed cost. Variable costs change with the level of production. The cost of raw materials and energy rises when the firm produces more.

Profit is the money that remains after the firm has paid all its costs. We can find it with a simple rule: profit equals total revenue minus total cost. When total revenue is greater than total cost, the firm earns a profit. When total cost is greater than total

revenue, the firm makes a loss.

Firms always try to increase their profit. They can do this by raising revenue, by reducing costs, or by doing both at the same time.

3. Answer the questions on the text.

1. Why does every firm produce goods or services?
2. What is total revenue, and what does it depend on?
3. What is the difference between fixed costs and variable costs?
4. Give an example of a fixed cost and a variable cost.
5. How can we calculate profit?
6. How can a firm increase its profit?

4. Complete the sentences according to the text.

1. Every firm produces goods or services in order to...
2. Total revenue depends on the price of the product and...
3. Fixed costs do not change with...
4. Profit equals total revenue ...
5. A firm can increase its profit by raising revenue, by reducing costs, or by ...

5. Find in the text the English equivalents of the following expressions.

1. производить товары или оказывать услуги с целью получения прибыли;
2. общая выручка;
3. продажа продукции;
4. зависеть от цены товара и проданного количества;
5. постоянные и переменные затраты;
6. уровень производства;
7. сырьё и энергия;
8. общая выручка минус общие затраты;
9. общая выручка больше общих затрат;
10. нести убыток;
11. увеличивать выручку;
12. сокращать затраты.

6. Fill in the gaps with the correct prepositions from the list: *of, for, on, into* or *at*.

Some prepositions may be used more than once.

1. Total cost is divided _____ two groups: fixed and variable costs.
2. Total revenue depends _____ the price and the quantity.
3. A firm has to pay rent _____ its building.
4. Variable costs change with the level _____ production.
5. Producers sell their goods _____ different prices.
6. The cost _____ raw materials rises when the firm produces more.

7. Match the words to make collocations from the text.

1. to make	a) materials
2. to raise	b) production

3. to reduce	c) a profit / a loss
4. raw	d) costs
5. level of	e) revenue

8. Match the terms with their definitions.

1. total revenue	a) costs that do not change with the quantity of output
2. total cost	b) the amount of money a firm receives from the sale of its products
3. fixed costs	c) the money that remains after a firm has paid all its costs
4. variable costs	d) the amount of money a firm spends to produce its goods
5. profit	e) the quantity of goods or services that a firm produces
6. loss	f) costs that change with the level of production
7. output	g) basic materials, such as metal or grain, used to make products
8. raw materials	h) the situation when total cost is greater than total revenue

9. Complete the table with the missing parts of speech.

Noun	Verb
production	
	divide
reduction	
payment	_____
_____	calculate
growth	

10. Translate the sentences into English using the vocabulary of the lesson.

1. Чтобы увеличить прибыль, фирма должна продавать больше продукции.
2. Общие затраты включают как постоянные, так и переменные затраты.
3. Переменные затраты растут, когда фирма увеличивает выпуск продукции.
4. Сырьё и энергия являются основными переменными затратами для большинства производителей.
5. Чтобы сократить убытки, компания должна уменьшить свои затраты.
6. Арендная плата – типичная постоянная затрата: она остаётся одинаковой каждый месяц.

Grammar focus: degrees of comparison of adjectives and adverbs

Table 4.1. Degrees of comparison adjectives and adverbs (Степени сравнения прилагательных и наречий)

Type (Тип)	Comparative form (Сравнительная степень)	Superlative form (Превосходная степень)
Short adjectives (Короткие прилагательные)	adjective + -er <i>higher, lower, cheaper, greater</i>	<i>the + adjective + -est</i> <i>the highest, the lowest, the cheapest, the greatest</i>
Adjectives ending in -y (Прилагательные на -y)	change -y to -ier <i>easier, heavier</i>	<i>the + -iest</i> <i>the easiest, the heaviest</i>
Long adjectives (Длинные прилагательные)	more + adjective <i>more expensive, more efficient, more profitable</i>	the most + adjective <i>the most expensive, the most efficient, the most profitable</i>
good	better than	the best
bad	worse than	the worst
many / much	more	the most
little	less	the least
far	farther / further	the farthest / the furthest

Table 4.2. Key constructions (Основные сравнительные конструкции)

Construction (Конструкция)	Example (Пример)
comparative + than	Plant A has <i>lower costs</i> than Plant B. – На заводе А затраты ниже, чем на заводе В.
superlative form	Plant C is <i>the most profitable</i> option. – Завод С – наиболее выгодный вариант.
as + adjective + as	Fixed costs are <i>as important as</i> variable costs. – Постоянные затраты так же важны, как и переменные затраты.
not as / so + adjective + as	Plant B is <i>not as efficient as</i> Plant C. – Завод В не такой эффективный, как завод С.

11. Find and correct the mistakes in the comparative and superlative forms. One sentence is correct.

- Fixed costs are more easier to predict than variable costs.
- This supplier offers cheaper raw materials than the previous supplier.
- Option C is the more profitable option of the three.
- The new machine is efficienter than the old one.
- This firm has the most low average cost in the industry.
- Total revenue must be more great than total cost.
- The old production process is lesser efficient than the new one.
- Reducing waste is one of the better ways to lower production costs.

12. Study the table comparing energy sources by several criteria. The figures are simplified and are given for classroom practice only. Make sentences using comparative and superlative forms.

Table vocabulary: oil – нефть; natural gas – природный газ; nuclear power – атомная энергетика; hydropower – гидроэнергетика; CO₂ emissions – выбросы CO₂; safety – безопасность; availability – доступность ресурса.

Criterion	Coal	Oil	Natural Gas	Nuclear Power	Hydropower
Price (per kWh)	\$0.05	\$0.10	\$0.06	\$0.09	\$0.04
Efficiency (%)	35 %	40 %	60 %	90 %	90 %
Production Cost (\$/MWh)	\$40	\$75	\$55	\$95	\$30
CO ₂ Emissions (g/kWh)	820	650	490	0	0
Safety (accidents per year)	5	3	2	0 (rare)	1
Availability (years left)	150	50	60	100	unlimited

Note: For Safety and CO₂ emissions, a lower number means a better result.

Example: Oil is *more expensive than* coal. Hydropower has *the lowest* production cost.

1. Compare the price per kWh of coal and oil.
2. Compare the efficiency of coal and natural gas.
3. Compare the production costs of hydropower and nuclear power.
4. Compare the CO₂ emissions of coal and natural gas.
5. Which energy source has the lowest price per kWh?
6. Which energy source is the safest?

13. Rewrite the sentences using *as ... as* or *not as ... as*. Do not change the meaning.

Example: Coal is cheaper than oil. – Oil is *not as cheap as* coal.

1. Nuclear power and hydropower have the same efficiency. (*as ... as*)
2. Natural gas is safer than coal. (*not as ... as*)
3. Oil is more expensive than natural gas. (*not as ... as*)
4. Fixed costs and variable costs are equally important for a firm. (*as ... as*)
5. The old machine is less efficient than the new one. (*not as ... as*)

14. Ask questions using the given words. Use a suitable comparative or superlative form and the correct auxiliary verb.

Example: Which / energy source / efficient: coal or natural gas?

Which energy source is more efficient: coal or natural gas?

1. Which / cost / important / for a firm: fixed or variable?
2. Why / profit / one of the / good / indicators / of a firm's success?

3. What / higher price / lead to?
4. When / a firm / make / a larger profit: when revenue rises or when costs fall?
5. What / the / good / way / to increase profit?
6. Why / variable costs / difficult / to predict than fixed costs?

15. Pair work.

Work in pairs. **Compare** the concepts and answer the questions. Use at least three expressions from the Useful language section.

1. What is the difference between fixed costs and variable costs? Which are easier to predict?
2. What is the difference between total revenue and profit? Which is usually higher? Why?
3. What is the difference between a profit and a loss? Which result is better for a firm?
4. What fixed and variable costs does a thermal power plant have? Give two examples of each. Which costs are more difficult to control?

Useful language: comparing costs and results

- ... *has higher / lower costs than* ...
- ... *is more / less expensive than* ...
- ... *is more / less efficient than* ...
- ... *has higher revenue / profit than* ...
- ... *is the most / least profitable option.*
- *In my opinion, ... is better because* ...

16. Case study.

A thermal power plant needs to replace an old machine. The managers are comparing two options. **The plant plans to use the new machine for five years.**

The figures are hypothetical and are given for classroom practice only. **Assume that only the purchase price, energy costs and maintenance costs are considered.**

Criterion	Option A	Option B
Purchase price	\$120,000	\$80,000
Efficiency	90 %	75 %
Energy costs per year	\$20,000	\$30,000
Maintenance costs per year	\$8,000	\$12,000

Discuss:

1. Which option is cheaper to buy?
2. Which option is more efficient?
3. Which option has lower annual energy and maintenance costs?
4. What is the total cost of each option over five years?
5. Which option has lower total costs over five years?
6. Which option should the plant choose? Explain your answer.

17. Writing.

Write 5–6 sentences answering the question: **Why does a company want to keep its costs low, and how can it do this?**

Choose a firm, such as a bakery, a power plant or a small shop. Describe its fixed and variable costs and explain how reducing costs affects its profit.

Use at least four words or expressions from the lesson:

fixed costs, variable costs, total cost, total revenue, profit, loss, reduce, increase.

Use:

- at least two comparative forms;
- at least one superlative form;
- at least two linking words or phrases.

Prompts:

- A company wants to keep its costs low because profit equals total revenue minus total cost.
- For example, a bakery has fixed costs such as ... and variable costs such as ...
- Its variable costs are higher / lower than ...
- ... is the largest cost for this firm.
- If the firm reduces its costs, its profit ...

Linking words and phrases:

because, so, in order to, as a result, however

18. Translate the text into Russian in writing, using a dictionary.

Total and Average Cost

A firm needs to know not only its total cost, but also its average cost. The average cost is the total cost divided by the quantity of goods produced. It shows how much it costs to produce one unit of output. If a firm produces more units, its average cost often falls, because the fixed costs are shared among a larger number of products. For this reason, large firms can sometimes sell their goods at a lower price than small firms.

LESSON 5. WHAT IS ENERGY?

Discuss the questions before reading the text.

- Where do you use energy every day?
- Can energy disappear? What happens to it?
- Name three forms of energy you know.

1. Vocabulary for the lesson.

ability (n)	ə'biləti	способность
bond (n)	bɒnd	связь, соединение
build (v)	bɪld	строить
burn (v)	bɜ:n	сжигать
change (from one form to another) (phrase)	tʃeɪndʒ frəm wʌn fɔ:m tə ə'nʌðə	переходить (из одной формы в другую)
charge (n)	'tʃɑ:dʒ	заряд
coal (n)	kəʊl	уголь
common (adj)	'kɒmən	распространённый, обычный
convert (v)	kən'vɜ:t	преобразовывать, превращать
create (v)	kri'eɪt	создавать
define (v)	dɪ'faɪn	определять, давать определение
destroy (v)	dɪ'strɔɪ	разрушать, уничтожать
develop (v)	dɪ'veləp	разрабатывать, развивать
directly (adv)	dɪ'rektli	непосредственно, прямо
electric charge (n)	ɪ'lektrɪk tʃɑ:dʒ	электрический заряд
energy (n) chemical energy energy in motion kinetic energy mechanical energy nuclear energy potential energy stored energy thermal energy	'enədʒi 'kemɪkəl 'enədʒi 'enədʒi ɪn 'məʊʃən kɪ'netɪk 'enədʒi mə'kænɪkəl 'enədʒi 'nju:kliə 'enədʒi pə'tenʃəl 'enədʒi 'θɜ:məl 'enədʒi stə:d 'enədʒi	энергия; химическая энергия; энергия движения; кинетическая энергия; механическая энергия; ядерная энергия; потенциальная энергия; накопленная энергия; тепловая энергия
engine (n) steam engine	endʒɪn 'sti:m ,endʒɪn	двигатель; паровой двигатель, паровая машина
exist (v)	ɪg'zɪst	существовать
fossil fuel (n)	'fɒsəl ,fju:əl	ископаемое топливо
gas (n)	ɡæs	газ
generate (v)	'dʒenəreɪt	вырабатывать, генерировать
generator (n)	'dʒenəreɪtə	генератор
heat (n, v)	hi:t	тепло, теплота; нагревать

Industrial Revolution (n)	inˌdʌstriəl ˌrevəˈluːʃən	промышленная революция
industry (n)	ˈɪndəstri	промышленность, отрасль
joule (n)	dʒuːl	джоуль, единица измерения энергии
law of conservation of energy (phrase)	ˌlɔː əv ˌkɒnsəˈveɪʃən əv ˈenədʒi	закон сохранения энергии
measure (v)	ˈmeʒə	измерять
non-renewable (adj)	ˌnɒn rɪˈnjuːəbəl sɔːs	невозобновляемый
nucleus (n)	ˈnjuːkliəs	ядро атома
oil (n)	ɔɪl	нефть
plant (n) power plant nuclear power plant	plɑːnt ˈpaʊə plɑːnt ˈnjuːkliə ˈpaʊə plɑːnt	завод, станция; электростанция; атомная электростанция
power (n)	ˈpaʊə	мощность
powerful (adj)	ˈpaʊəfəl	мощный
rate (n)	reɪt	скорость, темп
renewable (adj)	rɪˈnjuːəbəl	возобновляемый
several (adj)	ˈsevərəl	несколько
steam (n)	ˈstiːm	пар
source (n)	sɔːs	источник
store (v)	stɔː	хранить, накапливать
supply (v)	səˈplaɪ	снабжать, подавать
transform (v)	trænsˈfɔːm	преобразовывать, превращать
transport (n)	ˈtrænspɔːt	транспорт
turbine (n)	ˈtɜːbaɪn	турбина
watt (n)	wɒt	ватт, единица измерения мощности

2. Read and translate the text.

What Is Energy?

Energy is one of the most important ideas in science and in everyday life. Energy is usually defined as the ability to do work. We cannot see energy directly, but we can see what it does: it moves cars, heats homes, lights cities and powers machines in factories.

Energy exists in many different forms. Scientists often divide them into two large groups: stored energy and energy in motion. We call stored energy potential energy. A good example is the chemical energy in fuels such as coal, oil and gas. We call energy in motion kinetic energy. Moving water, wind and a turning wheel all have kinetic energy.

There are several common forms of energy. Thermal energy is the internal energy of an object associated with the motion of its particles. Mechanical energy is the total kinetic and potential energy of an object. Electrical energy is the energy of

moving electric charges. Chemical energy is stored in the bonds between atoms, and nuclear energy is stored in the nucleus of the atom.

One of the most important laws of nature is the law of conservation of energy. It states that energy cannot be created or destroyed; it can only change from one form to another. When we burn fuel in a power plant, chemical energy is converted into thermal energy, then into mechanical energy and finally into electrical energy.

Because energy can take so many forms and can be transformed so easily, it plays a central role in industry and in the modern economy.

3. Answer the questions on the text.

1. How do scientists define energy?
2. Why can we say that energy is important in everyday life?
3. What is the difference between potential energy and kinetic energy?
4. Name several common forms of energy.
5. What does the law of conservation of energy state?
6. What happens to energy when we burn fuel in a power plant?

4. True or False? Read the statements. Correct the false ones.

Example: We can create and destroy energy. – False. We cannot create or destroy energy; it can only change from one form to another.

1. We can see energy directly.
2. Potential energy is stored energy.
3. Energy can be created and destroyed.
4. When we burn fuel, chemical energy is first converted into thermal energy.
5. Kinetic energy is the energy of motion.

5. Find in the text the English equivalents of the following expressions.

1. способность совершать работу;
2. увидеть, что энергия делает;
3. разные формы энергии;
4. накопленная энергия;
5. энергия движения;
6. химическая энергия в топливе;
7. движущиеся электрические заряды;
8. связи между атомами;
9. закон сохранения энергии;
10. переходить из одной формы в другую;
11. преобразовываться в тепловую энергию;
12. играть центральную роль в промышленности и современной экономике.

6. Fill in the gaps with the correct prepositions from the list: *of, into, in, to or from*. Some prepositions may be used more than once.

1. Energy is defined as the ability _____ do work.
2. Scientists divide energy _____ two large groups.
3. Chemical energy is stored _____ the bonds between atoms.
4. The law of conservation _____ energy is one of the most important laws of nature.
5. Chemical energy is converted _____ thermal energy in a power plant.
6. Energy can change _____ one form to another.

7. Match the words to make collocations from the lesson.

1. to do	a) energy
2. to store	b) charges
3. to convert	c) of nature
4. moving electric	d) work
5. law	e) energy into another form

8. Match the form of energy with its description.

1. thermal energy	a) energy stored in the bonds between atoms
2. mechanical energy	b) the internal energy of an object due to the motion of its particles
3. electrical energy	c) energy stored in the nucleus of the atom
4. chemical energy	d) the total kinetic and potential energy of an object
5. nuclear energy	e) the energy of moving electric charges

9. Complete the table with the missing nouns or verbs.

Verb	Noun
define	
	conversion
transform	
_____	creation
destroy	_____
	measurement
exist	

10. Find in the text words from the same word family as the following words.

1. definition
2. motion
3. electricity
4. chemistry
5. transformation

11. Translate the sentences into English using the vocabulary of the lesson.

1. Уголь, нефть и газ являются ископаемыми видами топлива, и они содержат химическую энергию.
2. Закон сохранения энергии гласит, что энергию нельзя создать или уничтожить, но можно преобразовать из одной формы в другую.
3. Кинетическая энергия – это энергия движения, а потенциальная энергия – это запасённая энергия.
4. Когда мы сжигаем уголь, химическая энергия преобразуется в тепловую, затем в механическую и, наконец, в электрическую энергию.
5. Энергия ветра – это кинетическая энергия, которая преобразуется в электрическую энергию с помощью турбин.

Grammar focus: Past Simple

Table 5.1. Past Simple formation (Образование форм Past Simple)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	subject + V-ed/V2	People <i>used</i> coal to produce steam. Engineers <i>built</i> new power plants.
Negative (Отрицание)	subject + did not / didn't + V1	People <i>didn't</i> use electricity in their homes.
General question Yes/No question (Общий вопрос)	Did + subject + V1?	<i>Did</i> engineers <i>build</i> new power plants?
Special question / Wh-question (Специальный вопрос)	Wh-word + did + subject + V1?	When <i>did</i> engineers <i>build</i> the first power plants?
Short answers (Короткий ответ)	Yes, subject did. / No, subject didn't.	Yes, they did. / No, they didn't.
Time markers (Временные маркеры)	in the nineteenth century; later; then; in 1900; many years ago, last (week, month, year), yesterday.	The steam engine changed industry in <i>the nineteenth century</i> .

Table 5.2. Irregular verbs used in the lesson (неправильные глаголы, встречающиеся в уроке)

Infinitive	Past Simple	Participle II	Translation
begin	began	begun	начинать(ся)
build	built	built	строить
burn	burnt	burnt	сжигать
find	found	found	находить
have	had	had	иметь

12. Read the mini-paragraph and underline the verbs in the Past Simple. Divide them into regular and irregular verbs.

The Development of Energy Use

In the nineteenth century, people used coal to produce steam. The steam engine changed industry and transport. Later, engineers built electric power plants, and these plants began to supply energy to cities and factories. In the twentieth century, scientists developed new energy technologies.

Regular verbs	Irregular verbs

13. Open the brackets and use the correct Past Simple form of the verbs.

1. In the nineteenth century, people _____ (*use*) coal to produce steam.
2. The steam engine _____ (*change*) industry and transport.
3. Engineers _____ (*build*) electric power plants near large cities.
4. The new plants _____ (*supply*) energy to homes and factories.
5. Scientists _____ (*develop*) new ways to generate electricity.
6. Electricity _____ (*begin*) to play an important role in industry.
7. Power plants _____ (*convert*) chemical energy into thermal energy.
8. New energy technologies _____ (*develop*) rapidly in the twentieth century.

14. Correct the factual mistakes according to the mini-paragraph in exercise 12. Use a negative sentence and then give the correct information.

Example: *Scientists developed new energy technologies in the eighteenth century.*

*Scientists **didn't develop** new energy technologies in the eighteenth century. They **developed** them in the twentieth century.*

1. People used oil to produce steam in the nineteenth century.
2. The steam engine changed only agriculture.
3. Scientists built electric power plants.
4. Engineers built electric power plants in ancient times.
5. The plants supplied energy only to villages.
6. Scientists stopped developing energy technologies in the twentieth century.

15. Make general questions in the Past Simple and give short answers according to the mini-paragraph in exercise 12.

Example: *People used coal to produce steam.*

Did people use coal to produce steam? – Yes, they did.

1. The steam engine changed industry and transport.
2. Engineers built electric power plants.
3. The plants supplied energy to cities and factories.
4. Scientists developed new energy technologies.
5. People used oil to produce steam in the nineteenth century.
6. Scientists developed new energy technologies in the nineteenth century.

16. Ask special questions using the question words in brackets.

Example: *People used coal to produce steam. (What)*

What did people use to produce steam?

1. The steam engine changed industry and transport. (*What*)
2. Engineers built electric power plants. (*What*)
3. Scientists developed new energy technologies in the twentieth century. (*When*)
4. The plants supplied energy to cities and factories. (*Where*)

17. Pair work.

Work in pairs. **Discuss** the questions using the **Past Simple**. Use at least three expressions from the Useful language section.

1. What energy sources did people use before electricity became common?
2. How did the steam engine change industry and transport?
3. When did the first electric power plants begin to supply energy to cities?
4. Which energy technologies did engineers develop in the twentieth century?
5. Which invention had the greatest influence on everyday life? Explain your answer.

Useful language: describing past developments

- *In the nineteenth century, people used ...*
- *The steam engine changed ...*
- *Later, engineers built ...*
- *... began to supply energy to ...*
- *People did not use ...*
- *Did people use ...? — Yes, they did. / No, they did not.*
- *After that, ...*
- *Finally, ...*

18. Case study.

Bringing Electricity to a Mountain Village

In 1925, engineers built a small hydroelectric power plant near a mountain village. Before that, the villagers used coal and wood for heating and oil lamps for lighting. The new plant used the energy of moving water and supplied electricity to homes, workshops and a local school.

Discuss:

1. What energy sources did the villagers use before 1925?
2. What did the engineers build, and which energy source did the plant use?
3. What form of energy did the moving water have, and what form of energy did the plant produce?
4. How did the new power plant change life in the village?
5. Why was moving water a suitable energy source for the mountain village?

19. Writing.

Write 5–6 sentences answering the question: **How did energy use develop in the nineteenth and twentieth centuries?**

Describe the energy sources people used, the technologies engineers developed and the changes these technologies brought to everyday life and industry.

Use at least four words or expressions from the lesson:

coal, steam engine, power plant, generate electricity, energy source, convert energy, industry.

Use:

- the **Past Simple** at least four times;
- at least one regular verb;
- at least one irregular verb;
- at least one negative form;
- at least two linking words or phrases.

Prompts:

- In the nineteenth century, people used ...
- The steam engine changed ...
- Later, engineers built ...
- Power plants began to ...
- People did not have / use ...
- In the twentieth century, scientists developed ...
- As a result, ...

Linking words and phrases:

first, then, later, after that, as a result, finally, however

20. Translate the text into Russian in writing, using a dictionary.

Energy and Power

People often use the words ‘energy’ and ‘power’, but these words do not mean the same thing. Energy is the ability to do work, while power is the rate at which energy is used or produced. In other words, power tells us how quickly energy is transferred. Energy is measured in joules, and power is measured in watts. A powerful machine uses a large amount of energy in a short time.

LESSON 6. HEAT AND TEMPERATURE

Discuss the questions before reading the text.

- How do you keep a house warm in winter?
- Why does a metal spoon in hot tea become hot?
- Why can the Sun warm the Earth through empty space?

1. Vocabulary for the lesson.

aluminium (n)	ˌæljəˈminiəm	алюминий
average (adj)	ˈævərɪdʒ	средний
bar (n)	bɑː	стержень
boil (v)	bɔɪl	кипеть
boiler (n)	ˈbɔɪlə	котёл
break (v)	breɪk	ломаться, разбиваться
common (adj)	ˈkɒmən	распространённый
conduction (n)	kənˈdʌkʃən	теплопроводность, теплопередача; кондукция
conductor (n)	kənˈdʌktə	проводник
convection (n)	kənˈvekʃən	конвекция
cooling (n)	ˈkuːlɪŋ	охлаждение
copper (n)	ˈkɒpə	медь
degree (n)	dɪˈɡriː	градус
difference (n)	ˈdɪfrəns	разница, разность
direction (n)	dəˈrekʃən	направление
empty space (n)	ˈempti speɪs	пустое пространство
equilibrium (n)	iːkwɪˈlɪbriəm	равновесие;
thermal equilibrium	ˈθɜːməl iːkwɪˈlɪbriəm	тепловое равновесие
fall (v)	fɔːl	падать, снижаться
flow (v, n)	fləʊ	течь, переходить; поток
fluid (n)	ˈfluːɪd	текучая среда; жидкость или газ
gas (n)	ɡæs	газ
heat (n, v)	hiːt	тепло; нагревать
heat exchanger (n)	hiːt ɪksˈtʃeɪndʒə	теплообменник
heat loss (n)	hiːt lɒs	потеря тепла, теплотери
heating (n)	ˈhiːtɪŋ	нагрев, отопление
insulation (n)	ˌɪnsjʊˈleɪʃən	изоляция, теплоизоляция
insulator (n)	ˈɪnsjʊleɪtə	изолятор, теплоизоляционный материал
involve (v)	ɪnˈvɒlv	включать в себя
liquid (n)	ˈlɪkwɪd	жидкость
lose (v)	luːz	терять
measure (v)	ˈmeɪʒə	измерять
notice (v)	ˈnəʊtɪs	замечать

particle (n)	'pɑ:tɪkəl	частица
pipe (n)	paɪp	труба
protect (v)	prə'tekt	защищать
radiation (n)	,reɪdɪ'eɪʃən	излучение
record (v)	rɪ'kɔ:d	записывать, фиксировать
reduce (v)	rɪ'dju:s	снижать, сокращать
rise (v)	raɪz	подниматься, повышаться
sink (v)	sɪŋk	опускаться
solid (n, adj)	'sɒlɪd	твёрдое тело; твёрдый
suddenly (adv)	'sʌdnli	внезапно
surrounding (P I)	sə'raʊndɪŋ	окружающий
temperature (n)	'temprətʃə	температура
test (v)	test	испытывать, проверять
transfer (v, n) heat transfer (n)	træns'fɜ:; 'trænsfɜ: hi:t 'trænsfɜ:	передавать; передача; теплопередача
vessel (n)	'vesəl	сосуд
wave (n)	weɪv	волна

2. Read and translate the text.

Heat and Temperature

In everyday speech, people often use the words 'heat' and 'temperature' as if they mean the same thing. In physics, however, they describe two different ideas.

Temperature is a measure of how hot or cold an object is. More exactly, it tells us about the average kinetic energy of the tiny particles that make up the object. When the particles move faster, the temperature is higher. When they move more slowly, the temperature is lower. We measure temperature with a thermometer, in degrees Celsius or Fahrenheit, or in kelvins.

Heat is energy transferred from one object to another because of a difference in temperature. Heat naturally flows from a warmer object to a colder one. This flow continues until both objects reach the same temperature. At that moment, we say that they are in thermal equilibrium.

There are three ways in which heat can travel. In conduction, heat passes through a solid material, for example along a metal bar. In convection, heat moves through a liquid or a gas as the warm parts rise and the cold parts sink. In radiation, heat travels as waves and can even cross empty space; this is how the energy of the Sun reaches the Earth.

Engineers must understand heat and temperature very well, because almost every industrial process involves heating, cooling or the transfer of thermal energy.

3. Answer the questions on the text.

1. How are the words 'heat' and 'temperature' used in everyday speech, and why are they different in physics?
2. What does temperature tell us about the particles in an object, and how do we measure it?
3. Why does heat flow from one object to another, and in which direction does it flow?
4. What happens when two objects reach thermal equilibrium?
5. What are the three ways in which heat can travel? Give an example of each.
6. Why must engineers understand heat and temperature?

4. True or False? Read the statements. Correct the false ones.

Example: *Temperature is a form of energy. – False. Temperature is not a form of energy; it is a measure of how hot or cold an object is.*

1. Heat and temperature mean exactly the same thing.
2. Heat naturally flows from a colder object to a warmer one.
3. In conduction, heat passes through a solid material.
4. In convection, warm parts rise and cold parts sink.
5. Radiation cannot travel through empty space.
6. When two objects reach the same temperature, heat stops flowing between them.

5. Find in the text the English equivalents of the following expressions.

1. мера того, насколько горяч или холоден объект;
2. средняя кинетическая энергия частиц;
3. частицы, из которых состоит объект;
4. измерять температуру термометром;
5. разница температур;
6. переходить от более тёплого объекта к более холодному;
7. достигать одинаковой температуры;
8. находиться в тепловом равновесии;
9. проходить через твёрдый материал;
10. распространяться в виде волн и пересекать пустое пространство.

6. Complete the sentences with the correct preposition: *from, to, of, through* or *in*. Some prepositions can be used more than once.

1. Heat flows _____ a warmer object _____ a colder one.
2. Temperature is a measure _____ how hot an object is.
3. In conduction, heat passes _____ a solid material.
4. We measure temperature _____ degrees Celsius.
5. Copper is a better conductor _____ heat than glass.
6. Heat can travel _____ empty space in the form of waves.
7. The two objects are _____ thermal equilibrium.

7. Fill in the gaps with the correct word combinations from the list. Change the form of the verbs if necessary. Use each word combination once.

a good conductor of heat; a common insulator; protect hot pipes; reach thermal equilibrium; reduce heat loss; transfer thermal energy

1. Copper is _____.
2. Glass is _____.
3. Insulation helps _____ in buildings.
4. Special materials are used to _____ in industrial systems.
5. A heat exchanger _____ from one fluid to another.
6. Two objects _____ when they have the same temperature.

8. Match the terms with their definitions.

1. conduction	a) the process of making something warmer
2. convection	b) a state in which two objects have the same temperature and no heat flows between them
3. cooling	c) the transfer of heat as waves, which can cross empty space
4. heating	d) a material that does not allow heat to pass through it easily
5. insulator	e) the transfer of heat through a fluid as warm parts rise and cold parts sink
6. radiation	f) the transfer of heat through a solid material, for example along a metal bar
7. thermal equilibrium	g) the process of making something colder or removing heat from it

9. Complete the table with the corresponding nouns. In one case, the verb and the noun have the same form.

Verb	Noun
conduct	
cool	
radiate	
measure	
insulate	
transfer	
differ	

10. Fill in the gaps with suitable words or phrases from the list. Change their form if necessary. There are two extra options.

average, boil, boiler, direction, fluid, particle, solid, surrounding air, thermometer, wave

1. In a _____, water is heated to produce hot water or steam for a building.
2. The tiny _____ of a substance move faster when its temperature rises.
3. Water begins to _____ at 100 degrees Celsius.
4. A _____ can be either a liquid or a gas because both can flow.
5. The engineer used an arrow to show the _____ of heat flow.

6. An uninsulated pipe transfers some of its heat to the _____.
7. In a _____, the particles are packed closely together and cannot move freely.
8. We read the temperature on the scale of a _____.

11. Translate the sentences into English using the vocabulary of the lesson.

1. Температура показывает среднюю кинетическую энергию частиц, из которых состоит объект.
2. Тепло передаётся через твёрдый материал путём теплопроводности, а в жидкости или газе — путём конвекции.
3. Излучение может пересекать пустое пространство, поэтому энергия Солнца достигает Земли.
4. В системе отопления горячая вода течёт по трубам и нагревает воздух в помещении.
5. Во время охлаждения температура жидкости снижается, и жидкость становится холоднее.
6. Промышленные процессы часто включают нагрев, охлаждение и передачу тепловой энергии.

Grammar focus: Past Simple vs Past Continuous

Table 6.1. Past Continuous Formation (Образование Past Continuous)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	subject + was / were + V-ing	The engineers <i>were testing</i> the new turbine.
Negative (Отрицание)	subject + was not / were not + V-ing	The plant <i>was not supplying</i> energy at that moment.
General question Yes/No question (Общий вопрос)	Was / Were + subject + V-ing?	<i>Were</i> the engineers <i>testing</i> the turbine?
Special question / Wh-question (Специальный вопрос)	Wh-word + was / were + subject + V-ing?	What <i>were</i> the engineers <i>doing</i> at 10 o'clock?
Short answers (Короткий ответ)	Yes, subject was / were. No, subject was not / were not.	Yes, they were. / No, they were not.
Typical markers (Типичные маркеры)	at 10 o'clock, at that moment, while, when.	

Table 6.2. Comparison of Past Simple and Past Continuous (Сравнение использования Past Simple и Past Continuous)

Tense (Время)	Past Simple	Past Continuous
Feature (Характеристика)	Завершенное действие или факт в прошлом	Действие, протекавшее в определенный момент в прошлом
Example 1	The engineer <i>checked</i> the generator. – Инженер <i>проверил</i> генератор.	At 10 o'clock, the engineer <i>was checking</i> the generator. – В 10 часов инженер <i>проверял</i> генератор.
Example 2	Engineers <i>built</i> a power plant in 1925. – Инженеры <i>построили</i> электростанцию в 1925 году. <i>Важен факт.</i>	Engineers <i>were building</i> a power plant in 1925. – Инженеры <i>строили</i> электростанцию в 1925. <i>Важен процесс.</i>

12. Read the mini-paragraph and write out the verbs in the Past Simple and Past Continuous.

During the Experiment

During the experiment, the students were heating water in a metal vessel. One student was measuring the temperature while another student was recording the results. The students were watching the thermometer when the water started to boil. At that moment, the temperature stopped rising.

Past Continuous	Past Simple

13. Open the brackets and use the correct Past Simple or Past Continuous form of the verbs.

- While the engineer _____ (*test*) the new heat exchanger, the temperature _____ (*rise*) suddenly.
- While the technician _____ (*measure*) the temperature, the liquid _____ (*begin*) to boil.
- The researchers _____ (*work*) on the cooling system when the pipe _____ (*break*).
- The engineer _____ (*notice*) a significant temperature difference while he _____ (*check*) the pipes.
- The metal bar quickly _____ (*become*) hot while heat _____ (*flow*) through it.
- While the team _____ (*test*) the new material, they _____ (*make*) an important discovery.
- The students _____ (*record*) the results when the thermometer _____ (*fall*) into the vessel.

14. Translate the sentences into English using the vocabulary and grammar of the lesson. Use the Past Simple or Past Continuous as appropriate.

1. Студенты нагревали воду, когда она начала кипеть.
2. Пока один студент измерял температуру, другой записывал результаты.
3. Инженер проверял теплообменник, когда температура внезапно поднялась.
4. Пока тепло проходило через металлический стержень, стержень нагревался.
5. Рабочие ремонтировали систему охлаждения, когда труба сломалась.
6. Пока исследователи проводили эксперимент, они заметили значительную разницу температур.

15. Pair work.

Work in pairs. **Discuss** the experiment from Exercise 12. Use the **Past Simple** and **Past Continuous** and at least three expressions from the Useful language section.

1. What were the students doing during the experiment?
2. What was one student doing while another student was recording the results?
3. What happened when the water started to boil?
4. What happened to the temperature after the water started to boil?
5. What did the students notice during the experiment?

Useful language: describing an experiment

- During the experiment, the students were ...
- While one student was ..., another student was ...
- The students were ... when ...
- At that moment, ...
- They noticed that ...
- After that, ...
- Finally, ...

16. Case study.

Inspecting a Heating System

Yesterday, engineers were inspecting a heating system in a factory. Hot steam was flowing through a long metal pipe. While the engineers were measuring the temperature, they noticed that the pipe was losing a large amount of heat to the surrounding air. They stopped the inspection and discussed the problem.

Discuss the questions. Use the **Past Continuous** to describe actions in progress and the **Past Simple** to describe completed events.

1. What were the engineers doing when they noticed the heat loss?
2. What was flowing through the pipe?
3. How was heat passing through the metal wall of the pipe?
4. Why was the heat loss a problem for the factory?
5. Which material is more suitable for reducing heat loss: a conductor or an insulator? Explain your answer.

17. Writing.

Write 5–6 sentences answering the question: **What happened during a heat experiment?**

Describe:

- what the students were doing;
- what happened during the experiment;
- what result they observed.

Use at least four words or expressions from the lesson: *temperature, thermometer, heat transfer, metal vessel, measure temperature, rise, thermal energy, record the results.*

Use:

- the **Past Continuous** at least twice to describe actions in progress;
- the **Past Simple** at least twice to describe completed events and results;
- both **when** and **while**;
- at least two additional time expressions or linking words.

Prompts:

- During the experiment, the students were ...
- While one student was ..., another student was ...
- The temperature was rising when ...
- Then ...
- The students noticed that ...
- Finally, ...

Time expressions and linking words: *during, while, when, then, after that, as a result, finally*

18. Translate the text into Russian in writing, using a dictionary.

Conductors and Insulators

Some materials let heat pass through them easily, while others do not. Materials that allow heat to flow quickly are called good conductors. Most metals, such as copper and aluminium, are good conductors, and engineers use them in heat exchangers and radiators. Materials that do not let heat pass easily are called insulators. Still air, glass and plastic are common insulators. We use insulators to keep heat inside buildings and to protect hot pipes in industry.

LESSON 7. ENERGY SOURCES: FOSSIL FUELS AND RENEWABLES

Discuss the questions before reading the text.

- What sources of energy does your country use?
- Which is better for the environment: coal or wind? Why?
- Why can countries not rely only on solar energy?

1. Vocabulary for the lesson.

advantage (n)	əd'vɑ:ntɪdʒ	преимущество
approve (v)	ə'pru:v	утверждать, одобрять
available (adj)	ə'veɪləbəl	доступный, имеющийся
biomass (n)	'baɪəʊməs	биомасса
burn (v)	bɜ:n	гореть; сжигать
challenge (n)	'tʃælɪndʒ	сложная задача; проблема, требующая решения
coal (n)	kəʊl	уголь
convenient (adj)	kən'vi:nɪənt	удобный
dependence (n)	dɪ'pendəns	зависимость
develop (v)	dɪ'veləp	развивать, разрабатывать
disadvantage (n)	dɪsəd'vɑ:ntɪdʒ	недостаток
emissions (n pl)	ɪ'mɪʃənz	выбросы
energy consumption (n)	'enədʒi kən'sʌmpʃən	энергопотребление
energy mix (n)	'enədʒi mɪks	энергетический баланс; совокупность используемых источников энергии
environment (n)	ɪn'vaɪrənmənt	окружающая среда
environmental (adj)	ɪn'vaɪrən'mentəl	экологический; связанный с окружающей средой
fossil fuel (n)	'fɒsəl 'fju:əl	ископаемое топливо
geothermal heat (n)	dʒi:əʊ'θɜ:məl hi:t	геотермальное тепло
government (n)	'gʌvənmənt	правительство
hydropower (n)	'haɪdrəʊ'paʊə	гидроэнергия; гидроэнергетика
import (v, n)	ɪm'pɔ:t; 'ɪmpɔ:t	импортировать; импорт
in favour of (phrase)	ɪn 'feɪvər əv	в пользу
install (v)	ɪn'stɔ:l	устанавливать
island (n)	'aɪlənd	остров
limited (adj)	'lɪmɪtɪd	ограниченный
natural gas (n)	'nætʃərəl 'gæs	природный газ
non-renewable (adj)	'nɒn rɪ'nju:əbəl	невозобновляемый
obtain (v)	əb'teɪn	получать, добывать
offshore (adj, adv)	ˌɒf'ʃɔ:	морской; в открытом море
oil (n)	ɔɪl	нефть
pollute (v)	pə'lju:t	загрязнять
provide (v)	prə'vaɪd	обеспечивать, предоставлять

reduce (v)	rɪ'dju:s	уменьшать, сокращать
release (v)	rɪ'li:s	выделять, выбрасывать
reliable (adj)	rɪ'laɪəbəl	надёжный
rely on (phr v)	rɪ'laɪ ɒn	полагаться на, зависеть от
renew (v)	rɪ'nju:	возобновлять
renewable (adj)	rɪ'nju:əbəl	возобновляемый
replace (v)	rɪ'pleɪs	заменять
reserves (n pl)	rɪ'zɜ:vz	запасы
run out (phr v)	rʌn aʊt	заканчиваться, истощаться
solar (adj) solar energy solar panel solar plant	 'səʊlər 'səʊlər 'enədʒi 'səʊlə 'pænəl 'səʊlə plɑ:nt	солнечный; солнечная энергия; солнечная панель; солнечная электростанция
source (n)	sɔ:s	источник
supply (v, n)	sə'plai	снабжать, поставлять; снабжение, запас
tidal power (n)	'taɪdəl 'paʊə	энергия приливов; приливная энергетика
tide (n)	taɪd	прилив
transition (n)	træn'zɪʃən	переход
unlimited (adj)	ʌn'limitɪd	неограниченный
wind (n) wind energy (n) wind farm (n) wind turbine (n)	 wind 'wind 'enədʒi 'wind fɑ:m 'wind 'tɜ:bain	ветер; ветровая энергия; ветровая электростанция; ветряная турбина

2. Read and translate the text.

Energy Sources: Fossil Fuels and Renewables

Modern society uses a huge amount of energy every day. We obtain this energy from many different sources, which we usually divide into two large groups: non-renewable sources and renewable sources.

Non-renewable sources cannot be replaced quickly after they are used. The main non-renewable energy sources are fossil fuels: coal, oil and natural gas. They were formed deep in the ground over millions of years from the remains of plants and animals. Today, fossil fuels still provide most of the world's energy. They are convenient and cheap, but they have two serious disadvantages: their reserves are limited, and burning them releases gases that pollute the air and contribute to climate change.

Renewable sources, on the other hand, are renewed by natural processes. Solar energy comes from the Sun, wind energy comes from moving air, and hydropower comes from flowing or falling water. People also use biomass, geothermal heat and the energy of the tides. Renewable sources are generally cleaner than fossil fuels. Some renewable sources, such as solar and wind energy, are almost unlimited, but they are not always available: the Sun does not shine at night, and the wind does not blow all the time.

For these reasons, most countries today are trying to use less energy from fossil fuels and more energy from renewable sources. The transition from fossil fuels to renewable energy is one of the greatest challenges facing the modern economy.

3. Answer the questions on the text.

1. What two large groups do we divide energy sources into?
2. What are the main fossil fuels, and how were they formed?
3. What are the advantages and disadvantages of fossil fuels?
4. Give three examples of renewable energy sources.
5. Why are some renewable sources not always available?
6. What energy transition are most countries trying to make today, and why?

4. True or False? Read the statements. Correct the false ones.

Example: Renewable sources are limited. – False. Renewable sources are renewed by natural processes, and some are almost unlimited.

1. Fossil fuels can be replaced quickly after they are used.
2. Coal, oil and natural gas are fossil fuels.
3. Burning fossil fuels can contribute to climate change.
4. Solar and wind energy are always available.
5. Some renewable energy sources are almost unlimited.
6. Most countries today are trying to use more energy from fossil fuels.

5. Find in the text the English equivalents of the following expressions.

1. огромное количество энергии;
2. невозобновляемые источники;
3. их запасы ограничены;
4. загрязнять воздух;
5. падающая вода;
6. одна из величайших проблем, стоящих перед современной экономикой.

6. Fill in the gaps with the correct prepositions or prepositional phrases from the list: *from, into, on, of, out of* or *in*. Use each option once.

1. We obtain energy _____ many different sources.
2. We divide energy sources _____ two large groups.
3. Many countries rely _____ fossil fuels.
4. The reserves _____ oil and gas are limited.
5. One day, some countries will run _____ oil.
6. Governments change their energy mix _____ favour of cleaner sources.

7. Match the verbs with the words or phrases to make collocations from the lesson.

1. run	a) energy
2. rely	b) gases
3. release	c) out of oil
4. provide	d) fossil fuels
5. replace	e) on fossil fuels

8. Classify the energy sources into two groups: renewable and non-renewable.

coal, solar energy, oil, wind energy, natural gas, hydropower, biomass, geothermal heat, tidal power

Renewable energy sources	Non-renewable energy sources

9. Match the terms with their definitions.

1. biomass	a) electricity produced using the energy of falling or flowing water
2. energy mix	b) energy sources that are renewed by natural processes
3. fossil fuel	c) the combination of different energy sources that a country uses to meet its energy needs
4. geothermal heat	d) energy sources that cannot be replaced quickly after they are used
5. hydropower	e) a fuel formed from the remains of plants and animals over millions of years
6. non-renewable energy sources	f) heat that comes from inside the Earth
7. renewable energy sources	g) plant or animal material used as fuel to produce energy
8. tidal power	h) electricity produced using the energy of the tides

10. Complete the table with the correct nouns and adjectives. In one case, the verb and the noun have the same form.

A.

Verb	Noun
pollute	
provide	
replace	
supply	

B.

Verb	Adjective
depend	
limit	
rely	
renew	

Grammar focus: Future Simple (will) vs be going to
The basic meaning of can, may, must

Table 7.1. Future Simple – prediction or opinion about the future (Future Simple – прогнозирование и выражение мнения о будущем)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	subject + will + V1	Renewable energy <i>will grow</i> .
Negative (Отрицание)	subject + will not / (won't) + V1	Countries <i>will not</i> (won't) rely only on fossil fuels in the future.
General question / Yes/No question (Общий вопрос)	Will + subject + V1?	<i>Will</i> energy prices <i>rise</i> ?
Special question / Wh-question (Специальный вопрос)	Wh-word + will + subject + V1?	<i>How will</i> the country <i>produce</i> electricity in 2050?
Short answers (Короткий ответ)	Yes, + pronoun + will. / No, + pronoun + won't.	Yes, they will. / No, they won't.
Common expressions (Распространенные выражения)	I think...; I believe...; Experts predict that...; probably; in the future	<i>I think</i> fossil fuels <i>will become</i> more expensive.

Table 7.2. Be going to – a plan or intention that already exists (Be going to – планирование и выражение намерения)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	subject + am / is / are going to + V1	The country <i>is going to build</i> a solar plant.
Negative (Отрицание)	subject + am / is / are not going to + V1	The company <i>is not going to use</i> coal.
General question / Yes/No question (Общий вопрос)	Am / Is / Are + subject + going to + V1?	<i>Is</i> the government <i>going to develop</i> wind energy?
Special question / Wh-question (Специальный вопрос)	Wh-word + am / is / are + subject + going to + V1?	<i>Where are</i> they <i>going to build</i> the wind farm?

Form (Форма)	Structure (Структура)	Example (Пример)
Short answers (Короткий ответ)	Yes, + pronoun + am / is / are. / No, + pronoun + am not / isn't / aren't.	Yes, it is. / No, it isn't.
Typical context (Употребление)	a decision has already been made	<i>The government has approved the project. It is going to build three solar plants.</i>

11. Complete the sentences with *will* or the correct form of *be going to*. Use *will* for predictions and opinions. Use *be going to* for plans and intentions that have already been decided.

- Experts believe that renewable energy _____ become more important in the future.
- The government has approved the project. It _____ build three new solar plants.
- I think fossil fuels _____ become more expensive.
- The company has bought land near the coast. It _____ build a new wind farm.
- In the future, many countries _____ use less coal.
- We have already made a plan. We _____ install solar panels next year.
- Scientists predict that global energy consumption _____ continue to grow.
- The island has decided to reduce its dependence on imported oil. It _____ develop solar and wind power.

Table 7.3. The basic meaning of modal verbs *can*, *may* and *must* (Базовые значения модальных глаголов *can*, *may*, *must*)

Modal verb (Модальный глагол)	Basic meaning (Базовое значение)	Example (Пример)
can + V1	ability or general possibility (способность или общая возможность)	Solar panels can provide electricity for a house. – Солнечные панели могут снабжать дом электроэнергией.
may + V1	possible future development (возможная ситуация в будущем)	Fossil fuels may become more expensive. – Ископаемое топливо, возможно , станет дороже.
must + V1	necessity or obligation (необходимость или обязательство)	Countries must reduce emissions. – Страны должны сократить выбросы.
Запомните: после модальных глаголов используется инфинитив без частицы to .		

12. Complete the sentences with *can*, *cannot*, *may* or *must*. Use each modal verb twice.

- Modern wind turbines _____ supply electricity to remote areas.
- Solar panels _____ produce electricity at night.
- Oil and natural gas _____ become more expensive in the future.
- Countries _____ reduce emissions to protect the environment.

5. Biomass _____ replace some fossil fuels in heating systems.
6. Tidal power _____ become an important energy source for islands.
7. A reliable energy system _____ depend on only one source.
8. Governments _____ create a cleaner and more reliable energy mix.

13. Complete the text with *will*, the correct form of *be going to*, *can*, *cannot*, *may* or *must*. Use each form once.

The government has approved a new energy programme. It 1) _____ build two solar power plants next year. Experts believe that renewable energy 2) _____ become more important. Solar panels 3) _____ provide electricity during the day, but they 4) _____ produce it at night. Energy prices 5) _____ remain high, although experts are not certain. For this reason, the country 6) _____ develop a cleaner and more reliable energy mix.

14. Translate the sentences into English using the vocabulary and grammar of the lesson.

1. Эксперты считают, что возобновляемая энергия станет более важной в будущем.
2. Правительство уже утвердило проект и собирается построить три солнечных электростанции.
3. Солнечные панели могут снабжать дома электроэнергией, но они не могут производить её ночью.
4. Ископаемое топливо может стать более дорогим, потому что его запасы ограничены.
5. Компания купила землю у побережья и собирается построить новую ветровую электростанцию.
6. Страны должны сокращать выбросы и уменьшать зависимость от невозобновляемых источников энергии.
7. Я думаю, что в будущем многие страны будут использовать меньше угля.
8. Будущий энергетический баланс будет включать больше возобновляемых источников энергии.

15. Pair work.

Work in pairs. Discuss the questions about the future of energy. Use at least three expressions from the Useful language section.

1. Which energy sources will become more important in the future?
2. Which energy sources can provide reliable electricity in your region?
3. What environmental problems may fossil fuels cause?
4. Which renewable energy projects do you think your region will develop?
5. What must countries do to create a cleaner energy mix?

Useful language:

- *I think ... will become more important.*
- *Our region is going to develop ...*
- *... can provide reliable electricity.*
- *... may become more expensive.*
- *We must reduce ...*
- *The future energy mix will include ...*

16. Case study.

Planning the Island's Future Energy Mix

A small island has no fossil fuels of its own and imports all its oil at a high price. The island is sunny and windy for most of the year. The government has approved a ten-year energy programme. It is going to build a solar power plant and a small offshore wind farm.

Discuss the questions. Use **will** for predictions, **be going to** for approved plans, and **can, may** and **must** to describe possibilities, possible problems and necessary actions.

1. Why is the island's current energy situation difficult, and which renewable sources can it use?
2. What energy projects is the government going to develop?
3. What problems may arise when the island uses solar and wind energy, and how can it solve them?
4. How will the island's energy mix change, and what must the government do to reduce the island's dependence on imported oil?

17. Writing.

Write 6–7 sentences answering the question: **How will your country produce energy in the future?**

Use at least four words or expressions from the lesson: *renewable energy, non-renewable energy, fossil fuel, energy source, pollute, run out, energy mix, replace.*

Use:

- **will** at least once to make a prediction;
- **be going to** at least once to describe a plan or intention;
- at least two of the modal verbs **can, may** and **must**;
- at least two linking words or phrases.
- **Prompts:**
- In the future, my country will ...
- I think renewable energy will ...
- The government is going to ...
- Renewable sources can ...
- Fossil fuels may ...
- We must ...
- The future energy mix will ...

Linking words and phrases: *because, so, however, in the future, as a result, that is why*

18. Translate the text into Russian in writing, using a dictionary.

The Energy Mix

No country uses only one energy source. The combination of different sources that a country uses is called its energy mix. This mix depends on many factors: natural resources, the level of technology, fuel prices and government policy. A country with large coal reserves may rely on coal, while a sunny country may develop solar power. Today, many countries are changing their energy mix in favour of cleaner sources.

LESSON 8. THE ROLE OF ENERGY IN THE ECONOMY

Discuss the questions before reading the text.

- Why does every factory need energy?
- What happens to prices when fuel becomes more expensive?
- Can energy resources increase a country's wealth? Give an example.

1. Vocabulary for the lesson.

activity (n) economic activity (n)	æk'tɪvəti ,i:kə'nɒmɪk æk'tɪvəti	деятельность; экономическая деятельность
affect (v)	ə'fekt	влиять на
announce (v)	ə'naʊns	объявлять, сообщать
appliance (n)	ə'plaɪəns	прибор, бытовое устройство
be closely connected (phrase)	bi: 'kləʊsli kə'nektɪd	быть тесно связанным
competitive (adj)	kəm'petətɪv	конкурентоспособный
consume (v)	kən'sju:m	потреблять
consumer (n)	kən'sju:mə	потребитель
consumption (n) energy consumption	kən'sʌmpʃən 'enədʒi kən'sʌmpʃən	потребление; энергопотребление
cost (n)	kɒst	стоимость; затраты
decoupling (n)	,di:'kʌplɪŋ	разделение, разграничение
economic growth (n)	,i:kə'nɒmɪk grəʊθ	экономический рост
efficient (adj)	ɪ'fɪʃənt	эффективный
efficiency (n) energy efficiency	ɪ'fɪʃənsi 'enədʒi ɪ'fɪʃənsi	эффективность; энергоэффективность
energy imports (phrase)	'enədʒi ɪm'pɔ:ts	импорт энергоносителей
energy policy (n)	'enədʒi ɪ'pɒləsi	энергетическая политика
energy-efficient technology (phrase)	'enədʒi ɪ'fɪʃənt tek'nɒlədʒi	энергоэффективная технология
equipment (n)	ɪ'kwɪpmənt	оборудование
fall (v)	fɔ:l	падать, снижаться
function (v)	'fʌŋkʃən	работать, функционировать
go hand in hand with sth (phrase)	gəʊ hænd ɪn hænd wɪð	быть тесно связанным с чем-либо
government (n)	'gʌvənmənt	правительство
grow (v)	grəʊ	расти, увеличиваться
household (n)	'haʊshəʊld	домохозяйство
import (v, n)	ɪm'pɔ:t; 'ɪmpɔ:t	импортировать; импорт

increase (v, n)	in'kri:s; 'inkri:s	увеличиваться, увеличивать; рост, увеличение
input (n)	'ɪnpʊt	производственный ресурс; фактор производства
install (v)	in'stɔ:l	устанавливать
introduce (v)	ˌɪntrə'dju:s	вводить, внедрять
invest in (phr v)	in'vest in	инвестировать в, вкладывать средства в
investment (n)	in'vestmənt	инвестиция, вложение
labour (n)	'leɪbə	труд, рабочая сила
manufacturing (n)	ˌmænjʊ'fæktʃərɪŋ	промышленное производство
output (n)	'aʊtpʊt	объём выпуска, произведённая продукция
pass on (phr v)	pɑ:s ɒn	перекладывать на (кого-л.)
production costs (n pl)	prə'dʌkʃən kɒsts	производственные затраты
raw materials (n pl)	rɔ: mə'tiəriəlz	сырьё
reduce (v)	rɪ'dju:s	снижать, сокращать
rise (v, n)	raɪz	расти, повышаться; рост, повышение
run (v)	rʌn	приводить в действие; обеспечивать работу
stable (adj)	'steɪbəl	стабильный, устойчивый
sharply (adv)	'ʃɑ:pli	резко
steadily (adv)	'stedɪli	стабильно, устойчиво, постепенно
vehicle (n)	'vi:ɪkəl	транспортное средство
wealth (n)	welθ	богатство, благосостояние

2. Read and translate the text.

The Role of Energy in the Economy

Energy and the economy are closely connected. Every economic activity – farming, manufacturing, transport and services – needs energy. Without energy, factories cannot produce goods, vehicles cannot move, and modern cities cannot function. For this reason, economists pay special attention to energy.

Energy is an input, or factor of production, just like labour and capital. Firms buy energy in order to produce goods and services, and households buy it to heat their homes and to run their appliances. Because both firms and households need energy, the demand for it is high and relatively stable.

The price of energy has a strong effect on the whole economy. When the price of oil or gas rises sharply, the cost of production rises too. Firms must pay more for transport and raw materials, and they often pass these higher costs on to consumers. In

this way, a rise in energy prices can lead to higher prices for many other goods.

Energy resources can also increase a country's wealth. Countries that have large reserves of oil, gas or coal can export these resources and earn a great deal of money. At the same time, the efficient use of energy makes a country more competitive because its firms can produce the same goods at a lower cost. This is why energy policy is one of the central questions for every modern government.

In recent years, many governments have introduced new energy policies, and firms have invested in energy-efficient technologies. These changes have reduced energy consumption in some industries. As a result, many firms have become more competitive. In some countries, the economy has grown while energy use has remained relatively stable. Economists call this process decoupling.

3. Answer the questions on the text.

1. Why are energy and the economy closely connected?
2. What do firms and households use energy for?
3. In what sense is energy a factor of production?
4. How does a rise in energy prices affect the economy?
5. How can large energy reserves increase a country's wealth?
6. Why can the efficient use of energy make a country more competitive?
7. What changes have governments and firms made in recent years, and what results have these changes produced?

4. True or False? Read the statements. Correct the false ones.

Example: *Energy is not important for transport. – False. Vehicles cannot move without energy.*

1. Every economic activity needs energy.
2. Households use energy only to heat their homes.
3. The demand for energy is high and relatively stable.
4. When the price of oil or gas rises sharply, the cost of production falls.
5. Large reserves of oil, gas or coal can increase a country's wealth.
6. In recent years, firms have invested less in energy-efficient technologies.

5. Find in the text the English equivalents of the following expressions.

1. быть тесно связанными;
2. фактор производства;
3. спрос на энергию;
4. перекладывать возросшие затраты на потребителей;
5. крупные запасы нефти, газа или угля;
6. производить те же товары с меньшими затратами;
7. инвестировать в энергоэффективные технологии;
8. потребление энергии оставалось относительно стабильным.

6. Fill in the gaps with the correct prepositions from the list: *on, for, of, to, with or in*. Some prepositions may be used more than once.

1. Energy use often goes hand in hand _____ economic growth.
2. The demand _____ energy is high and relatively stable.
3. Firms often pass higher costs on _____ consumers.
4. The cost _____ production often depends _____ energy prices.
5. Many firms invest _____ energy-efficient technologies.
6. A rise _____ energy prices can lead _____ higher prices for other goods.

7. Match the adjectives with the nouns to make collocations from the text.

1. central	a) reserves
2. economic	b) attention
3. efficient	c) use
4. large	d) effect
5. special	e) activity
6. strong	f) question

8. Match the terms with their definitions.

1. appliance	a) the process of making products in large quantities
2. competitive	b) to operate or control a machine, system or business
3. decoupling	c) an electrical device used in the home, such as a fridge or washing machine
4. function	d) able to compete well with others because of lower costs or better quality
5. manufacturing	e) a car, truck or other machine used for transport
6. run	f) the process of reducing the link between economic growth and energy use
7. vehicle	g) a large amount of money, property and valuable resources
8. wealth	h) to work or operate properly

9. Fill in the gaps with suitable words or phrases from the list. There are two extra options.

appliance, competitive, decoupling, economic activity, energy consumption, government, input, manufacturing, vehicle, wealth

1. The _____ is responsible for developing energy policies that affect the whole economy.
2. Every _____, from farming to transport, requires a supply of energy.
3. A _____ that uses less fuel is more attractive to buyers.
4. Energy efficiency makes industries more _____ by reducing their production costs.
5. The _____ sector uses a large amount of energy to produce goods in factories.
6. A modern _____, such as a refrigerator or washing machine, consumes electricity every day.
7. Without energy as an _____, industrial production would stop completely.
8. New technologies can help firms reduce their _____.

10. Complete the table with the corresponding noun or verb.

Noun	Verb
consumption	
	produce
growth	
	invest
reduction	
	manufacture

Grammar focus 1: Present Perfect vs Past Simple

Present Perfect используется для описания действий или изменений в прошлом, которые связаны с настоящим. Past Simple используется для завершённых действий в определенный законченный момент в прошлом.

Table 8.1. Present Perfect Formation (Образование Present Perfect)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	I / you / we / they + have + V3 He / she / it + has + V3	Governments <i>have introduced</i> new energy policies. Energy efficiency <i>has become</i> more important.
Negative (Отрицание)	I / you / we / they + have not (haven't) + V3 He / she / it + has not (hasn't) + V3	Firms <i>haven't</i> reduced their energy costs yet. The price of gas <i>hasn't fallen</i> yet.
General question Yes/No question (Общий вопрос)	Have I / you / we / they + V3? Has + he / she / it + V3?	<i>Have</i> firms reduced their energy consumption? <i>Has</i> the government introduced a new energy policy?
Special question / Wh-question (Специальный вопрос)	Wh-word + have / has + subject + V3?	<i>What</i> changes <i>have</i> governments introduced? How <i>has</i> energy use changed?
Short answers (Короткий ответ)	Yes, + pronoun + have / has. No, + pronoun + haven't / hasn't.	Yes, I have. / No, I haven't. Yes, they have. / No, they haven't. Yes, it has. / No, it hasn't.
Typical markers (Типичные маркеры)	since, for, just, already, yet ever, never, recently, lately, today, this week / month / year, in recent years	Economists have studied this relationship <i>for</i> many years Energy prices have <i>already</i> risen. Have you <i>ever</i> visited a power plant? Many firms have invested in energy-efficient technologies <i>this year</i> .

Table 8.2. Comparison of Present Perfect and Past Simple (Сравнение Present Perfect и Past Simple)

Feature (Характеристика)	Present Perfect	Past Simple
Meaning (Значение)	A past action connected with the present (Действие в прошлом связано с настоящим).	A completed action at a specific finished time in the past (Завершенное действие в определенный период в прошлом).
Time reference (Временное соотношение)	No specific finished past time is stated; the period or result is connected with now (Не указан точный период в прошлом , результат связан с настоящим).	A specific finished time is stated or understood (Период в прошлом точно указан или подразумевается).
Common markers (Типичные маркеры)	just, already, yet, ever, never, since, for, recently, lately, today, this week / month / year, in recent years	yesterday, last week / month / year, in 2019, in March, two years ago, then
Example (Пример)	Energy prices <i>have risen</i> . – Цены на энергию <i>повысились</i> . The country <i>has reduced</i> its energy imports since 2020. – Страна <i>снизила</i> импорт энергоносителей с 2020 года.	Oil prices <i>rose last year</i> . – В <i>прошлом году</i> цены на нефть <i>повысились</i> . The company <i>installed</i> new equipment <i>in March</i> . – Компания <i>установила</i> новое оборудование в <i>марте</i> .

Table 8.3. Irregular verbs used in the lesson (Неправильные глаголы, встречающиеся в уроке)

V1	V2	V3
be	was / were	been
become	became	become
fall	fell	fallen
find	found	found
grow	grew	grown
lead	led	led
rise	rose	risen
see	saw	seen

11. Fill in the gaps with *just, already, yet, since, for, recently* or *this year*. Use each word or phrase once.

- The government has _____ announced a new energy policy, and journalists are still discussing it.
- Although the programme began only a month ago, several companies have _____ reduced their production costs.
- Energy prices have not fallen _____.

4. Economists have studied the relationship between energy and the economy _____ many years.
5. Energy efficiency has become more important _____ 2020.
6. Several firms have invested in energy-efficient technologies _____. These investments were made only in the last few weeks.
7. The country has reduced its energy consumption by 5 % _____, and it plans to reduce it further next year.

12. Open the brackets and use the correct Present Perfect form of the verbs. Then write a general question for each sentence.

1. Economists _____ (*study*) the relationship between energy and the economy for many years.
2. The price of energy _____ (*rise*) sharply several times over the last decade.
3. Many countries _____ (*invest*) in renewable energy sources in recent years.
4. Scientists _____ (*not find*) a perfect solution to the energy problem yet.
5. The demand for energy _____ (*grow*) steadily over the past 50 years.
6. Engineers _____ (*develop*) a new technology that reduces energy consumption.
7. Energy efficiency _____ (*become*) more important for firms since the last price increase.
8. We _____ (*see*) a strong connection between energy prices and economic growth in recent years.

13. Open the brackets and use the correct Present Perfect or Past Simple form of the verbs.

1. The price of oil _____ (*rise*) sharply in 1973.
2. Since 2020, many firms _____ (*invest*) in renewable energy sources.
3. Last month, the factory _____ (*reduce*) its energy consumption.
4. The demand for electricity _____ (*grow*) steadily over the past ten years.
5. Economists _____ (*study*) energy markets in the 1970s.
6. The government _____ (*already introduce*) a new energy policy this year.
7. The country _____ (*reduce*) its energy imports since 2020.
8. The company _____ (*install*) new equipment in March.

Grammar focus 2: modal verbs and their equivalents

Table 8.4. Modal verbs and their equivalents (Модальные глаголы и их эквиваленты)

Form (Форма)	Meaning (Значение)	Example (Пример)
can / could / be able to	ability, possibility (способность, возможность)	Energy resources can increase a country's wealth. – Энергетические ресурсы могут увеличить благосостояние страны. Economists will be able to analyse the impact of energy prices. – Экономисты смогут проанализировать влияние цен на энергию.
may / might	possibility or formal permission (возможность, формальное разрешение)	Households may install solar panels. – Домохозяйства могут устанавливать солнечные панели. Governments might introduce stricter energy policies. – Правительства, возможно , введут более строгую энергетическую политику
must	strong obligation or prohibition (строгое долженствование)	Countries must consider energy policy carefully. – Страны должны тщательно рассматривать энергетическую политику.
must not (mustn't)	prohibition (запрет)	Firms must not ignore energy regulations. – Компаниям нельзя игнорировать энергетические нормы.
have to / has to / had to / will have to	an external requirement or necessity (внешняя необходимость)	The company had to invest in energy-efficient technologies. – Компании пришлось инвестировать в энергоэффективные технологии.
do not have to	lack of obligation (отсутствие необходимости)	Companies do not have to use fossil fuel. – Компании не обязаны использовать ископаемое топливо
should / ought to	recommendation, advice (совет, рекомендация)	Firms should reduce energy waste. – Компаниям следует сокращать потери энергии.
need to	practical necessity (практическая необходимость)	Countries need to diversify their energy sources. – Странам необходимо диверсифицировать свои источники энергии.
be allowed to	permission (разрешение)	Households are allowed to choose their energy supplier. – Домохозяйствам разрешено выбирать своего поставщика энергии.
be required to	a formal or external obligation (формальное или внешнее требование)	Firms are required to comply with energy regulations. – Компании обязаны соблюдать энергетические нормы.
be to	a formal instruction or scheduled requirement (формальная инструкция или требование)	The efficiency targets are to be met by 2030. – Целевые показатели эффективности должны быть достигнуты к 2030 году.

14. Complete the sentences with the correct modal. Some verbs may be used more than once.

can, could, may, might, must, had to, should, need to, will be able to, are allowed to |

1. Countries that have large oil reserves _____ export them and earn money.
2. Firms _____ reduce their energy consumption to stay competitive.
3. Companies _____ report their energy use to the authorities.
4. Without energy, factories _____ not produce goods.
5. Countries _____ reduce their dependence on imported energy.
6. Only licensed companies _____ trade energy resources.
7. Energy prices _____ rise sharply in the future.
8. The government _____ balance economic growth and environmental protection.
9. Many firms _____ increase their prices when oil prices rose.
10. In future many households _____ generate their own electricity.

15. Pair work.

Work in pairs. **Student A** chooses one recent change from the list. **Student B** explains how this change has affected firms and consumers, what consequences it can or may have, and what firms or governments must do. **Then swap roles** and choose a different change.

Finally, **compare** the two changes and decide which one has had a stronger effect on the economy.

Recent changes:

1. Energy prices have risen sharply.
2. A factory has reduced its energy consumption.
3. The government has introduced a new energy policy.
4. Companies have invested in energy-efficient technologies.

Useful language:

- ... *has / have increased / reduced* ...
- *This change has led to* ...
- *It can affect firms / consumers because* ...
- *It may lead to higher / lower* ...
- *Firms / Governments must* ...
- *I think ... has had a stronger effect than ... because* ...

Use at least four words or phrases:

production costs, consumers, competitive, energy prices, energy policy, reduce, invest in, pass higher costs on to.

16. Case study.

Rising Natural Gas Prices

A country imports most of its natural gas. This winter, the price of gas on the world market has risen sharply. Factories have faced higher heating and production costs, and some firms have passed these higher costs on to consumers.

Discuss the questions. Use the **Present Perfect** to describe recent changes and **can**, **may** and **must** to discuss possible consequences, available actions and necessary measures.

1. What has happened to the price of natural gas, and how has this affected factories?
2. How have higher production costs affected consumers and the prices of goods?
3. What problems may continue if gas prices remain high?
4. What can the government do to reduce the country's dependence on imported gas, and what must factories do to reduce their energy costs?

17. Writing.

Write 6–7 sentences answering the question: **How have energy prices and energy use changed in your country or region in recent years?**

Use at least four words or phrases from the lesson:

energy prices, production costs, consumers, energy consumption, competitive, efficient, reduce, invest in, energy policy, economic growth.

Use:

- the **Present Perfect** at least twice;
- the **Past Simple** at least once with a specific finished past time, such as **last year, in 2022** or **two years ago**;
- **since** or **for** at least once;
- **already** or **yet** at least once;
- at least two linking words or phrases.

Prompts:

- In recent years, energy prices have ...
- Since ..., energy consumption has ...
- The government has already ...
- Companies have invested in ...
- Last year, ...
- As a result, ...

Linking words and phrases:

because, as a result, since then, however, that is why

18. Translate the text into Russian in writing, using a dictionary.

Energy and Economic Growth

For a long time, economic growth went hand in hand with increased energy use. Richer countries usually consumed more energy than poorer ones. Today, however, many developed countries are trying to break this link. With the help of new technology, they want to keep their economies growing while using less energy for each unit of output. Economists call this the decoupling of economic growth from energy use.

SEMESTER 1 GRAMMAR WORKSHOP

Putting it all together

During Semester 1, you have learned how to describe facts and regular actions, actions in progress, completed past events, future actions and changes connected with the present. This workshop adds one final tense to the Active Voice system, brings the main tense forms together and completes the question system before the Semester 1 Progress Check.

Part 1. One step further back: what had happened before?

New grammar: Past Perfect

1. Read the short energy-audit timeline and compare the order of events.

1. The factory carried out an energy audit. Before the audit began, electricity bills **had risen** sharply.
2. The engineers inspected the insulation. It **had become** ineffective before the inspection.
3. By the time the engineers finished the inspection, they **had identified** the main sources of heat loss.
4. The management decided to replace the insulation after the engineers **had completed** the audit.
5. The factory installed LED lamps after the team **had calculated** the potential savings.

Answer the questions.

1. Which actions happened first?
2. Which actions happened later?
3. Which verb form is used for the earlier actions?
4. What do the highlighted verb forms have in common?

Past Perfect formation (Образование Past Perfect)

Form (Форма)	Structure (Структура)	Example (Пример)
Affirmative (Утверждение)	subject + had + V3	The engineers <i>had completed</i> the audit.
Negative (Отрицание)	subject + had not (hadn't) + V3	The company <i>hadn't checked</i> the insulation.
General question (Общий вопрос)	Had + subject + V3?	<i>Had</i> the engineers <i>tested</i> the system?
Special question (Специальный вопрос)	Wh-word + had + subject + V3?	What <i>had</i> the engineers <i>identified</i> ?
Short answers (Короткий ответ)	Yes, + subject + had. No, + subject + hadn't.	Yes, they <i>had</i> . / No, they <i>hadn't</i> .
Запомните: Past Perfect используется, когда из одной точки в прошлом мы обращаемся к действию, которое произошло ещё раньше.		

Past Perfect vs Past Simple (Сравнение использования Past Perfect и Past Simple)

Tense (Время)	Use and markers (Употребление и маркеры)	Markers (Маркеры)	Example (Пример)
Past Perfect	the earlier of two past actions (действие, предшествующее другому действию в прошлом)	before, after, by the time, already, just, never, not yet	By the time the audit <i>began</i> , the factory <i>had already collected</i> the energy data.
Past Simple	the later past action or a completed action at a stated past time (более позднее действие или завершённый факт в прошлом)	yesterday, last week, last year, in 2025, then	After the engineers <i>had completed</i> the audit, the manager <i>approved</i> the project.

2. Complete the sentences with the correct Past Simple or Past Perfect form of the verbs in brackets.

- The factory **(reduce)** _____ its energy consumption after it **(install)** _____ new insulation.
- The engineers **(start)** _____ production after they **(test)** _____ the new equipment.
- The manager **(decide)** _____ to replace the old lamps because he **(calculate)** _____ the potential savings.
- By the time the audit **(begin)** _____, the company **(collect)** _____ all the energy data.
- The factory **(switch)** _____ to renewable energy after the price of electricity **(increase)** _____ significantly.
- The engineers **(design)** _____ a new heat-recovery system after they **(analyse)** _____ the factory's energy losses.
- The company **(save)** _____ a considerable amount of money after it **(install)** _____ a waste heat recovery system.
- The manager **(already / leave)** _____ the meeting when the new data **(arrive)** _____.

3. Complete the story with the Past Perfect or Past Simple. Then identify which actions happened first and which happened later.

Last year, the factory **(carry out)** _____ an energy audit. Before that, the company **(never / check)** _____ its heat losses. When the engineers **(inspect)** _____ the pipes, they **(find)** _____ that the old insulation **(be)** _____ in poor condition. By the time they **(finish)** _____ the report, they **(already / identify)** _____ the main sources of heat loss. After the audit, the management **(decide)** _____ to replace the old insulation and modernise the equipment. By the end of the year, the factory **(reduce)** _____ its energy consumption by 15 per cent.

Part 2. Review: Active Voice tenses

Now the Active Voice tense system for Semester 1 is complete. Review the forms together and choose each tense according to the meaning and time reference of the situation.

4. Complete the text using the correct Active Voice form of the verbs in brackets. Use the Present Simple, Present Continuous, Past Simple, Past Continuous, Present Perfect, Past Perfect or Future Simple. Some tenses are used more than once.

An Energy Audit

A large factory normally **(use)** _____ a great deal of electricity to run its machines. Last year, the management **(order)** _____ an energy audit because electricity bills **(rise)** _____ sharply by that time. While the engineers **(inspect)** _____ the building, they **(discover)** _____ that the factory was losing a large amount of heat through the roof and old pipes. Before the audit began, the company **(never / check)** _____ its insulation carefully. By the time the factory **(install)** _____ new insulation, the engineers **(complete)** _____ the audit. The factory also replaced its old lamps with LED lamps. Since then, it **(reduce)** _____ its energy consumption by 15 per cent. At the moment, the engineers **(test)** _____ a waste heat recovery system. The factory now **(spend)** _____ less on energy every month than it did before. The engineers believe that the new system **(reduce)** _____ fuel use even further next year.

Part 3. Asking the right questions

You have already used general, special and subject questions in different tenses. Now bring the main question types together, revise their structure and add one more useful type: Tag Questions.

Main question types (Основные типы вопросов)

Question type (Тип вопроса)	Structure (Структура)	Example (Пример)
General / Yes-No question (Общий вопрос)	auxiliary + subject + verb ...?	Has the company reduced its energy use?
Special / Wh-question (Специальный вопрос)	Wh-word + auxiliary + subject + verb ...?	Why did the factory replace the old equipment?
Subject question (Вопрос к подлежащему)	Who / What + verb ...?	Who approved the new energy programme?
Alternative question (Альтернативный вопрос)	general question + or + alternative?	Did the company replace the boiler or repair it?
Tag question (Разделительный вопрос)	statement + short question tag	The new system is more efficient, isn't it?

New grammar: Tag Questions

Разделительный вопрос – это короткий вопрос, который добавляется в конце утверждения. Он используется, чтобы проверить информацию, получить подтверждение или вовлечь собеседника в разговор.

Tag Questions with the main Active Voice forms (Разделительные вопросы с основными формами Active Voice)

Form in the statement (Форма в утверждении)	Positive statement + negative tag (Утверждение + отрицательный tag)	Negative statement + positive tag (Отрицание + положительный tag)
Present Simple	The system reduces heat losses, doesn't it?	The system doesn't waste energy, does it?
Present Continuous	The engineers are testing the system, aren't they?	The engineers aren't testing the old unit, are they?
Past Simple	The factory installed LED lamps, didn't it?	The factory didn't replace the machines, did it?
Past Continuous	The engineers were inspecting the pipes, weren't they?	The engineers weren't testing the boiler, were they?
Present Perfect	The company has reduced its energy use, hasn't it?	The company hasn't completed the audit, has it?
Past Perfect	The engineers had checked the equipment, hadn't they?	The engineers hadn't completed the test, had they?
Future Simple	The upgrade will lower the bills, won't it?	The project won't take long, will it?
Modal verb	The factory can reduce its fuel use, can't it?	The company can't replace all the equipment, can it?
Запомните: заменяйте подлежащее на советующее местоимения: <i>the factory – it; the engineers – they.</i>		

5. Write the required question for each sentence.

- The company has introduced a new energy policy. (*general question*)
- The engineers completed the audit last week. (*When ...?*)
- The operations manager approved the new schedule. (*Who ...?*)
- The factory replaced the old boiler. (*alternative question: replace / repair*)
- The new insulation reduces heat losses. (*tag question*)
- The company has not replaced the old equipment yet. (*tag question*)
- The factory can recover waste heat. (*tag question*)
- Energy prices rose because fuel became more expensive. (*Why ...?*)

6. Complete the sentences with the correct question tags.

- The new insulation reduces heat losses, _____?
- The engineers are testing the waste heat recovery system, _____?
- The company replaced its old lamps last year, _____?
- The old equipment wasn't energy-efficient, _____?
- The factory has reduced its energy consumption by 15 per cent, _____?
- The company had never examined its heat losses before the audit, _____?
- The new system will lower electricity bills, _____?
- The factory can reuse waste heat, _____?

PROGRESS CHECK I

Lessons 1–8 and Semester 1 Grammar Workshop

Recommended time: 20–25 minutes.

A. Complete the sentences with the correct form or construction.

1. The operations manager usually **(compare)** _____ the weekly figures.
2. At present, the company **(use)** _____ a temporary production plan.
3. Line B is **(efficient; comparative)** _____ than Line A.
5. The technicians **(replace)** _____ the damaged valve yesterday.
6. While the pump **(run)** _____, the operator noticed a leak.
7. The company has approved the project and **(be going to / install)** _____ the equipment in October.
8. Only trained operators **(be allowed to)** _____ use the new control system.
9. Countries **(must)** _____ reduce emissions to meet the new standard.
10. The laboratory **(not / complete)** _____ the final test yet.
11. By the time the audit began, the engineers **(check)** _____ all the energy meters.

B. Write the required question for each sentence.

12. The company has introduced a new energy policy. **(general question)**

13. The engineer calculated the potential saving before the meeting. **(What ...?)**

14. The energy manager approved the final report. **(Who ...?)**

15. The factory replaced the boiler. **(alternative question: replace / repair)**

C. Complete the sentences with the correct question tags.

16. The plant has reduced waste, _____?
17. The company had never checked its heat losses before the audit, _____?

LESSON 9. INPUTS, OUTPUTS AND PRODUCTIVITY

Discuss the questions before reading the text.

- What inputs are needed to produce electricity, bread or a car?
- How can the productivity of a factory be measured?
- Why do companies buy new equipment?

1. Vocabulary for the lesson.

affect (v)	ə'fekt	влиять, воздействовать
amount (n)	ə'maʊnt	количество, объём
blunt (adj)	blʌnt	тупой, затупившийся
calculate (v)	'kælkjuleɪt	рассчитывать, вычислять
collect (v)	kə'lekt	собирать
compare (v)	kəm'peə	сравнивать
data (n, pl)	'deɪtə	данные, информация
defective (adj)	dɪ'fektɪv	дефектный, неисправный
define (v)	dɪ'faɪn	определять, давать определение
digital meter (n)	'dɪdʒɪtəl 'mɪ:tə	цифровой измерительный прибор
enormous (adj)	ɪ'nɔ:məs	огромный, значительный
experienced (adj)	ɪk'spiəriənst	опытный, квалифицированный
figure (n)	'fɪɡə	цифра, показатель
improvement (n)	ɪm'pru:vmənt	улучшение, усовершенствование
increase (v)	ɪn'kri:s	увеличивать
input (n)	'ɪnpʊt	входной ресурс, затрачиваемый фактор
labour (n)	'leɪbə	труд, рабочая сила
maintain (v)	meɪn'teɪn	обслуживать, поддерживать
make a difference (phrase)	meɪk ə 'dɪfrəns	иметь большое значение
measure (v, n)	'meɪʒə	измерять; мера, показатель
monitoring system (n)	'mɒnɪtərɪŋ 'sɪstəm	система мониторинга
obtain (v)	əb'teɪn	получать, достигать
output (n)	'aʊtpʊt	выпуск продукции, результат
productivity (n)	'prɒdʌk'tɪvəti	производительность;
labour productivity	'leɪbə 'prɒdʌk'tɪvəti	производительность труда;
total productivity	'təʊtəl 'prɒdʌk'tɪvəti	совокупная производительность

properly (adv)	'prɒpəli	правильно, надлежащим образом
quality standard (n)	'kwɒləti ,stændəd	стандарт качества
ratio (n)	'reɪʃiəʊ	соотношение, отношение
record (v, n)	rɪ'kɔ:d; 'rekɔ:d	записывать; запись, отчётные данные
relationship (n)	rɪ'leɪʃənʃɪp	взаимосвязь, отношение
shift (n)	ʃɪft	рабочая смена
source (n)	sɔ:s	источник
standard of living (n)	'stændəd əv 'lɪvɪŋ	уровень жизни
training programme (n)	'treɪnɪŋ ,prəʊgræm	программа обучения
unit of output (phrase)	'ju:nɪt əv 'aʊtpʊt	единица выпускаемой продукции
value (n)	'vælju:	показатель, значение, величина
wages (n pl)	'weɪdʒɪz	заработная плата
be affected by (phrase)	bɪ ə'fektɪd baɪ	зависеть от, подвергаться влиянию
be compared with (phrase)	bɪ kəm'peəd wɪð	сравниваться с
be defined as (phrase)	bɪ dɪ'faɪnd əz	определяться как
be measured in (phrase)	bɪ 'meɪzəd ɪn	измеряться в

2. Read and translate the text.

Inputs, Outputs and Productivity

Every production system can be described by its inputs and outputs. Inputs are the resources used in production, while outputs are the goods or services produced by the system. The relationship between them is measured by a value called productivity.

Productivity is defined as the ratio of output to input. In simple terms, it shows how much is produced from a given amount of resources. When more output is obtained from the same input, productivity increases. Productivity can also be raised by producing the same output with fewer resources.

Productivity can be measured in different ways. Labour productivity, for example, is the amount of output produced by one worker in one hour. Sometimes all inputs are considered together, and the result is called total productivity. Whichever measure is used, the aim is to compare what enters the system with what comes out of it.

Productivity is affected by many factors. Modern machines, well-trained workers and good organisation all help to raise it. When old equipment is replaced, the same work can often be done faster and with less energy. When machines are properly maintained, they break down less often and produce fewer defective parts. The skill of the workers is equally important: an experienced employee with a suitable tool can produce more than an untrained worker using a blunt one.

High productivity is important for both a company and a country. A productive firm can sell its goods at a lower price, pay higher wages and invest in new equipment. At national level, rising productivity supports economic growth and a higher standard of living.

Higher productivity does not always mean working harder. More often it means working in a better way – with better tools, a better plan and better organisation. A small improvement that is repeated year after year can make an enormous difference.

Managers therefore measure productivity regularly. Today, figures are often collected automatically by digital meters and monitoring systems and are compared with targets and earlier results. In the past, production records were usually completed by hand. In one engineering plant, a digital monitoring system was installed last year. After it was introduced, faults were detected more quickly and the amount of defective output was reduced.

3. Answer the questions on the text.

1. How can every production system be described?
2. What is productivity, and how can it be increased?
3. What is the difference between labour productivity and total productivity?
4. What factors affect productivity?
5. Why is productivity important for a company and for a country?
6. Why does higher productivity not always mean working harder?
7. How are productivity figures recorded today, and how were they recorded in the past?

4. Complete the sentences according to the text.

1. The inputs of a production system are the resources that ...
2. Productivity is defined as the ratio of ...
3. Productivity increases when more output ...
4. Labour productivity is the amount of output ...
5. Modern machines, well-trained workers and good organisation help ...
6. A firm with high productivity can sell its goods at a lower price, ... and invest in new equipment.
7. At national level, rising productivity supports ...
8. Today, production figures are often collected automatically, while in the past they...

5. Find in the text the English equivalents of the following expressions.

1. ресурсы, используемые в производстве;
2. товары или услуги, производимые системой;
3. отношение выпуска продукции к затраченным ресурсам;
4. производительность труда;
5. совокупная производительность;
6. продавать товары по более низкой цене;
7. поддерживать экономический рост и более высокий уровень жизни;
8. иметь огромное значение;

9. собираться автоматически цифровыми измерительными приборами;
10. заполняться вручную;
11. сократить количество дефектной продукции.

6. Fill in the gaps with the correct prepositions from the list: *as, by, from, in, of, per, to or with*. Use each option once.

1. Productivity is defined _____ the ratio of output to input.
2. Labour productivity may be measured _____ units per worker per hour.
3. The data are collected _____ digital meters.
4. The new figures are compared _____ the results of the previous month.
5. More output was obtained _____ the same amount of labour.
6. The number _____ defective items was reduced.
7. The factory produced twelve units _____ worker during the shift.
8. High productivity contributes _____ a higher standard of living.

7. Match the words to make collocations from the lesson.

1. labour	a) standards
2. digital	b) programme
3. quality	c) productivity
4. training	d) system
5. collect	e) output
6. record	f) data
7. increase	g) figures
8. reduce	h) resource use

8. Match the terms with their definitions.

1. input	a) the amount of goods or services produced by a system
2. output	b) a relationship between two quantities, usually expressed by dividing one by the other
3. productivity	c) the resources used in production
4. ratio	d) the output produced by one worker in a given time
5. labour productivity	e) the relationship between output and the resources used to produce it
6. total productivity	f) productivity calculated by considering all major inputs together
7. digital meter	g) a device that measures and records a value electronically
8. shift	h) a period of work in a factory or other organisation

9. Fill in the gaps with suitable words from the list. There are two extra options.
blunt, improvements, labour, measure, properly, ratio, relationship, source, value, wages

1. The _____ between output and input determines productivity.
2. _____ costs often represent a significant part of a company's expenses.
3. Technological _____ help reduce production time.

4. Equipment must be maintained _____ to avoid breakdowns.
5. The _____ of output to input is called productivity.
6. The _____ of a product depends on its quality and production cost.
7. Higher _____ can improve the standard of living of workers.
8. Education is an important _____ of skilled labour.

10. Complete the table with the missing words from the same word family.

Verb	Noun(s)	Adjective / Participle
produce	producer	productive
measure		measurable
compare		comparable
calculate		—
improve		improved
—	defect	

11. Translate the sentences into English using the vocabulary of the lesson.

1. Производительность показывает взаимосвязь между выпуском продукции и затраченными ресурсами.
2. Менеджеры рассчитывают производительность труда на одного работника в час.
3. Современное оборудование и хорошо обученные работники повышают производительность.
4. Регулярное техническое обслуживание помогает сократить количество дефектной продукции.
5. Предприятие с высокой производительностью может платить более высокую заработную плату.
6. Менеджеры сравнивают текущие показатели с результатами предыдущих месяцев.
7. Цифровые приборы собирают данные в течение каждой рабочей смены.
8. Даже небольшое улучшение может иметь огромное значение.

Grammar focus: Present Simple and Past Simple Passive

Страдательный залог (Passive Voice) имеет общую форму be + V3 и используется, когда требуется сделать акцент на самом действии или его результате, а не на том, кто его совершил, а также когда исполнитель действия неизвестен, неважен или очевиден из контекста.

Table 9.1. Present Simple and Past Simple Passive forms (Образование страдательного залога в Present Simple и Past Simple)

Form (Форма)	Structure (Структура)	Example (Пример)
Present Simple Passive	<i>am / is / are + V3</i>	Productivity is measured every day. – Производительность измеряется каждый день.
Present Simple Passive negative	<i>am / is / are not + V3</i>	The figures are not recorded by hand. – Данные не записываются вручную.
Present Simple Passive question	<i>Am / Is / Are + subject + V3?</i>	Are the results compared every month? – Результаты сравниваются каждый месяц?
Past Simple Passive	<i>was / were + V3</i>	The monitoring system was installed last year. – Система мониторинга была установлена в прошлом году.
Past Simple Passive negative	<i>was / were not + V3</i>	The data were not checked yesterday. – Данные не были проверены вчера.
Past Simple Passive question	<i>Was / Were + subject + V3?</i>	Were the workers trained before the system was introduced? – Рабочих обучили до того, как систему внедрили ?
Запомните: <i>by</i> + исполнитель в страдательном залоге используется, когда исполнитель важен.		

12. Choose the correct Active or Passive Voice form in each sentence.

- Modern machines and well-trained workers **affect / are affected** productivity significantly.
- Productivity **affects / is affected** by the quality of the equipment and the skills of the workers.
- Labour productivity **measures / is measured** in units per worker per hour.
- Digital meters **record / are recorded** production figures automatically.
- Production figures **compare / are compared** with planned targets every month.
- The company **installed / was installed** a new monitoring system last year.
- The old equipment **replaced / was replaced** by new machines last week.
- Technical staff **maintain / are maintained** the equipment regularly.

13. Open the brackets and use the correct Present Simple or Past Simple Passive form of the verbs.

- Productivity _____ (*define*) as the ratio of output to input.
- The data _____ (*collect*) automatically every shift.
- Production records _____ (*complete*) by hand in the past.
- A digital monitoring system _____ (*install*) last year.
- The results _____ (*compare*) with the target every month.
- The workers _____ (*train*) before the new system was introduced.
- Defective units _____ (*identify*) during the final inspection yesterday.
- Energy use _____ (*measure*) in kilowatt-hours.

14. Rewrite the sentences in the Passive Voice. Omit the agent when it is not important.

1. Digital meters record the production figures.
2. The technical team maintains the machines every week.
3. The company installed a new monitoring system last year.
4. The manager compared the results with the target.
5. Workers produced 500 units during the morning shift.
6. The inspection team identified several defective parts.
7. Economists calculate labour productivity per worker.
8. The factory introduced a new training programme in March.

15. Write questions in the Passive Voice using the given question words.

1. The results are compared every month. (How often)
2. Productivity is measured in units per worker per hour. (How)
3. The digital system was installed last year. (When)
4. The workers were trained before the system was introduced. (Were ...?)
5. The figures are recorded by the operations department. (By which department)
6. The defective parts were removed yesterday. (What)
7. The equipment is maintained according to a schedule. (Is ...?)
8. The new method was tested in Workshop 3. (Where)

16. Pair work

Work in pairs. You are productivity analysts discussing changes in the way a factory measures and improves productivity. Choose one change: digital meters, an electronic monitoring system, worker training, a weekly maintenance schedule or revised quality standards.

Student A explains how productivity is measured now and what was changed in the past. **Student B** asks two questions in the Passive Voice. Then swap roles and choose another change.

Compare the two changes and decide which one improved the reliability of the productivity figures most. Use the Present Simple Passive for regular processes and the Past Simple Passive for completed changes.

Useful language:

- Today, output is measured ...
- The figures are recorded / compared ...
- Last year, a new system was installed / introduced ...
- I think ... had the stronger effect because ...

17. Case study

Comparing Two Factories

Factory A produces 120 pumps a day with 12 workers. Factory B produces 180 pumps a day with the same number of workers.

Criterion	Factory A	Factory B
Production figures	written by hand	recorded digitally
Maintenance	after breakdowns	weekly schedule
Training	no formal training last year	workers were trained

1. Calculate the labour productivity of each factory.
2. Compare data recording, maintenance and training. Why may Factory A's measurement process be less reliable?
3. Which two changes should Factory A introduce first? Explain your choice.
4. How should the results be measured after three months?

Use the Present Simple Passive for regular processes and the Past Simple Passive for completed changes. Use the Useful language from Exercise 17.

18. Writing.

Write 7–8 sentences answering the question: **How is productivity measured, and how was it improved at a factory?**

Use the notes below.

Regular measurement:

- output is counted during every shift;
- labour, energy and material inputs are recorded;
- the figures are compared with planned targets.

Changes introduced last year:

- digital meters were installed;
- the workers were trained;
- a weekly maintenance schedule was introduced.

Results:

- the figures became more accurate;
- defects were identified earlier;
- output increased from 120 to 150 units per day.

Use at least four words or expressions from the lesson: *input, output, productivity, digital meter, labour productivity, monitoring system, record figures, raise productivity.*

Use:

- the Present Simple Passive at least twice;
- the Past Simple Passive at least twice;
- one general or special question in the Passive Voice;
- at least two linking words or phrases.

Prompts:

- Productivity is defined as ...
- During each shift, the figures are ...
- Last year, a new system was ...
- The workers were ...
- After that, defects were ...
- As a result, output ...

Linking words and phrases: *first, regularly, last year, after that, because, as a result, however.*

19. Translate the text into Russian in writing, using a dictionary.

Measuring Productivity

Productivity is usually measured as the amount of output divided by the amount of input. For example, if a worker produces ten units in one hour, labour productivity is ten units per hour. If a new machine helps the same worker to produce fifteen units in the same time, productivity has risen by half.

Managers measure productivity in order to compare different methods of production and to identify possible improvements. When a new method gives a higher figure, it is considered more productive, and it is usually chosen. The figures are also compared from month to month, so that any fall in productivity is noticed quickly and its cause is found.

A factory that measures its productivity knows exactly where it stands, while a factory that does not is working in the dark. In this way, productivity becomes a simple but powerful tool for management: it turns a vague question – “Are we working well?” – into a clear number that can be measured, compared and improved. Regular measurement is therefore one of the first habits of a well-run company

LESSON 10. TYPES OF PRODUCTION PROCESSES

Discuss the questions before reading the text.

- Is a ship produced in the same way as a bottle of water?
- Why are cars usually made on an assembly line?
- How are computers and robots changing traditional production methods?

1. Vocabulary for the lesson.

accurately (adv)	'ækjərətli	точно, правильно
assembly line (n)	ə'sembli laɪn	сборочная линия, конвейер
batch (n)	bætʃ	партия продукции
carefully (adv)	'keəfəli	тщательно, внимательно
carry out (phr v)	'kæri aʊt	выполнять, осуществлять
cost (n) cost per unit (phrase)	kɒst kɒst pə 'ju:nɪt	затраты, стоимость; затраты на единицу продукции
custom-built (adj)	'kʌstəm 'bɪlt	изготовленный по индивидуальному заказу
depend on (phr v)	dɪ'pend ɒn	зависеть от
flexibility (n)	'fleksə'bɪləti	гибкость
flexible (adj)	'fleksəbəl	гибкий
flexible manufacturing cell (phrase)	'fleksəbəl 'mænʃʊ'fæktʃəriŋ sel	гибкая производственная ячейка
gradually (adv)	'grædʒuəli	постепенно
identical (adj)	aɪ'dentɪkəl	одинаковый, идентичный
individual order (phrase)	'ɪndɪ'vɪdʒuəl 'ɔ:də	индивидуальный заказ
install (v)	ɪn'stɔ:l	устанавливать
medium quantity (n)	'mi:diəm 'kwɒntəti	средний объём продукции
perform (v)	pə'fɔ:m	выполнять
produce (v)	'prɒdʒu:s	производить
production (n) batch production job production mass production (n)	prə'dʌkʃən bætʃ prə'dʌkʃən dʒɒb prə'dʌkʃən mæs prə'dʌkʃən	производство; серийное производство партиями; единичное производство; массовое производство
reconfigure (v)	'ri:kən'fɪgə	перенастраивать, изменять конфигурацию
reduce (v)	rɪ'dʒu:s	снижать, сокращать
reset (v)	ri:'set	перенастраивать, переустанавливать
robotic system (n)	rəʊ'bɒtɪk 'sɪstəm	роботизированная система
select (v)	sɪ'lekt	выбирать
separately (adv)	'sepərətli	отдельно, по отдельности

skilled worker (n)	skild 'wɜ:kə	квалифицированный рабочий
standard product (n)	'stændəd ,prɒdʌkt	стандартное изделие
unique (adj)	ju:'ni:k	уникальный, единственный в своём роде
volume (n) production volume	,vɒlju:m prə'dʌkʃən ,vɒlju:m	объём; объём производства
workstation (n)	'wɜ:ksteɪʃən	рабочее место, рабочий пост
be made to order (phrase)	bi meɪd tə 'ɔ:də	изготавливаться на заказ
meet a special requirement (phrase)	mi:t ə 'speʃəl rɪ ,kwaɪəmənt	соответствовать особому требованию

2. Read and translate the text.

Types of Production Processes

Goods are not all produced in the same way. Depending on the product, the required quantity, the available equipment and the delivery time, different production processes are selected. Three main types are usually distinguished: job production, batch production and mass production.

In job production, a single product is made to meet a special order. Each item is produced separately, and the work is often carried out by skilled workers. This method is used for large or unique products, such as a ship, a bridge or a custom-built machine. Job production is flexible, but it is also slow and expensive because every product is different and much depends on the skill of the workers.

In batch production, a group of identical items is made together. When one batch has been completed, the machines are reset or reconfigured and a different product is started. Bakeries, furniture workshops and many engineering firms use this method. Batch production offers a useful compromise: it is more flexible than mass production and less expensive than job production.

In mass production, a very large number of identical products is made on an assembly line. The product is moved from one workstation to the next, and a particular operation is performed at each stage. Because the method is highly automated, goods are produced quickly and the cost per unit is low. It is used for cars, electronic devices and many household products. Its main weakness is limited flexibility: the line is designed for one product, and changing it can be difficult and expensive.

The correct process is chosen according to the product, the production volume, the required flexibility and the cost. A company that builds a few large machines will choose job production; a company that sells millions of identical containers will use mass production; and a firm producing medium quantities of several products will often select batch production.

Modern technology is gradually reducing the traditional differences between these methods. Flexible manufacturing cells have been installed in many factories, and robotic systems have been programmed to produce several products. At present, small batches are being made on equipment that was once used only for mass production. In

some plants, one line is being reconfigured while another continues to operate.

Further changes will be introduced in the future. More operations will be controlled automatically, smaller batches will be produced without long delays, and production schedules will be adjusted in real time. Whatever process is selected, the aim remains the same: to make the required product, in the right quantity and at an acceptable cost.

3. Answer the questions on the text.

1. Why are different types of production processes used?
2. What are the three main types of production?
3. What is job production used for, and how does it work?
4. How does batch production work, and why is it considered a useful compromise?
5. How are goods made in mass production, and what is the main weakness of this method?
6. How is the correct production process selected?
7. How is modern technology changing traditional production methods?
8. What further changes will be introduced in the future?

4. True or False? Read the statements. Correct the false ones.

Example: *All goods are produced by the same method. – False. Different production processes are selected for different products and quantities.*

1. Job production is normally used for millions of identical products.
2. Skilled workers are often involved in job production.
3. In batch production, the machines are never reset or reconfigured.
4. Mass production usually reduces the cost per unit.
5. Flexible manufacturing cells have been installed in many factories.
6. No production operations will be controlled automatically in the future.

5. Match each type of production with its typical example.

1. job production	a) cars and electronic devices made on an assembly line
2. batch production	b) a bridge or a custom-built machine made to a special order
3. mass production	c) identical chairs produced in groups before the equipment is reset

6. Find in the text the English equivalents of the following expressions.

1. выбираться в зависимости от изделия и требуемого количества;
2. изготавливаться для выполнения специального заказа;
3. производиться отдельно;
4. перенастраивать станки после завершения партии;
5. изготавливаться на сборочной линии;
6. выполняться на каждом этапе;
7. иметь низкие затраты на единицу продукции;
8. быть установленными на многих предприятиях;
9. быть запрограммированными для производства нескольких изделий;

10. производится небольшими партиями в настоящее время;
11. контролироваться автоматически в будущем.

7. Fill in the gaps with the correct prepositions from the list: *according to, at, between, by, on, to or within*. Some options may be used more than once.

1. The process is selected _____ the product and the production volume.
2. Custom-built machines are made _____ order.
3. The machines are reset _____ batches.
4. Cars are usually made _____ an assembly line.
5. The assembly line was introduced _____ the beginning of the twentieth century.
6. Many operations are performed _____ robotic systems.
7. The cost per unit must remain _____ an acceptable range.
8. Flexible production contributes _____ faster order fulfilment.

8. Match the words to make collocations from the lesson.

1. assembly	a) unit
2. individual	b) system
3. skilled	c) order
4. standard	d) volume
5. production	e) line
6. flexible manufacturing	f) worker
7. robotic	g) product
8. cost per	h) cell

9. Match the terms with their definitions.

1. job production	a) the production of a large number of identical products, usually on an assembly line
2. batch production	b) a place where one operation is performed in a production process
3. mass production	c) the production of one item or a small number of items to a special order
4. assembly line	d) a group of identical items produced together before the equipment is reset
5. workstation	e) a line on which a product moves through a series of operations
6. flexibility	f) a group of machines and robots that can be reconfigured for different products
7. flexible manufacturing cell	g) the ability to change a method, product or production volume
8. production volume	h) the quantity of goods produced during a given period

10. Practise the active vocabulary and word families.

A. Fill in the gaps with suitable words or phrases from the list. There are two extra options.

assembly line, batch production, carefully, carry out, depending on, flexibility, gradually, job production, mass production, reset

1. In _____, each product is made individually to meet a specific customer order.
2. After each batch is completed, the machines must be _____ before a different product is started.
3. _____ is a compromise between job production and mass production.
4. _____ the product and the quantity required, different production methods are selected.
5. The main advantage of job production is its _____.
6. The differences between production types are _____ becoming smaller.
7. Each workstation is designed to _____ a particular operation.
8. The manager must study the order _____ before selecting the production method.

B. Complete the table with the missing words from the same word family.

Verb	Noun	Adjective / Participle
produce	production	
automate		automated
reconfigure		reconfigured
select		selected
identify	identification	
—	flexibility	

11. Translate the sentences into English using the vocabulary of the lesson.

1. В единичном производстве квалифицированные рабочие изготавливают изделия по индивидуальным заказам.
2. В серийном производстве станки перенастраивают между партиями.
3. Серийное производство сочетает гибкость с более низкими затратами на единицу продукции.
4. На сборочной линии каждое рабочее место выполняет определённую операцию.
5. Массовое производство используют для выпуска большого количества одинаковых изделий.
6. Выбор производственного процесса зависит от изделия, объёма производства и требуемой гибкости.
7. Гибкие производственные ячейки позволяют предприятиям выпускать небольшие партии разных изделий.
8. Роботизированные системы помогают преодолеть традиционные ограничения массового производства.

Grammar focus: The Extended Passive Voice System

Table 10.1. Extended Passive Voice forms (Расширенная система времён в страдательном залоге)

Form (Форма)	Structure (Структура)	Example (Пример)	Markers (Маркеры)
Future Simple Passive	<i>will be + V3</i>	More processes will be automated next year. – В следующем году будет автоматизировано больше процессов.	<i>tomorrow, next week/month/year, in 2040</i>
Present Perfect Passive	<i>have / has been + V3</i>	A new production line has been installed. – Новая производственная линия была установлена .	<i>just, already, ever, never, since, for, yet, this week/month, year</i>
Present Continuous Passive	<i>am / is / are being + V3</i>	A batch is being produced now. – Партия в данный момент производится .	<i>now, at present, at the moment, currently</i>
Past Continuous Passive	<i>was / were being + V3</i>	The line was being reconfigured at 10 a.m. – В 10 утра линию перенастраивали .	<i>this time in the past, at 9 o'clock yesterday</i>

12. Elicit the Passive Voice form in each sentence, identify its tense and translate the sentence into Russian.

1. A new flexible manufacturing cell will be installed next month.
2. Three production lines have already been upgraded.
3. A trial batch is being produced in Workshop 2 at the moment.
4. At noon yesterday, the machines were being reset.
5. The final decision will be made tomorrow after the cost analysis.
6. The machines have not been reconfigured yet.
7. New safety sensors are being tested now.
8. The production line was being reconfigured when an urgent order arrived.

13. Choose the Passive Voice form that best fits the meaning and time reference of each sentence.

1. A new robotic system **was installed / has been installed** last year.
2. The current batch **is being produced / has been produced** at the moment.
3. The machines **will be reset / have been reset** tomorrow after the current batch is completed.
4. Two custom-built units **have already been made / are being made**, so they are ready for delivery.
5. At 9 a.m. yesterday, the production line **was being tested / has been tested**.
6. The new production schedule **has not been approved / is not being approved** yet, so production cannot begin.
7. More operations **will be controlled / were being controlled** automatically in the future.
8. The equipment **is being reconfigured / has been reconfigured** at the moment, so the line cannot operate.

14. Open the brackets and use the correct Passive Voice form of the verbs.

1. A new flexible manufacturing cell _____ (*install*) next month.
2. Three production lines _____ (*upgrade*) already.
3. A trial batch _____ (*produce*) in Workshop 2 at the moment.
4. At noon yesterday, the machines _____ (*reset*) for a different product.
5. The final decision _____ (*make*) tomorrow after the cost analysis.
6. The machines _____ not _____ (*reconfigure*) yet.
7. New safety sensors _____ (*test*) now.
8. The production line _____ (*reconfigure*) when an urgent order arrived.
9. More standard products _____ (*produce*) by robots in the future.
10. Several individual orders _____ (*complete*) so far this week.

15. Complete the text with the correct Passive Voice forms of the verbs in brackets.

A furniture factory is changing its production system. A new flexible cell 1) _____ (*install*) last month, and two workers 2) _____ already _____ (*train*) to operate it. At the moment, the first batch of chairs 3) _____ (*produce*). The equipment 4) _____ (*monitor*) by engineers while the process is being tested. The results 5) _____ not _____ (*analyse*) yet. If the test is successful, the old line 6) _____ (*replace*) next year, and more individual orders 7) _____ (*complete*) without increasing the cost per unit. During the installation last month, production 8) _____ (*transfer*) to another line.

16. Translate the sentences into English using the correct Passive Voice form.

1. Гибкая производственная ячейка уже установлена.
2. Рабочие ещё не обучены работе с новой системой.
3. В данный момент пробная партия производится на новой линии.
4. Станки перенастраивались, когда поступил срочный заказ.
5. Вторая роботизированная линия будет установлена в следующем году.
6. Производственный график уже изменён.
7. Новые датчики сейчас испытываются.
8. После успешного испытания несколько операций будут автоматизированы.

17. Pair work

Work in pairs. You are a production engineer and an operations manager discussing job production, batch production or mass production.

Student A chooses one method and explains what is normally produced by it, what equipment has already been installed or replaced, what is being tested or produced now and what will be changed in the future. **Student B** asks three questions: about a completed change, a current process and a future change.

Then swap roles and choose a different method. Compare the two methods and decide which one will become more flexible after modernisation. Use the Present Perfect Passive, Present Continuous Passive and Future Simple Passive.

Useful language:

- The product is normally made ...
- A new system has already been installed.

- At the moment, ... is being produced / tested.
- Next year, ... will be installed / replaced.

18. Case study

Choosing and Modernising a Production Process

A furniture company has three orders: one custom-designed conference table, sixty identical office chairs and five thousand simple wooden stools. One flexible manufacturing cell has already been installed and is still being tested. A second robotic line will be installed next year. The company wants to reduce cost per unit without losing flexibility.

1. Which production method should be used for each order, and which order should use the flexible manufacturing cell?
2. What has already been installed, what is being tested now and what will be installed next year?
3. Which production process should be modernised first? Explain your priority.
4. How will the new equipment affect cost per unit and flexibility?

Use at least one Present Perfect Passive, one Present Continuous Passive and one Future Simple Passive form. Use the Useful language from Exercise 17.

19. Writing

Write **7–8 sentences** answering the question:

How has a production process been modernised, and what will be changed next?

Use the notes below.

Before modernisation:

- machines were reset manually;
- small orders took too long;
- production data were recorded on paper.

Changes already completed:

- a flexible manufacturing cell has been installed;
- several workers have been trained;
- the production schedule has been changed.

Current and future work:

- a trial batch is being produced now;
- the new sensors are being tested;
- a robotic line will be installed next year.

Use at least four words or expressions from the lesson:

job production, batch production, mass production, assembly line, flexible manufacturing cell, reconfigure, be installed, be produced in batches.

Use:

- the Past Simple Passive at least once to describe the situation before modernisation;
- the Present Perfect Passive at least twice to describe completed changes;
- the Present Continuous Passive at least once to describe work in progress;

- the Future Simple Passive at least once to describe a planned change;
- at least two linking words or phrases.

Prompts:

- Before modernisation, the machines were ...
- Production data were ...
- A new system has already been ...
- Several workers have been ...
- At the moment, a trial batch is being ...
- Next year, a robotic line will be ...
- As a result, the company will ...

Linking words and phrases:

before, already, at the moment, next year, after that, however, as a result.

20. Translate the text into Russian in writing, using a dictionary.

The Assembly Line

The assembly line is one of the most important ideas in mass production. On an assembly line, the product is moved from one workstation to the next. At each station, a worker or a robot performs one simple operation, such as fixing a part or painting a surface.

Because the work is divided into small steps, it is completed quickly and accurately. Workers perform a limited number of repeated tasks rather than the entire production process. This method was first used widely in the car industry at the beginning of the twentieth century. As a result, manufacturers could produce goods in very large quantities and sell them at lower prices.

Over the last century, assembly-line systems have been introduced in factories throughout the world. Today, modern lines are controlled by computers, and many operations are being carried out by robots. The basic idea remains the same: the product moves through a sequence of simple, repeated operations.

In the future, more operations will be automated, and production data will be analysed in real time. However, careful planning will remain essential, because if one workstation operates too slowly, the whole line is delayed.

LESSON 11. QUALITY CONTROL IN MANUFACTURING

Discuss the questions before reading the text.

- Why must products be checked before they are delivered to customers?
- What can happen if a defective product reaches a customer?
- Which quality-control actions are compulsory, and which are only recommended?

1. Vocabulary for the lesson.

adjust (v)	ə'dʒʌst	регулировать, настраивать
batch (n)	bætʃ	партия продукции
carry out (v)	'kæri aʊt	проводить, осуществлять
comply with (phr v)	kəm'plai wið	соответствовать
conclusion (n)	kən'klu:ʒən	вывод;
draw conclusions	drɔ: kən'klu:ʒənz	делать выводы
costly (adj)	'kɒstli	дорогостоящий, затратный
customer complaint (n)	'kʌstəmə kəm'pleɪnt	жалоба клиента
defective (adj)	dɪ'fektɪv	дефектный
examine (v)	ɪg'zæmɪn	проверять, осматривать, исследовать
implement (v)	'ɪmplɪment	внедрять, реализовывать
inspect (v)	ɪn'spekt	проверять, осматривать, инспектировать
inspection (n)	ɪn'spekʃən	проверка, инспекция
inspector (n)	ɪn'spektə	инспектор, контролёр
isolate (v)	'aɪsəleɪt	изолировать, отделять
legal standard (n)	'li:gəl ,stændəd	законодательный стандарт
mandatory (adj)	'mændətəri	обязательный
measurement (n)	'meʒəmənt	измерение
optional (adj)	'ɒpʃənəl	необязательный, факультативный
prevent (v)	pri'vent	предотвращать, предупреждать
production line (n)	prə'dʌkʃən laɪn	производственная линия
quality control (n)	'kwɒləti kən'trəʊl	контроль качества
recall (v, n)	rɪ'kɔ:l; 'ri:kɔ:l	отзывать продукцию; отзыв продукции
record (v)	rɪ'kɔ:d	записывать, фиксировать
regulation (n)	,regjʊ'leɪʃən	правило, нормативное требование
remove (v)	rɪ'mu:v	удалять, устранять
repair (n, v)	rɪ'peə	ремонт; ремонтировать
repeat (v)	rɪ'pi:t	повторять
requirement (n)	rɪ'kwaɪəmənt	требование
sample (n)	'sɑ:mpəl	образец, выборка
sensor (n)	'sensə	датчик

ship (v)	ʃɪp	отправлять, отгружать
standard (n)	'stændəd	стандарт
testing procedure (n)	'testɪŋ prə'si:dʒə	процедура испытаний
training (n)	'treɪnɪŋ	обучение, подготовка
be allowed to (phrase)	bɪ ə'laʊd tə	иметь разрешение
be required to (phrase)	bɪ rɪ'kwaɪəd tə	быть обязанным

2. Read and translate the text.

Quality Control in Manufacturing

When products are made, they have to meet technical, safety and customer standards. The organised activities used to check and maintain this quality are called quality control. The main aim is to make sure that goods leaving the factory are free from defects and that any problem is identified as early as possible.

Quality control has to be carried out at every stage of production. Raw materials must be inspected when they are delivered. During production, measurements have to be recorded at regular intervals, and an item that does not meet the standard must be removed or isolated. Finished goods must be tested before they are shipped to customers.

Several methods can be used. Some products are measured with special instruments; others are tested by hand or by machine. In modern factories, many routine checks can be performed automatically by computers and sensors. Instead of examining every item, inspectors may check a sample from each batch and draw conclusions about the whole batch.

Good quality is not achieved by inspection alone. It is usually better to prevent defects than to find them after production. The cause of a repeated defect should be investigated: a machine may have to be adjusted, a material may be of poor quality or a worker may need additional training. When the cause is removed, the defect is less likely to become a larger and more costly problem.

Not every action is required in every situation. A company does not have to stop the whole production line when one minor defect is found, provided that the item can be isolated safely. However, a dangerous product must not be shipped, an uncertain test may have to be repeated and a serious safety problem must be reported immediately.

Companies also have to comply with external regulations. A legal standard may require a particular testing procedure, and inspectors may be required to sign a report. Last year, one factory had to recall a batch because the measurements had not been recorded correctly. Since then, the procedure has been revised and additional training has been implemented.

Good quality control brings important benefits. Less material is wasted, fewer products have to be repaired or replaced and customers remain satisfied. Money saved by preventing defects can be used elsewhere, and a company known for reliable products can build a strong reputation.

3. Answer the questions on the text.

1. What is quality control, and what is its main aim?
2. At which stages of production is quality control carried out?
3. How are products checked in modern factories?
4. How are samples used to draw conclusions about a whole batch?
5. Why is it better to prevent defects than to find them after production?
6. When does the whole production line not have to be stopped?
7. Why did one factory have to recall a batch last year?
8. What benefits does good quality control bring?

4. True or False? Read the statements. Correct the false ones.

Example: *Quality control is carried out only at the end of production. – False. Quality control is carried out at every stage of production.*

1. Raw materials have to be inspected when they are delivered.
2. An item that does not meet the standard may be shipped to customers.
3. In modern factories, many routine checks can be performed automatically.
4. The whole production line must always be stopped when one minor defect is found.
5. An uncertain test may have to be repeated.
6. A legal standard may require a particular testing procedure.
7. Good quality control reduces material waste and the cost of repairs.

5. Find in the text the English equivalents of the following expressions.

1. соответствовать техническим требованиям, требованиям безопасности и требованиям клиентов;
2. проводиться на каждом этапе производства;
3. фиксировать результаты измерений через регулярные интервалы;
4. удалять или изолировать изделие, не соответствующее стандарту;
5. проверять выборку из каждой партии;
6. предотвращать дефекты, а не находить их после завершения производства;
7. не быть обязанным останавливать всю производственную линию;
8. не отправлять опасное изделие клиенту;
9. соответствовать внешним нормативным требованиям;
10. отозвать партию продукции.

6. Fill in the gaps with the correct prepositions from the list: *at, before, from, in, of, to, with or without*. Use each option once.

1. Defective goods must be prevented _____ reaching the customer.
2. Incoming materials are inspected _____ they are used.
3. The test results must conform _____ the permitted limits.
4. An unusual value must be reported _____ once.
5. The cause _____ a repeated fault should be investigated.
6. The company has to comply _____ legal standards.
7. The measurements were recorded incorrectly _____ the report.
8. No batch may be shipped _____ a completed inspection.

7. Match the words to make collocations from the lesson.

1. quality	a) procedure
2. customer	b) measurements
3. testing	c) item
4. legal	d) control
5. defective	e) complaint
6. record	f) standard
7. repeat	g) line
8. production	h) a test

8. Match the terms with their definitions.

1. quality control	a) a small quantity selected to represent a larger group
2. defect	b) a formal rule that a company has to follow
3. sample	c) a fault that makes a product fail to meet a requirement
4. inspection	d) a procedure used to check whether a product performs correctly
5. testing procedure	e) the process of removing a product from customers or the market because of a problem
6. regulation	f) a product that does not meet the required standard
7. defective item	g) the organised activities used to maintain the required quality
8. recall	h) a careful check of materials, equipment or products

9. Fill in the gaps with suitable words from the list. There are two extra options. *automatically, costly, defects, inspection, isolated, measurements, recall, sample, standards, training*

- Regular quality control helps prevent _____ mistakes.
- Inspectors check a _____ when examining every item would be too slow.
- All critical _____ must be recorded in the report.
- A defective item should be removed or _____ immediately.
- Routine checks can be performed _____ by sensors.
- Additional _____ may be required when workers use new equipment.
- Products must comply with technical and safety _____.
- A serious quality failure may lead to a product _____.

10. Complete the table with the missing words from the same word family.

Verb	Noun	Adjective / Participle
inspect	inspection; _____	
require		required
regulate		regulatory
measure		measurable
comply	compliance	
—	defect	

11. Translate the sentences into English using the vocabulary of the lesson.

1. Регулярный контроль качества помогает предотвращать дорогостоящие ошибки.
2. Инспекторы проверяют образец из каждой партии и фиксируют результаты измерений.
3. Инженеры осматривают оборудование и регулируют его при необходимости.
4. Если дефект не устранить на раннем этапе, он может перерасти в серьёзную проблему.
5. Компания соблюдает законодательные стандарты и утверждённые процедуры испытаний.
6. Производственная группа изолирует дефектные изделия перед отгрузкой.
7. Дополнительное обучение помогает сократить количество дефектов.
8. Отзыв продукции серьёзно вредит репутации компании.

Grammar focus: Modal Passive

Table 11.1. Modal verbs and their equivalents in Passive Voice (Модальные глаголы и их эквиваленты в страдательном залоге)

Feature	Active Voice	Passive Voice
Focus (Акцент)	The subject performs the action (Подлежащее выполняет действие).	The subject receives the action (Над подлежащим выполняется действие).
Structure (Структура)	Subject + modal verb / equivalent + V1 + object	Subject + modal verb / equivalent + be + V3
must / must not	Inspectors must check every batch. The company must not ship defective items.	Every batch must be checked . Defective items must not be shipped .
can / could	Sensors can record measurements automatically.	Measurements can be recorded automatically.
may / might	Engineers may repeat the test.	The test may be repeated .
should	Managers should investigate repeated faults.	Repeated faults should be investigated .
have to	The company has to record all measurements.	All measurements have to be recorded .
need to	The laboratory needs to calibrate the sensors.	The sensors need to be calibrated .
Запомните: субъект действия, вводящийся by , опускается, если он не важен: <i>Every batch must be checked.</i> <i>The test may be repeated.</i>		

12. Rewrite the sentences in the Passive Voice. Omit the agent when it is not important.

1. Inspectors must check every batch.
2. The technical team can repeat the test.
3. Managers should investigate the cause.
4. The company has to record all measurements.
5. Engineers may repair a defective item.
6. The operator must not ship the product.
7. The laboratory needs to calibrate the sensor.
8. The supervisor might approve the revised procedure.

13. Complete the quality-control instructions with suitable Active or Passive modal forms.

Before production starts, the raw materials 1) _____ (*have to / inspect*). During production, operators 2) _____ (*must / record*) the required measurements. A defective item 3) _____ (*may / repair*), but a dangerous product 4) _____ (*must not / ship*). If a sensor gives an unusual reading, the test 5) _____ (*may / repeat*). The whole line 6) _____ (*not have to / stop*) if the defective item can be isolated. Repeated faults 7) _____ (*should / investigate*), and additional training 8) _____ (*can / provide*) when necessary.

14. Find and correct the mistakes in the modal forms or meanings. One sentence is correct.

1. Every finished product must checked before shipment.
2. Inspectors has to record all measurements.
3. Defective items do not have to be shipped to customers.
4. Operators does not have to repeat the test if the reading is clearly within the permitted range.
5. The results should record in the inspection report.
6. After training, new workers are able use the testing equipment.
7. After a serious fault, the whole line may have to stopped.
8. An uncertain batch might have to be isolated.

15. Pair work

Work in pairs. You are a quality inspector and a production manager preparing a quality-control procedure.

Choose one action and decide whether it is mandatory, prohibited, unnecessary, recommended or possible. **Student A** explains the rule and the reason. **Student B** asks two questions and suggests one improvement. Then swap roles.

Finally, agree on three rules that must be included in the factory procedure. Use have to, must not, do not / does not have to and Modal Passive forms.

Actions:

recording critical measurements; stopping the whole line after one minor defect; shipping a product before inspection; repeating an uncertain test; training a new operator; isolating a defective batch; investigating repeated customer complaints.

Useful language:

- The product has to / must be ...
- The product must not be ...
- The whole line does not have to be stopped if ...
- I think this rule is necessary because ...

16. Case study**Defective Electric Kettles**

A factory produces electric kettles. Some kettles stop working after a few weeks. Finished products are checked only at the end of production, electrical measurements are not recorded during assembly, new workers receive little practical training, and a defective batch is sometimes released when a deadline is approaching.

Possible measures: introduce electrical checks during assembly; record all test results electronically; isolate uncertain batches; provide practical training; automate routine measurements; investigate repeated complaints.

1. Which current practices are unacceptable, and which actions are mandatory or prohibited?
 2. Which checks and training should be introduced, and what can be automated?
 3. Does the whole production line have to stop after one defective kettle is found? What must not be shipped?
 4. Choose the three measures that should be introduced first and explain their priority.
- Use active modal equivalents and Modal Passive forms. Use the Useful language from Exercise 17.*

17. Writing

Write **7–8 sentences** answering the question:

What rules should a factory follow to ensure product quality?

Use the notes below.

Incoming materials:

- inspect each delivery;
- record supplier and batch information.

During production:

- measure critical parameters;
- repeat uncertain tests;
- train new operators;
- do not stop the whole production line because of a minor defect unless safety is affected.

Before shipment and after a defect:

- isolate defective items;
- do not release a batch before inspection;
- investigate repeated faults and customer complaints.

Use at least four words or expressions from the lesson:

quality control, inspection, defective item, legal standard, testing procedure, record the measurements, repeat a test, comply with standards.

Use:

- *have to / has to* at least once;
- *must not* at least once;
- *do not / does not have to* at least once;
- at least two different Modal Passive forms;
- *should* or *can* at least once;
- at least two linking words or phrases.

Prompts:

- Incoming materials have to be ...
- Supplier and batch information must be ...
- During production, every critical measurement must be ...
- An uncertain test should be ...
- The whole production line does not have to be stopped if ...
- Defective items must not be ...
- Repeated faults should be ...
- As a result, product quality can be improved and ...

Linking words and phrases:

first, during production, before shipment, if, however, therefore, as a result.

18. Translate the text into Russian in writing, using a dictionary.

Standards and the Cost of Quality

When quality control fails, a company has to pay for it, often more than it expects. A defective product that is found inside the factory must be repaired or removed, and the company loses both time and materials. A defective product that reaches a customer is far more expensive. It may have to be replaced free of charge, the company may lose the customer, and its reputation may be damaged.

For this reason, engineers often say that quality is not an expense but a source of savings. The money that a company spends on preventing defects – on better machines, better materials and better training – is usually much less than the money it loses when poor-quality products are made and sold.

A factory that takes quality seriously from the beginning therefore spends less in the end, keeps its customers longer and earns greater trust in the market. Modern companies regard quality control not as an optional expense but as a necessary part of production that has to be planned from the start and monitored at every stage.

LESSON 12. HEAT TRANSFER IN INDUSTRY

Discuss the questions before reading the text.

- Why does a metal pipe become hot when steam flows through it?
- How can moving air carry heat through a room?
- How does heat from a flame or the Sun travel through space?

1. Vocabulary for the lesson.

absorb (v)	əb'zɔ:b	поглощать, впитывать
airflow (n)	'eəfləʊ	поток воздуха
bar (n)	bɑ:	стержень, брусок
conduct (v)	kən'dʌkt	проводить тепло или электричество
conduction (n)	kən'dʌkʃən	теплопроводность
conductor (n)	kən'dʌktə	проводник
convection (n)	kən'vekʃən	конвекция
convection current (n)	kən'vekʃən ,kʌrənt	конвекционный поток
coolant (n)	'ku:lənt	охлаждающая жидкость, теплоноситель
contact area (n)	'kɒntækt ,eəriə	площадь контакта
difference (n)	'dɪfrəns	разница
fan (n)	fæn	вентилятор
flame (n)	fleɪm	пламя
foam (n)	fəʊm	пена, пенопласт
give off (phr v)	ɡɪv ɒf	выделять, испускать
heat exchanger (n)	hi:t ɪks,tʃeɪndʒə	теплообменник
heat-transfer (n)	hi:t 'trænsfɜ:	теплопередача
insulation (n)	ˌɪnsju'leɪʃən	теплоизоляция
mechanism (n)	'mekənɪzəm	механизм, способ
medium (n)	'mi:diəm	среда; материальная среда
mineral wool (n)	'mɪnərəl wʊl	минеральная вата
polished (adj)	'pɒlɪʃt	полированный
poorly (adv)	'pɔ:li	плохо, слабо
pump (n, v)	pʌmp	насос; перекачивать
radiation (n)	ˌreɪdɪ'eɪʃən	излучение
rate (n)	reɪt	скорость
reflect (v)	rɪ'flekt	отражать
rough (adj)	rʌf	шероховатый, грубый
screen (n)	skri:n	экран
surface (n)	'sɜ:fɪs	поверхность
surroundings (n pl)	sə'raʊndɪŋz	окружающая среда, окружение
transfer (v, n)	træns'fɜ:; 'trænsfɜ:	передавать; передача

2. Read and translate the text.

Heat Transfer in Industry

Heat transfer plays a central role in almost every industrial process. Whenever there is a difference in temperature, thermal energy moves from a hotter region to a colder one. Engineers designing heating, cooling and power systems have to consider three basic mechanisms: conduction, convection and radiation.

In conduction, heat passes through a solid without movement of the material itself. When one end of a metal bar is heated, faster-moving particles pass energy to slower neighbouring particles. Metals conduct heat well and are widely used where heat must be transferred quickly. Materials conducting heat poorly, such as wood, foam or mineral wool, are used as insulation.

In convection, heat is carried by a moving liquid or gas. A heated fluid becomes less dense and rises, while cooler fluid sinks. Moving continuously through the system, the fluid forms a convection current and spreads heat through the whole volume. Pumps circulating water and fans moving air can make this process faster and more controlled.

In radiation, energy is transferred by waves, and no material medium is required. Energy given off by a hot surface travels through space until it is absorbed or reflected by another body. A dark, rough surface gives off and absorbs radiation well, while a bright, polished surface reflects more of it. Engineers selecting surface materials take these properties into account.

In real equipment, the three mechanisms usually work together. In a boiler, radiation coming from the flame heats the tube walls. Heat passing through the metal is transferred by conduction, while water flowing inside the tubes carries energy away by convection. In a heat exchanger, two flowing fluids move on opposite sides of a wall and transfer energy without mixing.

The heat-transfer rate depends on the temperature difference, the contact area, the material and the movement of the fluid. By changing these conditions, engineers can speed heat transfer up where it is useful and slow it down where heat has to be retained.

Knowing how heat moves, engineers can either assist it or reduce it. Where rapid transfer is needed, good conductors, pumps and fans are used. Where heat must be saved, insulation and reflecting screens are installed. In every case, all three mechanisms have to be taken into account.

3. Answer the questions on the text.

1. Why does heat transfer play a central role in industrial processes?
2. What are the three basic mechanisms of heat transfer?
3. How is heat transferred by conduction, and why are metals widely used in heat-transfer equipment?
4. How does a convection current form, and how can pumps and fans increase convection?
5. How is energy transferred by radiation, and how do dark and polished surfaces behave differently?

6. How do conduction, convection and radiation work together in a boiler?
7. How does a heat exchanger transfer energy without mixing the fluids?
8. Which factors affect the heat-transfer rate, and how can engineers control it?

4. True or False? Read the statements. Correct the false ones.

Example: Conduction requires a moving fluid. – False. Conduction transfers heat through a solid material.

1. Heat normally moves from a colder region to a hotter one.
2. Metals are good conductors of heat.
3. A heated fluid normally rises while cooler fluid sinks.
4. Radiation requires a material medium.
5. Dark, rough surfaces absorb radiation well.
6. In industrial equipment, the three heat-transfer mechanisms often work together.
7. The heat-transfer rate can be changed by changing the contact area or fluid movement.

5. Match each heat-transfer mechanism with its description.

1. conduction	a) heat passes through a solid without movement of the material
2. convection	b) heat is carried by a moving liquid or gas
3. radiation	c) energy is transferred by waves and no material medium is required

6. Find in the text the English equivalents of the following expressions.

1. играть центральную роль в промышленном процессе;
2. разница температур;
3. инженеры, проектирующие системы отопления, охлаждения и энергетические системы;
4. материалы, плохо проводящие тепло;
5. жидкость, непрерывно движущаяся по системе;
6. насосы, обеспечивающие циркуляцию воды, и вентиляторы, перемещающие воздух;
7. энергия, исходящая от горячей поверхности;
8. излучение, исходящее от пламени;
9. вода, текущая внутри труб котла;
10. принимать во внимание все три механизма теплопередачи.

7. Fill in the gaps with the correct prepositions from the list: by, from, in, into, on, through, to or with. Use each option once.

1. Heat moves _____ a hotter region to a colder one.
2. Conduction transfers heat _____ a solid material.
3. Convection currents form _____ a heated liquid or gas.
4. A pump provides the system _____ forced circulation.
5. Radiation is absorbed _____ a dark surface.
6. The transfer rate depends _____ the contact area.
7. Engineers take surface properties _____ account.
8. All three mechanisms contribute _____ heat transfer in industrial equipment.

8. Match the words to make collocations from the lesson.

1. heat-transfer	a) current
2. convection	b) fluid
3. contact	c) loss
4. mineral	d) rate
5. reduce heat	e) quickly
6. flowing	f) wool
7. rough	g) area
8. transfer heat	h) surface

9. Practise the active vocabulary and word families.

A. Fill in the gaps with suitable words from the list. There are two extra options.

airflow, absorb, conduction, fan, foam, heat exchanger, mineral wool, pump, surroundings, surface

1. A _____ is used to circulate coolant through a cooling system.
2. A ventilation fan increases _____ through a workshop.
3. Dark, rough materials _____ radiation effectively.
4. _____ is often installed around hot pipes to reduce heat loss.
5. A _____ transfers energy between two fluids without mixing them.
6. Heat is always lost to the _____, so insulation is important.
7. _____ contains small pockets of air and conducts heat poorly.
8. The type of _____ affects how much radiation is absorbed or reflected.

B. Complete the table with the missing words from the same word family.

Verb	Noun	Adjective
conduct	conduction	
convect		convective
radiate		radiative
absorb	absorption	
reflect		reflective
insulate		insulating

10. Translate the sentences into English using the vocabulary of the lesson.

1. Тепло передаётся от более горячей области к более холодной.
2. Металлы хорошо проводят тепло и широко используются в теплообменном оборудовании.
3. Насосы обеспечивают циркуляцию жидкости, а вентиляторы перемещают воздух.
4. Тёмные шероховатые поверхности хорошо поглощают излучение.
5. Минеральная вата и пенопласт уменьшают нежелательные теплопотери.
6. Скорость теплопередачи зависит от разницы температур, площади контакта и материала.
7. При проектировании промышленной системы инженеры учитывают все три механизма теплопередачи.

Grammar focus: Participle I and other V-ing forms

V-ing, может быть Participle I (действительное причастие настоящего времени), так и герундием. Герундий будет детально изучаться позже.

Table 12.1. Functions of Participle I and other V-ing forms (Функции Participle I и другие V-ing формы)

Function (Функция)	Structure (Структура)	Feature (Характеристика)	Example (Пример)
Participle I as an attribute before a noun (Participle I в роли определения перед существительным)	<i>V-ing + noun</i>	При переводе отвечает на вопрос «что делающий?».	<i>moving</i> air – движущийся воздух; <i>flowing</i> water – текущая вода
Participial phrase as an attribute after a noun (Оборот с Participle I в роли определения после существительного)	<i>noun + V-ing + ...</i>	При переводе отвечает на вопрос «что делающий?», дает дополнительную информацию о существительном.	Water <i>flowing</i> through the pipes carries heat. – Вода, протекающая через трубы, переносит тепло.
Participle I as an adverbial modifier (Participle I в роли обстоятельства)	<i>V-ing phrase, main clause</i>	При переводе отвечает на вопрос «что делая?».	<i>Moving</i> through the exchanger, the fluid transfers heat. – Проходя через теплообменник, жидкость переносит тепло.
Participle I as part of a predicate in Present Continuous (Participle I в составе сказуемого в Present Continuous)	<i>am / is / are + V-ing</i>	Отдельно не переводится.	The fluid is <i>moving</i> through the pipe. – Жидкость двигается по трубам.
Gerund (Герундий)	<i>V-ing form used as a noun</i>	Называет действие или процесс.	Heating water requires energy. – Нагрев воды требует энергии.

11. Identify the function of each V-ing form: Present Continuous, Participle I or Gerund. If a sentence contains two V-ing forms, identify both. For Participle I, state whether it is used as an attribute or an adverbial modifier.

1. The coolant is flowing through the pipes.
2. The coolant flowing through the pipes removes heat.
3. Flowing through the pipes, the coolant removes heat.
4. Heating water requires a large amount of energy.
5. Engineers are testing a new heat exchanger.
6. Engineers testing the new exchanger are recording the results.
7. Selecting the correct material is important.
8. A fan moving warm air increases convection.

12. Complete the sentences with the appropriate Participle I forms of the verbs from the list. There are two extra verbs. Then state whether each Participle I form is used as an attribute or an adverbial modifier.

absorb, circulate, flow, give off, install, move, rise, select, test, transfer

1. The water _____ through the tubes carries heat away.
2. Air _____ above the furnace warms the ceiling.
3. Engineers _____ the exchanger measured the inlet temperature.
4. _____ through the system, the coolant absorbed excess heat.
5. A pump _____ the fluid increases the convection rate.
6. _____ the surface material, the engineer considered radiation losses.
7. The flame _____ radiation heats the tube wall.
8. Workers _____ mineral wool around the pipe wore protective gloves.

13. Rewrite the sentences by replacing the active relative clause with a Participle I phrase.

Example: *The water that flows through the exchanger carries heat. – The water flowing through the exchanger carries heat.*

1. Engineers who design heat exchangers calculate the contact area.
2. The air that moves through the duct carries heat to the workshop.
3. A pump that circulates the fluid increases convection.
4. The particles that move faster have more kinetic energy.
5. The fan that forces air through the system uses electricity.
6. The radiation that comes from the flame heats the tube wall.
7. Workers who install insulation must protect their hands.
8. The fluid that enters the exchanger has a high temperature.

14. Translate the sentences into English using Participle I.

1. Горячий воздух, поднимающийся над печью, создаёт конвекционный поток.
2. Теплоноситель, циркулирующий по системе, переносит тепловую энергию.
3. Инженеры, измеряющие температуру, контролируют скорость теплопередачи.
4. Выбирая теплоизоляцию, инженер учитывает рабочую температуру.
5. Двигаясь по трубам, вода постепенно охлаждается.

6. Вентилятор, прогоняющий воздух через радиатор, усиливает конвекцию.
7. Изучая поверхность, специалисты определили её способность отражать излучение.
8. Материалы, содержащие небольшие воздушные полости, эффективно уменьшают теплопотери.

15. Pair work

Work in pairs. You are a process engineer and a safety engineer discussing heat transfer in an industrial system.

Choose one situation: water circulating in a heat exchanger; hot air rising above a furnace; steam flowing through an uninsulated pipe; radiation travelling from a flame to a wall; a fan moving air through a workshop.

Student A identifies the heat-transfer mechanism and explains whether heat transfer should be increased or reduced. **Student B** asks two questions and proposes one engineering change. Then swap roles and compare the two situations.

Use at least two Participle I attributes or participial phrases and one Participle I adverbial phrase.

Useful language:

- The fluid flowing through ... carries ...
- Air rising from ... transfers heat by ...
- A pump / fan moving ... increases ...
- The heat-transfer rate can be increased / reduced by ...

16. Case study

Heat Loss in a Workshop

A workshop contains a furnace and several long steam pipes. The uninsulated pipes run near the ceiling. Air rising from the furnace makes the upper part of the room very hot, while workers near the floor still feel cold. A fan moving air through the room is operating at low speed.

Possible measures: insulate the pipes with mineral wool; increase fan speed; install a reflective screen; move workstations away from the hottest area; change the position of the air outlets.

1. Which heat-transfer mechanisms are present, and what are the main causes of heat loss and uneven temperature?
2. How do the uninsulated pipes and slowly moving air affect energy use and worker comfort?
3. Which measures would reduce heat loss, and which would improve air circulation?
4. Which two measures should be introduced first? Consider energy saving, safety and ease of implementation.

Use at least two Participle I attributes or phrases and one Participle I adverbial phrase. Use the Useful language from Exercise 16.

17. Writing

Write 7–8 **connected sentences** answering the question:
How is heat transferred and controlled in an industrial system?
Use the notes below.

Heat transfer:

- heat moves through solid walls by conduction;
- a flowing liquid or gas carries heat by convection;
- radiation transfers energy from hot surfaces by waves.

Engineering control:

- pumps and fans increase fluid movement;
- insulation reduces unwanted heat loss;
- reflective surfaces limit radiation;
- engineers consider the temperature difference, contact area and material.

Use at least four words or expressions from the lesson:

conduction, convection, radiation, convection current, heat-transfer rate, reduce heat loss, take into account, insulation.

Use:

- at least two Participle I forms used as attributes or participial phrases describing a noun;
- at least one Participle I adverbial phrase;
- all three mechanisms of heat transfer;
- at least two linking words or phrases.

Prompts:

- Heat moving through a solid is ...
- A fluid flowing through the system ...
- Rising through the system, the warm fluid ...
- Radiation coming from a hot surface ...
- Using a pump or fan, engineers ...
- Taking these factors into account, engineers ...

Linking words and phrases:

first, while, at the same time, because, as a result, therefore, finally.

18. Translate the text into Russian in writing, using a dictionary.

Thermal Insulation

Sometimes heat transfer is useful, but sometimes it must be reduced. To keep heat where it is needed, engineers use thermal insulation. Materials containing many small pockets of air, such as mineral wool or foam, conduct heat poorly. Because the air trapped inside them cannot move easily, both conduction and convection are reduced.

When pipes and walls are covered with insulation, much less heat is lost to the surroundings. Steam or hot water flowing through an insulated pipe loses less energy and reaches its destination at a higher temperature. In a cold store, the same insulation

limits heat entering from outside. As a result, energy is saved and equipment is protected.

Thicker and more effective insulation usually reduces heat loss, but insulation also costs money. Selecting the insulation thickness, engineers have to balance energy savings against the cost of the material. A well-insulated plant is cheaper to operate, safer and more comfortable for employees. For this reason, engineers select the type and thickness of insulation as carefully as other components of the system.

LESSON 13. BOILERS AND STEAM GENERATION

Discuss the questions before reading the text.

- What is steam used for in industry and power plants?
- How is water turned into steam in an industrial boiler?
- Why must a boiler be operated carefully?
- Why must the water supplied to a boiler be cleaned?
- Compare the phrases heated water and water is heated. What is the difference in their structure and meaning?

1. Vocabulary for the lesson.

boil (v)	bɔɪl	кипеть; доводить до кипения
boiler (n)	'bɔɪlə	котёл;
fire-tube boiler	'faɪə tju:b ,bɔɪlə	жаротрубный котёл;
water-tube boiler	'wɔ:tə tju:b ,bɔɪlə	водотрубный котёл
boiling point (n)	'bɔɪlɪŋ pɔɪnt	точка кипения
burst (v)	bɜ:st	лопаться, разрываться
cover (v)	'kʌvə	покрывать
chimney (n)	'tʃɪmni	дымовая труба
damage (v)	'dæmɪdʒ	повреждать
deposit (n)	dɪ'pɒzɪt	отложение, осадок
economiser (n)	ɪ'kɒnəmaɪzə	экономайзер
escape (v)	ɪ'skeɪp	выходить, уходить
feedwater (n)	'fi:d ,wɔ:tə	питательная вода
fit (v)	fit	устанавливать, монтировать
flue gas (n)	'flu: gæs	дымовой газ
heat-transfer surface (n)	'hi:t 'trænsfɜ: ,sɜ:fɪs	поверхность теплообмена
insulation (n)	ɪn'sju'leɪʃən	теплоизоляция, изоляция
maintain (v)	meɪn'teɪn	обслуживать; поддерживать в исправном состоянии
operating condition (n)	'ɒpəreɪtɪŋ kən'dɪʃən	условие эксплуатации
overheat (v)	ˌəʊvə'hi:t	перегревать(ся)
recover (v)	rɪ'kʌvə	утилизировать, рекуперировать
safety device (n)	'seɪftɪ dɪ'vaɪs	предохранительное устройство
saturation (n)	ˌsætʃə'reɪʃən	насыщение
scale (n)	skeɪl	накипь
steam generation (n)	'sti:m ˌdʒenə'reɪʃən	производство пара, парогенерация
superheated steam (n)	ˌsu:pə'hi:tɪd 'sti:m	перегретый пар
thermal power plant (n)	'θɜ:məl 'paʊə plɑ:nt	тепловая электростанция
tube (n)	tju:b	труба;
steel tube	'sti:l tju:b	стальная труба
untreated water (n)	ˌʌn'tri:tɪd 'wɔ:tə	неподготовленная, неочищенная вода
valve (n)	vælv	клапан

2. Read and translate the text.

Boilers and Steam Generation

In many industries and in almost every thermal power plant, steam is used to carry energy from one part of a system to another. It is produced in a boiler, also called a steam generator.

In a boiler, the water supplied to the system is called feedwater. Cleaned feedwater is heated until it turns into steam. Heat is supplied by burning coal, oil, natural gas or another fuel. Hot gases produced during fuel combustion pass either inside or around steel tubes, while water flows on the other side. Heat passes through the tube walls, the water reaches the boiling point, and steam is formed. The steam formed in the boiler is separated from the water and sent to the next part of the steam system.

Boilers are commonly divided into fire-tube and water-tube types. In a fire-tube boiler, hot gases pass through the tubes and water surrounds them. In a water-tube boiler, water flows through the tubes and hot gases pass around them. Water-tube boilers can operate at higher pressure and are therefore widely used in large power plants.

In large boilers, steam may be heated further. Steam heated above the saturation temperature is called superheated steam and carries more energy. It is then sent to a turbine or to process equipment.

Modern boilers are made of strong steel and covered with insulation to reduce heat loss. Before flue gases escape through the chimney, they often pass through an economiser. Heat recovered from the flue gases is used to warm feedwater before it enters the boiler, reducing fuel use.

A boiler includes pumps, valves, instruments, controls and safety devices. Valves fitted at key points control the flow of water and steam. Instruments measure pressure, temperature and water level. If the pressure rises above a safe level, a safety valve releases steam. All components must operate together under controlled conditions.

Water quality and maintenance are essential. Untreated water leaves deposits or scale on heat-transfer surfaces. Tubes covered with scale transfer heat less effectively, so the metal may overheat and burst. Damaged insulation also increases heat loss. A boiler kept clean, correctly adjusted and regularly inspected can operate safely and efficiently for many years. Cleaned feedwater, undamaged insulation and tested safety devices help to reduce fuel use and prevent an unplanned shutdown.

3. Answer the questions on the text.

1. Where is steam produced in industry and power plants?
2. How is cleaned feedwater turned into steam in a boiler?
3. What happens to the steam formed in the boiler?
4. What is the difference between a fire-tube boiler and a water-tube boiler?
5. What functions do valves, instruments and safety devices perform?
6. How does an economiser improve boiler efficiency?
7. Why can deposits formed on the tubes cause overheating and damage?

4. True or False? Read the statements. Correct the false ones.

Example: *Untreated feedwater improves heat transfer. – False. Untreated feedwater forms deposits that reduce heat transfer.*

1. In a fire-tube boiler, water flows inside the tubes.
2. Water-tube boilers can operate at higher pressure than fire-tube boilers.
3. Superheated steam carries less energy than ordinary steam.
4. An economiser recovers part of the heat remaining in the flue gases.
5. Safety valves are used to increase dangerous pressure.
6. Scale on heat-transfer surfaces can reduce heat transfer and cause overheating.

5. Find in the text the English equivalents of the following expressions.

1. паровой котёл, или парогенератор;
2. вода нагревается, пока не превратится в пар;
3. горячие газы, образовавшиеся при сгорании топлива;
4. высокое давление и температура;
5. вода подаётся с помощью насосов;
6. пар, образованный в котле;
7. предохранительные устройства, установленные на котле;
8. уровень воды;
9. отложения, образовавшиеся на трубах;
10. вызывать перегрев и разрыв трубы.

6. Fill in the gaps with the correct prepositions from the list: *above, at, by, from, on, through, to or with*. Use each option once.

1. Feedwater is supplied _____ pumps.
2. Heat passes _____ the tube walls.
3. Superheated steam is heated _____ the saturation temperature.
4. Valves are fitted _____ key points in the system.
5. The boiler is covered _____ insulation.
6. Useful heat is recovered _____ the flue gases.
7. The recovered heat is used _____ warm the feedwater.
8. Deposits form _____ heat-transfer surfaces.

7. Match the words to make collocations from the lesson.

1. cleaned	a) heat loss
2. superheated	b) device
3. safety	c) feedwater
4. operating	d) steam
5. steel	e) conditions
6. recover	f) tube
7. remove	g) heat
8. reduce	h) scale

8. Match the terms with their definitions.

1. boiler	a) a device that uses hot flue gases to warm feedwater before it enters the boiler
2. economiser	b) water supplied to a boiler
3. feedwater	c) a device in which water is heated to produce steam
4. fire-tube boiler	d) a hard mineral layer formed on heated surfaces
5. water-tube boiler	e) a boiler in which hot gases pass through tubes surrounded by water
6. safety device	f) a boiler in which water flows through tubes heated from the outside
7. superheated steam	g) a device that protects equipment from dangerous operating conditions
8. scale	h) steam heated above the saturation temperature

9. Complete the sentences with the correct form of the verbs in Active or Passive Voice. There are two extra verbs.

boil, burst, clean, escape, flow, fit, operate, overheat, recover, supply

- Modern boilers _____ at high pressure.
- Safety valves _____ on every large boiler.
- Modern thermal power plants use special devices to _____ heat.
- If deposits are not removed, the tubes may _____.
- If the pressure becomes too high, excess steam _____ through the safety valve.
- Feedwater _____ before it enters the boiler.
- Water _____ to the boiler by pumps.
- An overheated boiler tube may _____.

Grammar focus: Participle II; Forms of Participle I

Participle II (V3) – это страдательное причастие прошедшего времени. У правильных глаголов Participle II образуется путём прибавления окончания -ed.

Table 13.1. Functions of Participle II (Функции Participle II)

Function (Функция)	Structure (Структура)	Feature (Характеристика)	Example (Пример)
Single Participle II as an attribute before a noun (Определение перед существительным)	V3 + noun	При переводе отвечает на вопрос «что сделанный?».	<i>heated</i> water – <i>нагретая</i> вода; <i>cleaned</i> feedwater – <i>очищенная</i> вода
Participial phrase as an attribute after a noun (Определение после существительного, в составе причастного оборота)	noun + V3 + ...	При переводе отвечает на вопрос «что сделанный?»; имеет зависимые слова.	Water <i>heated in the economiser</i> enters the boiler. – Вода, <i>нагретая / которая была нагрета</i> в экономайзере, поступает в котёл.

Function (Функция)	Structure (Структура)	Feature (Характеристика)	Example (Пример)
Predicative (state description) (Именная часть составного именного сказуемого, описывает состояние)	be / seem / remain + adjective-like V3	Описывает состояние предмета.	The valve is <i>closed</i> . – Клапан <i>закрыт</i> .
Part of a predicate in Passive Voice and Perfect tenses (Часть сказуемого при образовании страдательного залога и времён группы Perfect)	be + V3 have + V3	Отдельно не переводится.	The valve is <i>closed</i> by the operator every evening. – Клапан закрывается оператором каждый вечер. The operator <i>has closed</i> the valve. – Оператор <i>закрыл</i> клапан.
Adverbial Modifier (Обстоятельство)	(When/If) + V3..., + noun	Переводится с помощью «будучи...» или придаточного времени, причины или условия.	(When) <i>heated</i> to 100 °C, the water starts to boil. – Будучи нагретой / Когда её нагревают до 100 °C, вода начинает кипеть.

9. Complete the table with the missing words from the same word family.

Verb	Noun	Participle II
heat	heat	
insulate		insulated
operate		operating
pressurise	pressure	
superheat	superheating	
damage	damage	
maintain		maintained

10. Identify the function of the Participle II form in bold: single attribute, participial phrase, state description or Passive Voice predicate.

- The **cleaned** feedwater enters the economiser.
- Feedwater **cleaned before use** forms fewer deposits.
- The valve **remains closed** during normal operation.
- The valve **is closed** by the operator at the end of every shift.
- Steam **produced in the boiler** carries thermal energy.
- The boiler **is covered** with insulation during installation.
- Damaged** insulation increases heat loss.
- The water level **is measured** continuously.
- The tubes **remain blocked** because of scale.
- The tubes **are inspected** every month.

11. Choose the correct Participle I or Participle II form.

- The hot gases **heating** / **heated** the tubes leave through the chimney.
- The feedwater **heating** / **heated** in the economiser enters the boiler.

3. The steam **producing** / **produced** in the boiler carries thermal energy.
4. The pump **supplying** / **supplied** feedwater operates continuously.
5. The valves **fitting** / **fitted** at key points control the pressure.
6. The deposits **forming** / **formed** on the tubes reduce heat transfer.
7. The water **flowing** / **flowed** through the tubes is heated by the gases.
8. The insulation **protecting** / **protected** the boiler walls reduces heat loss.

12. Rewrite the sentences by replacing the passive relative clause with a Participle II phrase.

Example: *The water that is heated in the economiser enters the boiler. – The water heated in the economiser enters the boiler.*

1. The steam that is produced in the boiler is sent to the turbine.
2. The valves that are fitted at key points control the flow.
3. The instruments that are connected to the boiler measure pressure and temperature.
4. The feedwater that is cleaned before use forms fewer deposits.
5. The deposits that are formed on the tubes act as insulation.
6. The tubes that are covered with scale may overheat.
7. The heat that is recovered in the economiser warms the feedwater.
8. The insulation that was damaged during repairs must be replaced.

13. Translate the sentences into English using the vocabulary of the lesson. Use Participle II as a single attribute or in a participial phrase.

1. Очищенная питательная вода, подаваемая насосами, сначала поступает в экономайзер.
2. В жаротрубном котле горячие газы проходят по трубам, окружённым водой.
3. В водотрубном котле вода течёт по стальным трубам, нагреваемым снаружи горячими газами.
4. Перегретый пар, направленный в турбину, содержит больше энергии.
5. Предохранительные клапаны, установленные в ключевых точках, защищают котёл от опасного повышения давления.
6. Тепло, утилизированное в экономайзере, используется для подогрева питательной воды.
7. Трубы, покрытые толстым слоем накипи, передают тепло менее эффективно.
8. Котёл, очищенный и проверенный после ремонта, может быть возвращён в эксплуатацию.

Table 13.2. Forms and functions of Participle I (Залогово-временные формы и функции Participle I)

Form (Форма)	Function and Position (Функция и положение)	Example (Пример)
Participle I Passive being + V3	Attribute, after a noun (Определение, стоит после существительного)	The metal <i>being heated</i> is copper. – <i>Нагреваемый</i> металл / Металл, <i>который нагревается</i> , – это медь.
	Adverbial modifier, usually in the beginning of the sentence (Обстоятельство, обычно в начале предложения)	<i>Being heated</i> , the metal expands rapidly. – <i>Будучи нагретым</i> , металл быстро расширяется. / Когда металл нагревают, он быстро расширяется.
Perfect Participle Active having + V3	Adverbial modifier, usually in the beginning of the sentence (Обстоятельство, обычно в начале предложения)	<i>Having circulated</i> through the system, the water returned to the boiler. – <i>Пройдя</i> по системе, вода вернулась в котёл. / <i>После того как вода прошла</i> по системе, она вернулась в котёл.
Perfect Participle Passive having been + V3	Adverbial modifier, usually in the beginning of the sentence (Обстоятельство, обычно в начале предложения)	<i>Having been cooled</i> , the liquid contracted. – <i>Будучи охлаждённой</i> , жидкость сжалась. / <i>После того как жидкость охладили</i> , она сжалась.

14. Identify the form and function of the participles. Translate the following sentences into Russian.

1. Having reached its maximum temperature, the steam entered the turbine.
2. The equipment being tested at the plant will be used for heat recovery.
3. Designed for high efficiency, the new turbine operates at lower cost.
4. Being cooled by the fan, the engine temperature dropped quickly.
5. The adjusted valves allowed better control of the steam flow.
6. Having been tested for several weeks, the new system was finally installed.
7. Flowing through the pipes, the hot water heated the entire building.
8. Having identified the fault, the engineer shut down the turbine.
9. The engineers designing the new system considered all possible losses.

15. Pair work

Work in pairs. You are a boiler operator and a maintenance engineer reviewing boiler condition.

Choose one problem: untreated feedwater; tubes covered with deposits; damaged insulation; an untested safety valve; a dirty economiser; unstable superheated-steam temperature.

Student A describes the condition, its effect on boiler operation and the action required. **Student B** asks questions, confirms the diagnosis and proposes a maintenance action. Then swap roles and decide which problem must be corrected first.

Use at least three Participle II attributes or phrases and at least two Passive Voice predicates.

Useful language:

- The tubes covered with ...
- The insulation damaged during ... must be ...
- The safety device fitted at ... should be ...
- This problem should be corrected first because ...

16. Case study

Deposits and Damaged Insulation

A factory boiler is using more fuel than last year. During inspection, engineers recorded the following results:

Indicator / component	Inspection result
Fuel consumption	12% higher than last year
Outer boiler wall	unusually hot
Steel tubes	covered with a thick layer of scale
Insulation	damaged during recent repairs
Feedwater treatment	not carried out regularly

1. What problems are shown, and how do they affect heat transfer, fuel consumption and safety?
2. What should be cleaned, repaired, tested or replaced, and what should be done with the feedwater?
3. Which action should be completed first? Explain your priority.
4. How should boiler performance be checked after the repairs?

Use Participle II phrases to describe the components and problems. Use the Useful language from Exercise 14.

17. Writing.

Write 7–8 sentences answering the question: **How is steam produced safely and efficiently in a boiler?**

Use the notes below.

Water and heat supply:

- cleaned feedwater is supplied by pumps;
- water and hot gases flow on opposite sides of the tube walls;
- heat released by the fuel is transferred to the water.

Steam and safety:

- steam produced in the boiler is collected and may be superheated;
- valves fitted at key points control pressure and flow;
- safety devices are tested regularly.

Efficiency and maintenance:

- heat remaining in the flue gases is recovered in an economiser;

- deposits formed on the tubes are removed;
- damaged insulation is repaired.

Use at least three Participle II attributes or phrases, at least two Passive Voice predicates and at least two linking words or phrases.

Use at least four words or phrases from the lesson: *feedwater, steel tube, superheated steam, safety device, economiser, deposit, operating condition, recover heat, remove scale, damaged insulation.*

Useful sequence markers: *first, then, after that, before, because, as a result, finally.*

18. Translate the text into Russian in writing, using a dictionary.

Boiler Efficiency

Boiler efficiency shows how much of the energy contained in the fuel is converted into useful heat in the steam. In a modern boiler, most of the energy is used, but some is carried away with the hot flue gases or is lost through the boiler walls.

To improve efficiency, heat from the flue gases is often recovered and used to warm feedwater before it enters the boiler. An economiser is installed for this purpose. Heat-transfer surfaces are kept clean because deposits formed on them slow down heat transfer. Properly maintained insulation also helps to reduce heat loss through the boiler walls.

Clean surfaces and effective insulation reduce the amount of fuel needed to produce the same quantity of steam. Even a small improvement is valuable because an industrial boiler operates for many hours every day, and the fuel saved over a year can represent a large sum of money.

LESSON 14. STEAM TURBINES

Discuss the questions before reading the text.

- How can the energy of moving steam be made useful?
- What turns the generator in a power plant?
- What happens to the steam after it has done its work?

1. Vocabulary for the lesson.

arrange (v)	ə'reindʒ	располагать, размещать
blade (n)	bleɪd	лопатка турбины
closed loop (n)	kləʊzd lu:p	замкнутый контур
condenser (n)	kən'densə	конденсатор
convert (v)	kən'vɜ:t	преобразовывать
curved (adj)	kɜ:vɪd	изогнутый
direct (v)	də'rekt	направлять
divide (v)	dɪ'vaɪd	делить, разделять
expand (v)	ɪk'spænd	расширяться
expansion (n)	ɪk'spænfən	расширение
generator (n)	'dʒenəreɪtə	генератор
high-pressure section (n)	haɪ 'preʃə ,seksən	секция высокого давления
high-pressure steam (n)	haɪ 'preʃə sti:m	пар высокого давления
leak (v, n)	li:k	протекать, утекать; утечка
low-pressure section (n)	ləʊ 'preʃə ,seksən	секция низкого давления
maintain (v)	meɪn'teɪn	обслуживать, поддерживать
mechanical work (n)	mə'kænikəl wɜ:k	механическая работа
outlet (n)	'aʊtlet	выход, выпускной патрубок
pull (v)	pʊl	тянуть, вытягивать
push (v)	pʊʃ	толкать
rotate (v)	rəʊ'teɪt	вращаться
rotor (n)	'rəʊtə	ротор
row (n)	rəʊ	ряд
shaft (n)	ʃɑ:ft	вал
stage (n)	steɪdʒ	ступень, этап
steadily (adv)	'stedɪli	равномерно, устойчиво
steam cycle (n)	sti:m ,saɪkl	паровой цикл
strike (v)	straɪk	ударять
turbine (n)	'tɜ:bain	турбина
turbine casing (n)	'tɜ:bain ,keɪsɪŋ	корпус турбины
give up energy (phrase)	ɡɪv ʌp 'enədʒi	отдавать энергию
make the shaft rotate (phrase)	meɪk ðə ʃɑ:ft rəʊ'teɪt	заставлять вал вращаться
operate reliably (phrase)	'ɒpəreɪt rɪ'laɪəbli	работать надёжно
restore performance (phrase)	rɪ'stɔ: pə'fɔ:məns	восстанавливать производительность
turn steam back into water (phrase)	tɜ:n sti:m bæk 'ɪntə 'wɔ:tə	превращать пар обратно в воду

2. Read and translate the text.

Steam Turbines

After steam has been produced in the boiler, its energy has to be converted into useful work. In most thermal power plants, this conversion is carried out by a steam turbine.

A steam turbine has a rotor consisting of a shaft with many curved blades fixed to it. High-pressure steam is directed onto the blades. As the steam strikes their curved surfaces, it pushes the blades and makes the shaft rotate. The rotating shaft is connected to an electric generator, which converts mechanical energy into electricity.

The blades are arranged in several rows. As steam passes from one row to the next, it expands, its pressure and temperature fall, and it gradually gives up its energy. Large turbines are often divided into high-pressure and low-pressure sections so that steam energy can be used effectively at every stage of expansion.

The steam leaving the final stage is sent to a condenser, where it is cooled and condensed into water. The water is then pumped back to the boiler, forming a closed steam cycle. With the same water being used repeatedly, the plant reduces water consumption and supports continuous operation.

A steam turbine operates under extremely difficult conditions. The shaft rotates thousands of times per minute, and the blades are continuously struck by hot steam. Turbine components must therefore be made of suitable materials, shaped accurately, inspected regularly and maintained with great care.

With the shaft turning at a steady speed, the generator produces stable electrical output. With the blades arranged in several rows, steam expands gradually and gives up its energy efficiently.

3. Answer the questions on the text.

1. How is the energy of steam converted into useful work?
2. What does the rotor of a steam turbine consist of?
3. How does high-pressure steam make the shaft rotate?
4. What is the rotating shaft connected to, and what does the generator produce?
5. What happens to the pressure, temperature and energy of the steam as it passes through the turbine?
6. Why are turbine blades arranged in several rows and large turbines divided into sections?
7. What happens to the steam after it leaves the final turbine stage?
8. Why must turbine components be inspected and maintained carefully?

4. True or False? Read the statements. Correct the false ones.

Example: *The shaft is connected to a condenser. – False. The shaft is connected to an electric generator.*

1. High-pressure steam is directed onto the curved turbine blades.
2. Large turbines consist of only one row of blades.
3. Steam pressure and temperature fall as the steam moves through the turbine stages.
4. The steam leaving the final stage is returned directly to the boiler as steam.
5. A closed steam cycle allows the same water to be used repeatedly.
6. Turbine blades and other components require regular inspection and maintenance.

5. Find in the text the English equivalents of the following expressions.

1. изогнутые лопатки, закреплённые на валу;
2. пар высокого давления, направляемый на лопатки;
3. вращающийся вал;
4. вал, соединённый с электрическим генератором;
5. пар, переходящий от одного ряда лопаток к следующему;
6. турбины, разделённые на секции высокого и низкого давления;
7. пар, выходящий из последней ступени;
8. при многократном использовании одной и той же воды;
9. при вале, вращающемся с постоянной скоростью;
10. после завершения проверки.

6. Fill in the gaps with the correct prepositions from the list: *after, at, back, into, onto, through, to or with*. Use each option once.

1. Steam is directed _____ the turbine blades.
2. The shaft is connected _____ an electric generator.
3. Thermal energy is converted _____ mechanical work.
4. Steam expands as it passes _____ the turbine.
5. The water is pumped _____ to the boiler.
6. Energy is given up _____ each stage.
7. The unit is returned to service _____ the inspection.
8. The generator produces stable electrical output _____ the shaft turning steadily.

7. Match the words to make collocations from the lesson.

1. curved	a) performance
2. rotating	b) work
3. high-pressure	c) output
4. low-pressure	d) blades
5. mechanical	e) energy
6. stable electrical	f) steam
7. restore	g) section
8. give up	h) shaft

8. Match the terms with their definitions.

1. shaft	a) a machine that converts mechanical energy into electricity
2. blade	b) the rotating assembly consisting of a shaft and blades
3. rotor	c) a device in which steam is cooled and condensed into water
4. turbine	d) a curved component fixed to the rotor and acted on by steam
5. generator	e) a machine that converts the energy of steam into mechanical work
6. condenser	f) one part of a turbine in which steam expands and transfers energy
7. stage	g) the outer structure that contains the turbine components
8. turbine casing	h) a rotating bar that transfers mechanical work
9. steam cycle	i) the closed process in which water becomes steam and is later condensed

9. Complete the table with the missing words from the same word family.

Verb	Noun	Adjective / Participle
rotate	rotation	
expand		expanded
convert		converted
condense		condensed
connect		connected
arrange		arranged

10. Translate the sentences into English using the vocabulary of the lesson. Pay attention to the use of Participles.

1. Пар высокого давления направляется на изогнутые лопатки и заставляет вал вращаться.
2. Вращающийся вал соединён с электрическим генератором.
3. Лопатки расположены в несколько рядов, поэтому пар отдаёт энергию постепенно.
4. Пар, покидающий последнюю ступень, направляется в конденсатор.
5. После того как проверка была завершена, турбина была возвращена в эксплуатацию.
6. Одна и та же вода используется многократно, поэтому электростанция сокращает потребление воды.
7. Повреждённые лопатки должны быть заменены, а загрязнённые поверхности – очищены.
8. Если производительность турбины снизилась, инженеры должны выявить утечку и восстановить её работу.

Translation focus: as

Table 14.1. Common meanings and Russian translations of “as” (Значения слова “as” и его перевод на русский язык)

Meaning (Значение)	Translation pattern (Модель перевода)	Example (Пример)
Time: when / while	когда; в то время как; по мере того как	As steam passes through the turbine, its pressure falls. – <i>По мере того как</i> пар проходит через турбину, его давление снижается.
Reason: because / since	поскольку; так как	As turbine components operate under difficult conditions, they must be inspected regularly. – <i>Поскольку</i> компоненты турбины работают в сложных условиях, их необходимо регулярно проверять.
Comparison: as ... as	так же ... как; настолько ... насколько; как можно ...	The shaft must rotate <i>as steadily as possible</i> . – Вал должен вращаться <i>как можно более равномерно</i> .
Example: such as	например; такой как; такие как	Materials <i>such as</i> special steels are used for turbine blades. – Для изготовления лопаток турбины используются такие материалы, <i>как</i> специальные стали.
Time: as soon as	как только	The control valve opens <i>as soon as</i> the pressure rises. – Регулирующий клапан открывается, <i>как только</i> повышается давление.

11. Translate the sentences into Russian, paying attention to the different translations of *as*.

1. As the steam enters the turbine under high pressure, the blades begin to rotate.
2. As the steam passes through the rows of blades, it gives up its energy
3. The turbine shaft rotates as fast as necessary to generate electricity.
4. Such materials as special steels are used for making the blades.)
5. The steam transfers its energy to the blades as soon as it strikes them.
6. As high-pressure steam is directed onto the blades, it makes the shaft rotate.
7. As the blades are arranged in several rows, the steam gives up its energy gradually.
8. As technology develops, turbines become more efficient.

Grammar Focus: Absolute Participial Construction

Table 14.2. Absolute Participial Construction (Независимый причастный оборот)

Features of an Absolute Participial Construction (Особенности независимого причастного оборота): – It consists of a noun (pronoun) + a participle. Он состоит из существительного (местоимения) и причастия. – It is separated from the main clause by a comma. Он отделяется от основной части предложения запятой. – It can be introduced by <i>with</i>. Он может вводиться предлогом <i>with</i>. – It is translated as a clause, with the noun (pronoun) functioning as the subject and the participle functioning as the predicate. При переводе он обычно передаётся придаточным или самостоятельным предложением, в котором существительное (местоимение) выполняет функцию подлежащего, а причастие передаётся сказуемым.	
Position (Положение)	Example (Пример)
In the beginning of the sentence (В начале предложения)	<u>The water having been heated</u>, steam began to form. – Когда / Так как / После того, как вода была нагрета, начал образовываться пар. <u>With the new boiler installed</u>, the old one was taken out of service. – Так как новый котёл был установлен, старый вывели из эксплуатации.
In the end of the sentence (В конце предложения)	The steam entered the turbine, <u>its temperature being extremely high</u>. – Пар поступал в турбину, причём его температура была <u>чрезвычайно высокой</u>. The boiler was shut down, <u>with the pressure being too low</u>. – Котёл был остановлен, так как / причём давление было слишком низким. The boiler operates safely, <u>with the pressure being constantly monitored</u>. – Котёл работает безопасно, причём давление постоянно контролируется.

12. Complete the text with the correct Participle I or Participle II forms.

Steam 1) _____ (*produce*) in the boiler enters the turbine through special pipes. 2) _____ (*strike*) the blades, it transfers its energy to the rotating shaft. 3) _____ (*pass*) through several stages, the steam loses pressure and temperature. 4) _____ (*cool*) in the condenser, it becomes water again. The water 5) _____ (*pump*) back to the boiler begins another cycle. The inspection 6) _____ (*complete*), the operators can restart the unit. 7) _____ (*maintain*) properly, the turbine can operate reliably for many years.

13. Find the Absolute Participial Construction in each sentence, identify its subject and expand it into a full clause.

1. The pressure falling, the steam entered the low-pressure section.
2. The inspection having been completed, the operators restarted the turbine.
3. The water being heated, steam was produced at a steady rate.
4. The steam entered the turbine, its temperature remaining extremely high.
5. All safety checks completed, the unit was returned to service.
6. The blades having been cleaned, turbine output increased.
7. The steam leak identified, the plant was shut down for repairs.
8. The pressure increased, with the outlet valve being closed.
9. The engineers having identified the leak, the plant was shut down for repairs.
10. With the condenser operating correctly, the outlet pressure remained low.

14. Combine the sentences using with + noun + Participle I or Participle II.

Example: *The shaft was turning steadily. The generator produced stable electrical output. – With the shaft turning steadily, the generator produced stable electrical output .*

1. The blades were arranged in several rows. The steam expanded gradually.
2. The cooling water was circulating. The condenser operated normally.
3. The outlet valve was closed. The pressure increased.
4. The generator was connected to the shaft. Mechanical energy was converted into electricity.
5. The rotor was rotating at full speed. The vibration level remained acceptable.
6. The inspection was completed. The unit was ready for operation.
7. The blades were cleaned. Turbine output increased.
8. The steam leak was repaired. Turbine performance improved.

15. Choose the correct form: Passive Voice, Participle I, Participle II or an absolute construction.

1. Steam **directing** / **directed** onto the blades makes the shaft rotate.
2. Steam **striking** / **struck** the blades transfers energy to the rotor.
3. The blades **are inspected** / **inspecting** every month.
4. With the cooling water **flowing** / **flowed** through the tubes, the condenser operates correctly.
5. The inspection **completing** / **completed**, the operators restarted the unit.
6. The steam **has expanded** / **has been expanded** through several stages.
7. **Damaged** / **Damaging** blades must be replaced.
8. All checks **completed** / **completing**, the turbine was returned to service.

16. Analyse the sentences according to the given algorithm.

For each sentence:

- 1) underline the finite predicate and identify its tense and voice;
- 2) find the subject;
- 3) identify the Participle I / Participle II phrase or absolute construction;
- 4) expand the shortened construction into a full clause; 5) translate the sentence into Russian.

1. Steam directed onto the blades turns the shaft.
2. With the blades arranged in several rows, steam gives up its energy gradually.
3. The outlet pressure being low, the steam expanded further inside the turbine.
4. The inspection completed, the turbine was restarted.
5. Sensors installed near the casing are monitoring shaft vibration.

17. Pair work

Work in pairs. You are a turbine engineer and a trainee describing the steam cycle.

Choose one part of the process: steam entering the high-pressure section; steam striking the blades; the shaft driving the generator; expanded steam entering the condenser; condensed water returning to the boiler.

Student A describes the stage using Passive Voice and participial phrases. **Student B** asks clarifying questions and rewrites one participial or with-construction as a full clause. Then swap roles and combine both descriptions into one complete sequence.

Use at least two Passive Voice forms, one Participle I phrase and one Participle II phrase.

Useful language:

- First, steam is directed onto ...
- Striking the blades, the steam ...
- The rotating shaft is connected to ...
- Finally, the condensed water is ...

18. Case study

Falling Turbine Output

A steam turbine now produces 8 % less electricity from the same steam flow. Inspection results are shown below:

Indicator / component	Inspection result
Electrical output	8 % lower with the same steam flow
Blade rows	covered with dirt
Turbine casing	small steam leak detected
Shaft vibration	20 % above the normal level
Condenser	operating normally

1. Which faults have been identified, and how may they affect efficiency, safety and reliability?
2. Which components should be cleaned, repaired or checked, and which action has the highest priority?
3. What conditions must be confirmed before the turbine is restarted?
4. Summarise one finding using *with + noun + Participle I / II*, then express the same idea as a full clause.

Use at least two Passive Voice forms, two Participle I or Participle II phrases and one with-construction. Use the Useful language from Exercise 17.

19. Writing.

Write 7–8 sentences answering the question: **How does a steam turbine convert steam energy into electricity, and how is reliable operation maintained?**

Use the notes below.

Energy conversion:

- high-pressure steam is directed onto curved blades;
- steam striking the blades makes the shaft rotate;
- the rotating shaft drives the generator;
- expanded steam is sent to the condenser.

Reliable operation:

- blades are kept clean;
- steam leaks are repaired;
- shaft vibration is monitored;
- low pressure is maintained in the condenser.

Use at least four words or expressions from the lesson: *blade, shaft, generator, stage, condenser, be directed onto the blades, give up energy, turn steam back into water.*

Use:

- at least three Passive Voice forms;
- one Participle I phrase;
- one Participle II phrase;
- one construction with *with + noun + Participle I / II*, if appropriate;
- clear sequence markers;
- at least one sentence about maintenance or monitoring.

Prompts:

- First, high-pressure steam is ...
- Striking the blades, the steam ...
- The rotating shaft ...
- With the blades arranged ...
- The expanded steam ...
- To maintain reliable operation, ...
- Before the turbine is restarted, ...
- Finally, ...

Useful sequence markers: *first, then, next, after that, as a result, finally.*

20. Translate the text into Russian in writing, using a dictionary.

The Condenser

The condenser is an important part of every steam power plant. Its task is to turn the steam leaving the turbine back into water. Inside the condenser, steam is cooled by cold water flowing through tubes. As the steam loses heat, it condenses. The condensate is collected at the bottom of the condenser and returned to the boiler.

The condenser does more than recover. The condensate is collected at the bottom of water. By condensing the steam, it maintains low pressure at the turbine outlet. This allows the steam to expand further through the turbine and give up more of its energy. Cooling water may be taken from a river or the sea, or it may be cooled in cooling towers and used again.

Without a condenser, the plant would require a continuous supply of fresh water, and more energy would be wasted. With the condenser operating correctly, the condensate can be returned to the boiler and reused in the steam cycle, while the efficiency of the whole plant is improved.

LESSON 15. ENERGY EFFICIENCY

Discuss the questions before reading the text.

- How can a factory use less energy?
- Why is a modern LED lamp more efficient than an old lamp?
- What do you do at home to save energy?

1. Vocabulary for the lesson.

afford (v)	ə'fɔ:d	позволять себе
awareness (n)	ə'weənəs	осведомлённость, понимание важности;
raise awareness (phrase)		повышать осведомленность
bill (n)	bɪl	счёт
calculate (v)	'kælkjuleɪt	рассчитывать
carry out (phr v)	'kæri aʊt	проводить
consume (v)	kən'sju:m	потреблять
dependent (adj)	dɪ'pendənt	зависимый
efficient (adj)	i'fɪʃənt	эффективный, энергоэффективный
electricity and fuel bills (phrase)	ɪ'lek'trɪsəti ənd 'fju:əl bɪlz	оплата электроэнергии и топлива
emissions (n, pl)	i'mɪʃənz	выбросы
employee (n)	ɪm'plɔɪi:	сотрудник, работник
energy audit (n)	'enədʒi ,ɔ:dɪt	энергетический аудит
energy conservation (n)	'enədʒi ,kɒnsə'veɪʃən	энергосбережение, рациональное использование энергии
energy consumption (n)	'enədʒi kən'sʌmpʃən	потребление энергии
energy efficiency (n)	'enədʒi i'fɪʃənsi	энергоэффективность
environment (n)	ɪn'vaɪrənmənt	окружающая среда
equipment (n)	i'kwɪpmənt	оборудование
fuel (n)	'fju:əl	топливо
harmful (adj)	'hɑ:mfəl	вредный
heat loss (n)	hi:t lɒs	потеря тепла, теплопотери
improve (v)	ɪm'pru:v	улучшать, повышать
improvement (n)	ɪm'pru:vmənt	улучшение, усовершенствование
insulation (n)	ɪnsjʊ'leɪʃən	изоляция, теплоизоляция
install (v)	ɪn'stɔ:l	устанавливать
LED lamp (n)	ˌel i: 'di: læmp	светодиодная лампа
lighting (n)	'laɪtɪŋ	освещение
measure (n)	'meʒə	мера, мероприятие

meet energy needs (phrase)	mi:t 'enədʒi ni:dz	удовлетворять потребности в энергии
perform (v)	pə'fɔ:m	выполнять
protect (v)	prə'tekt	защищать
recover (v)	rɪ'kʌvə	рекуперировать
reduce (v)	rɪ'dju:s	сокращать
release (v)	rɪ'li:s	выделять, выпускать
renewable energy (n)	rɪ'nju:əbəl 'enədʒi	возобновляемая энергия
replace (with) (v)	rɪ'pleɪs	заменять
save energy (phrase)	seɪv 'enədʒi	экономить энергию
savings (n, pl)	'kælkjʊləɪt pə'tenʃəl 'seɪvɪŋz	экономия
switch to (v)	swɪtʃ tə	переходить на
turn into (phr v)	tɜ:n 'ɪntu:	превращать в
uninsulated (adj)	ˌʌn'ɪnsjʊleɪtɪd	неизолированный, без теплоизоляции
valuable (adj)	'væljuəbəl	ценный
waste (n, v)	weɪst	потери, отходы; тратить впустую
waste heat (n)	weɪst hi:t	отходящее, сбросное тепло
waste heat recovery system (phrase)	weɪst hi:t rɪ'kʌvəri sɪstəm	система рекуперации отходящего тепла

2. Read and translate the text.

Energy Efficiency

Energy is valuable and, in many cases, expensive, so people try not to waste it. Energy efficiency means using less energy to do the same useful work. An efficient machine performs the same task while consuming as little energy as possible.

We can see the idea of efficiency very clearly in lighting. An old lamp turns only a small part of its electrical energy into light; most of the rest is released as unwanted heat. A modern LED lamp gives the same amount of light but uses much less electricity. The LED lamp is therefore more efficient.

Energy efficiency is important for several reasons. First, it saves money: a factory that uses less energy spends less on its electricity and fuel bills. Second, it protects the environment, because lower energy use means burning less fuel and releasing fewer harmful gases. Third, it makes a country less dependent on imported fuel.

In industry, engineers improve efficiency in many ways. They add insulation to pipes and buildings to reduce heat loss. They recover waste heat and use it again in other processes. They also replace old equipment with modern, more efficient machines. Many factories have already reduced their energy use by combining these measures. Even small improvements can save large amounts of energy over time.

For all these reasons, energy efficiency is often called the “first fuel”. It is one of the cheapest and cleanest ways to meet our energy needs, because the best kilowatt-hour is the one that we do not have to produce at all.

3. Answer the questions on the text.

1. What does energy efficiency mean?
2. What happens to the electrical energy in an old lamp?
3. Why is a modern LED lamp more efficient than an old lamp?
4. Why is energy efficiency important for factories, the environment and a country's energy security?
5. How do engineers improve energy efficiency in industry?
6. What have many factories achieved by combining these measures?
7. Why is energy efficiency sometimes called the "first fuel"?

4. True or False? Read the statements. Correct the false ones.

Example: *Energy efficiency means using more energy to do the same work. – False.*
Energy efficiency means using less energy to do the same work.

1. Energy efficiency means doing the same useful work with less energy.
2. An old lamp turns most of its electrical energy into light.
3. A modern LED lamp produces the same amount of light while using less electricity.
4. Lower energy use means that factories burn more fuel and release more harmful gases.
5. Engineers can improve energy efficiency by adding insulation, recovering waste heat and replacing old equipment.
6. Energy efficiency is called the "first fuel" because it is one of the most expensive ways to meet energy needs.

5. Find in the text the English equivalents of the following expressions.

1. выполнять ту же полезную работу;
2. потреблять как можно меньше энергии;
3. превращать электрическую энергию в свет;
4. выделяться в виде нежелательного тепла;
5. снизить зависимость от импортного топлива;
6. сокращать теплопотери;
7. рекуперировать отходящее тепло;
8. удовлетворять потребности в энергии.

6. Fill in the gaps with the correct prepositions from the list: *as, for, in, into, on, over, to or with*. Use each preposition once.

1. An old lamp turns only a small part of its electrical energy _____ light.
2. Most of the remaining energy is released _____ unwanted heat.
3. A factory that uses less energy pays less _____ electricity and fuel.
4. Energy efficiency makes a country less dependent _____ imported fuel.
5. Engineers add insulation _____ pipes, roofs and walls.
6. Engineers use recovered waste heat again _____ other industrial processes.
7. Factories often replace old equipment _____ modern, more efficient machines.
8. Even small improvements can save large amounts of energy _____ time.

7. Match the adjectives with the nouns to make collocations from the text.

1. consume	a) efficiency
2. improve	b) energy
3. meet	c) energy needs
4. protect	d) harmful gases
5. recover	e) heat loss
6. replace	f) money
7. reduce	g) old equipment
8. release	h) the environment
9. save	i) waste heat

8. Match the terms with their definitions.

1. energy audit	a) material used to prevent heat from escaping
2. energy conservation	b) a document showing how much money must be paid for electricity, gas or another service
3. equipment	c) a study of how energy is used and where it can be saved
4. heat loss	d) heat that escapes from a building, pipe or industrial system
5. insulation	e) an efficient electric lamp that uses light-emitting diodes
6. LED lamp	f) machines and devices used for a particular purpose
7. waste heat	g) the practice of reducing energy use, often by changing behaviour
8. bill	h) energy released as heat that is not used in the main process

9. Fill in the gaps with suitable words or phrases from the list. There are two extra options.

bill, energy efficiency, environment, equipment, fuel, improvement, insulation, loss, useful work, waste heat

1. A modern lamp performs the same _____ with less electricity.
2. Good _____ in buildings reduces the need for heating.
3. Factories use _____ to turn raw materials into finished products.
4. _____ means using less energy to do the same task.
5. Saving energy helps protect the _____.
6. Companies try to recover _____ and use it again.
7. The company pays a high electricity _____ every month.
8. The new technology is a significant _____ for the industry.

10. Complete the table with the missing parts of speech.

Noun	Verb	Adjective
dependence		dependent
harm	harm	
	improve	improved
insulation		insulated
protection	protect	
use		useful
	value	valuable

11. Translate the sentences into English using the vocabulary of the lesson.

1. Современное оборудование помогает сократить потери тепла и снизить счета за электроэнергию.
2. Энергоэффективность позволяет странам удовлетворять свои потребности в энергии и использовать меньше топлива.
3. Светодиодные лампы превращают большую часть электрической энергии в свет и выделяют меньше тепла.
4. Инженеры рекуперировать отходящее тепло и используют его снова.
5. Современные системы освещения выполняют ту же полезную работу и потребляют меньше энергии.
6. Когда заводы потребляют меньше энергии, они сжигают меньше топлива и выделяют меньше вредных газов.

Grammar focus: it, one / ones, that / those: reference and other functions

The words *it*, *one* and *that* can perform several functions in English. In this lesson, the main focus is their use as reference and substitute words that help avoid unnecessary repetition. Other common functions are introduced for recognition and guided use: formal and emphatic *it*, formal *one*, and *that* as a conjunction or a relative pronoun.

В английском языке слова *it*, *one* и *that* могут выполнять несколько функций. Основной акцент в этом уроке сделан на их употреблении как слов, которые помогают избежать ненужного повторения. Другие распространённые функции вводятся для распознавания и управляемой практики: формальное и эмфатическое *it*, формальное *one*, а также *that* как союз и как союзное слово (относительное местоимение).

Grammar in context

Look again at the final paragraph of the text:

For all these reasons, energy efficiency is often called the “first fuel”. It is one of the cheapest and cleanest ways to meet our energy needs, because the best kilowatt-hour is the one that we do not have to produce at all.

In this passage, *it* refers back to *energy efficiency*, *one* avoids repeating the noun *kilowatt-hour*, and *that* introduces a clause describing the *kilowatt-hour*. The same words can also perform other functions, shown below.

Table 15.1. Reference and substitute forms of *it*, *one* / *ones*, *that* / *those* (Слова-заменители *it*, *one* / *ones*, *that* / *those*)

Word (Слово)	Use (Употребление)	Example (Пример)
it	refers to the same object, system or situation already mentioned (относится к предмету или ситуации из предыдущего контекста)	The factory installed <i>a monitoring system</i> . <i>It</i> records energy use. – Завод установил <i>систему мониторинга</i> . <i>Она</i> регистрирует потребление энергии.
one	replaces a singular countable noun when another item of the same type is meant (заменяет исчисляемое существительное в единственном числе, когда имеется в виду другой предмет того же типа)	An <i>LED lamp</i> uses less electricity than an old <i>one</i> . – <i>Светодиодная лампа</i> потребляет меньше электроэнергии, чем <i>старая (лампа)</i> .
ones	replaces plural countable nouns when other items of the same type are meant (заменяет исчисляемые существительные во множественном числе)	<i>Modern boilers</i> are more efficient than <i>older ones</i> . – <i>Современные котлы</i> более эффективны, чем <i>старые (котлы)</i> .
that	replaces a singular noun phrase in a formal comparison (заменяет именную группу в единственном числе при формальном сравнении)	<i>The energy consumption of the new unit</i> is lower than <i>that</i> of the old unit. – <i>Энергопотребление</i> нового агрегата ниже, чем (<i>энергопотребление</i>) у старого.
those	replaces a plural noun phrase in a formal comparison (заменяет именную группу во множественном числе в формальном сравнении)	<i>The operating costs of efficient factories</i> are lower than <i>those</i> of inefficient factories. – <i>Эксплуатационные расходы</i> эффективных заводов ниже, чем (<i>расходы</i>) у неэффективных заводов.

Table 15.2. Other common functions of *it*, *one* and *that*
(Другие распространённые функции *it*, *one* и *that*)

Pattern (Конструкция)	Function (Функция)	Example (Пример)
It is + adjective + to-infinitive	formal subject in an evaluation or general statement (формальное подлежащее в оценочном или общем высказывании, не переводится)	<i>It is important to measure energy use regularly.</i> – <i>Важно регулярно измерять потребление энергии.</i>
It is / was + focused element + that ...	emphatic construction; highlights one element (эмфатическая конструкция; логически выделяет один элемент)	<i>It is heat recovery that provides the greatest fuel saving.</i> – <i>Именно рекуперация тепла обеспечивает наибольшую экономию топлива.</i>
one + verb	formal impersonal subject (формальное неопределённо-личное подлежащее)	<i>One should compare the initial cost with long-term savings.</i> – <i>Следует сравнивать первоначальные затраты с долгосрочной экономией.</i>
that + clause	conjunction introducing an object clause (союз «что», вводящий придаточное-дополнительное)	<i>Engineers know that poor insulation increases heat loss.</i> – <i>Инженеры знают, что плохая изоляция увеличивает потери тепла</i>
noun + that + verb ...	relative pronoun referring back to a noun and introducing a defining relative clause (относительное местоимение (союзное слово «который»), вводит определительное придаточное)	<i>A system that recovers waste heat can reduce fuel use.</i> – <i>Система, которая рекуперировывает отходящее тепло, может снизить расход топлива.</i>

12. Identify the function of the words in bold. Use the categories from Tables 15.1 and 15.2.

1. The factory installed a new energy meter. **It** sends data to the control room.
2. We need a more efficient pump; the old **one** wastes energy.
3. The heat losses of insulated pipes are lower than **those** of uninsulated pipes.
4. **It** is important to compare energy use with production output.
5. **It was the energy audit that** revealed the largest heat losses.
6. **One** should compare initial cost with long-term savings.
7. Engineers know **that** damaged insulation increases heat loss.
8. A system **that** recovers waste heat can reduce fuel consumption.

13. Complete the sentences with *it, one, ones, that or those*.

1. The factory has installed a new control system. _____ monitors energy use continuously.
2. An LED lamp uses less energy than an old _____.
3. Modern boilers are more efficient than older _____.
4. The fuel consumption of the new unit is lower than _____ of the old unit.
5. The electricity bills of efficient factories are often lower than _____ of inefficient factories.
6. The company needs a new heat exchanger because the existing _____ is too small.
7. The engineers tested two insulation materials and selected the cheaper _____.
8. The new monitoring system is more accurate than the old _____.

14. Rewrite the sentences to avoid repetition. Use *it, one / ones, that or those*.

1. The new machine is more efficient than the old machine.
2. The energy consumption of Factory A is lower than the energy consumption of Factory B.
3. The company installed a new meter. The new meter is connected to the control room.
4. The maintenance costs of modern systems are lower than the maintenance costs of older systems.
5. The factory has several boilers. The largest boiler supplies the main workshop.
6. The new energy policy is stricter than the previous energy policy.

15. Rewrite or combine the sentences using the function in brackets.

1. Reducing unnecessary heat loss is important. (**formal it**)
2. The energy audit revealed the largest losses, not the monthly bill. (**emphatic it**)
3. Engineers should compare the initial investment with long-term savings. (**formal one**)
4. Engineers know this. Better insulation reduces heating demand. (**that as a conjunction**)
5. The factory installed a system. The system recovers waste heat from exhaust gases. (**that as a relative pronoun**)
6. Heat recovery provides the greatest fuel saving in this case. (**emphatic it**)

16. Pair work

Work in pairs. Compare three energy-efficiency measures: LED lighting, improved insulation and a waste heat recovery system. Student A recommends one measure and compares it with the existing one. Student B asks questions and proposes another option. Then agree on the most suitable measure.

Use at least two reference or substitute forms from Table 15.1 and one additional function from Table 15.2.

Useful language:

- It is important to consider ...

- The existing system is less efficient than the new one.
- The savings from this measure are greater than those from ...
- The installation cost is higher than that of ...
- It is ... that provides the greatest saving.
- One should also consider ...
- I would choose this one because ...

17. Case study

Selecting an Energy-Efficiency Measure

A factory can introduce only one major energy-efficiency measure this year. The figures are simplified and are provided for classroom practice.

Table 15.3. Energy-efficiency options

Option	Cost and implementation	Expected result
A. LED lighting	low cost; no production shutdown	8 per cent reduction in lighting electricity use
B. Pipe insulation	medium cost; two-day shutdown	12 per cent reduction in heating losses
C. Waste heat recovery	high cost; ten-day shutdown	18 per cent reduction in fuel use

1. Compare each proposed measure with the existing one.
2. Which option has the lowest cost, and which one offers the greatest saving?
3. Compare the expected savings of the three options using that or those.
4. Which measure should the factory select? Explain your decision.

In your discussion, use at least two reference or substitute forms from Table 15.1 and one sentence with formal or emphatic it, formal one, or a that-clause from Table 15.2.

18. Writing

Write 7–8 sentences answering the question: Which energy-efficiency measure should the factory select and why?

Use at least four words or expressions from the lesson: energy efficiency, energy consumption, insulation, LED lamp, waste heat, operating cost, reduce, recover, replace.

Use:

- one or ones at least twice;
- that or those as a substitute in a comparison at least once;
- one additional function from Table 15.2: formal / emphatic it, formal one, or a that-clause;
- at least two comparative forms;
- at least two linking words or phrases.

Prompts:

- It is important to ...

- The existing system is less efficient than the proposed one.
- The expected savings are greater than those of ...
- The installation cost is lower / higher than that of ...
- It is ... that offers the greatest benefit.
- One should also consider ...
- Therefore, I would select ...

19. Translate the text into Russian in writing, using a dictionary.

Energy Conservation

Energy efficiency is not the same as energy conservation, although the two ideas are closely connected. Energy efficiency means doing the same work with less energy, while energy conservation means reducing unnecessary energy use, often by changing our behaviour. Turning off the lights when we leave a room, turning down the heating at night and walking instead of driving are all examples of energy conservation. At a factory, employees can conserve energy by switching off machines and other equipment when they are not in use. Together, energy efficiency and energy conservation help society use its limited energy resources more wisely.

LESSON 16. PRODUCTION AND OPERATIONS MANAGEMENT

Discuss the questions before reading the text.

- What resources must be coordinated in a modern factory?
- How have computers changed the work of production managers?
- Why may a well-equipped factory still have poor results?

1. Vocabulary for the lesson

be concerned with (phrase)	bi kən'sɜːnd wið	заниматься, иметь отношение к
be responsible for (phrase)	bi ri'spɒnsəbəl fə	отвечать за
benefit (n)	'benɪfɪt	преимущество, выгода
carry out (phr v)	'kæri aʊt	выполнять, осуществлять
competitive (adj)	kəm'petətɪv	конкурентоспособный
coordinate (v)	kəʊ'ɔːdɪneɪt	координировать, согласовывать
dashboard (n)	'dæʃbɔːd	приборная панель, щиток управления
decision (n)	dɪ'sɪʒən	решение
delay (n, v)	dɪ'leɪ	задержка; задерживать
digital (adj)	'dɪdʒɪtəl	цифровой
efficiently (adv)	ɪ'fɪʃəntli	эффективно, производительно
enterprise (n)	'entəpraɪz	предприятие, компания
fail (v)	feɪl	терпеть неудачу, не достигать результата
figure (n)	'fɪɡə	цифра, показатель, данные
flowsheet (n)	'fləʊʃiːt	технологическая карта
goal (n)	ɡəʊl	цель
input (n)	'ɪnpʊt	входной ресурс, фактор производства
manage (v)	'mænɪdʒ	управлять
material flow (n)	mə'tɪəriəl fləʊ	поток материалов
monitor (v)	'mɒnɪtə	контролировать, отслеживать
operations management (n)	ˌɒpə'reɪʃənz 'mænɪdʒmənt	управление производством, операционный менеджмент
operations manager (n)	ˌɒpə'reɪʃənz 'mænɪdʒə	менеджер по производству
output (n)	'aʊtpʊt	продукция, результат производства
performance (n)	pə'fɔːməns	результативность, производственные показатели

process (v, n)	'prəʊses	обрабатывать; процесс
quality (n)	'kwɒləti	качество
real-time data (n pl)	ˌriːl taɪm 'deɪtə	данные в реальном времени
reorganise (v)	ri:'ɔ:gənaɪz	реорганизовывать
satisfied (adj)	'sætɪsfaɪd	удовлетворённый, довольный
schedule (n)	ˌʃedju:l	график,
production schedule	prə'dʌkʃən ˌʃedju:l	производственный график
store (v)	stɔː	хранить, складировать
succeed (v)	sək'si:d	добиваться успеха, преуспевать
supply chain (n)	sə'plai tʃeɪn	цепочка поставок
transformation (n)	ˌtrænsfə'meɪʃən	преобразование
waste (n, v)	weɪst	потери, отходы; тратить впустую
workload (n)	'wɜːkləʊd	рабочая нагрузка
workshop (n)	'wɜːkʃɒp	цех
stand idle (phrase)	stænd 'aɪdəl	простаивать

2. Read and translate the text.

Production and Operations Management

In every company, goods and services are created by a process known as production. Operations management is the part of management concerned with this process. Its task is to organise the way in which inputs are turned into useful outputs and to make sure that quality, cost and delivery requirements are met.

The inputs of a production system include raw materials, energy, labour, machines, money and information. These inputs are combined and transformed during production. As a result, finished products or services are obtained. This change is called the transformation process. The same principle applies both to a factory, where physical goods are made, and to a service enterprise, where the output may be a service rather than a product.

Operations management has become increasingly important as factories have grown larger and markets have become more competitive. Two enterprises may use similar machines and materials, yet one may produce more, at a lower cost and with better quality, because its operations are organised more effectively. The way production is managed may therefore decide whether a company succeeds or fails.

Operations managers are responsible for many decisions. They decide where work is carried out, how much is produced, which equipment is used and how employees are organised. They plan production schedules, distribute workloads and control the storage and movement of materials. They also coordinate departments so that the right products are made at the right time and at the required cost.

Good operations management brings several benefits. When a factory is well managed, materials are not wasted, machines do not stand idle unnecessarily and costs are kept under control. High-quality goods are delivered on time, customers remain satisfied and the enterprise develops a strong reputation.

In recent years, digital planning systems have been introduced in many

enterprises. Material flow has been monitored with these systems, actual figures have been compared with plans, and delays have been identified more quickly. Real-time data have been shared between departments, and in some companies supply chains have already been reorganised. These completed changes show what has been achieved, while regular monitoring continues to support day-to-day production decisions.

Technology has changed the tools used in operations management, but its basic goal has remained the same: to turn inputs into the right outputs and to use people, materials, equipment, energy and information as efficiently as possible.

3. Answer the questions on the text

1. What is production, and what is operations management concerned with?
2. What are the main inputs of a production system?
3. What is the transformation process?
4. What decisions are operations managers responsible for?
5. What benefits does good operations management bring?
6. How have digital planning systems changed the work of operations managers?

4. True or False? Read the statements. Correct the false ones.

Example: Resources are unlimited. – False. Resources are not unlimited. They are limited.

1. Operations management is concerned with the way inputs are transformed into useful outputs.
2. Raw materials, energy and labour are outputs of a production system.
3. Operations managers decide where a factory is built, how it is organised and how much should be produced.
4. Two firms that use the same machines and materials always achieve the same production costs and product quality.
5. Good operations management helps a company reduce waste, keep costs low and deliver products on time.
6. New technology has changed the tools used in operations management, but its basic aim has remained the same.

5. Find in the text the English equivalents of the following expressions

1. иметь отношение к производственному процессу;
2. превращать входные ресурсы в полезную продукцию;
3. процесс преобразования;
4. производить больше при более низких затратах и более высоком качестве;
5. отвечать за многие важные решения;
6. работа каждого отдела планируется и контролируется;
7. материалы не расходуются впустую, а затраты поддерживаются на низком уровне;
8. основная цель не изменилась.

6. Fill in the gaps with the correct prepositions from the list: *at, for, in, into, of, over, since or with*. Use each option once

1. Operations management is concerned _____ the production process.
2. Operations managers are responsible _____ many important decisions.
3. Inputs are turned _____ useful outputs during the production process.
4. One enterprise may produce more goods _____ a lower cost.
5. The work _____ each department must be carefully planned and controlled.
6. Decisions that once took several days can now be made _____ a few minutes.
7. Operations managers have been using digital planning systems _____ the last few years.
8. Some departments have been sharing real-time data _____ 2023.

7. Match the words to make collocations from the lesson.

1. production	a) flow
2. material	b) schedule
3. customer	c) chain
4. supply	d) demand
5. digital	e) performance
6. improve	f) system
7. reduce	g) resources efficiently
8. use	h) waste

8. Match the terms with their definitions.

1. production	a) the part of management concerned with organising and controlling production processes
2. operations management	b) a finished product, service or other result produced by a system
3. input	c) a business organisation or company
4. output	d) the process through which goods or services are created
5. transformation process	e) a resource that enters a production system, such as materials, labour or energy
6. enterprise	f) the process of turning inputs into useful outputs

9. Complete the table with the missing words from the same word family.

Verb	Noun	Adjective / Participle
manage	; manager	—
operate	operation;	operating
produce	; producer	productive
decide		—
compete	competition; competitor	
satisfy	_____	satisfied

10. Identify the part of speech of the words in bold: noun or verb. Translate the sentences into Russian.

1. The team will **process** the production data before the meeting.
2. This **process** requires careful planning.
3. The operations manager's main **concern** is meeting the production deadline.
4. These changes **concern** all production departments.
5. The new digital system will **result** in fewer delays.
6. We are still waiting for the **result** of the quality test.
7. The new software will **change** how materials are stored.
8. Any **change** in the production schedule must be approved by the operations manager.
9. The new system will **benefit** both employees and management.
10. One of the main **benefits** is lower production costs and less waste.

11. Translate the sentences into English using the vocabulary of the lesson

1. Чтобы добиться успеха, предприятие должно производить товары высокого качества.
2. Операционный менеджмент занимается преобразованием входных ресурсов в полезную продукцию.
3. Менеджеры по производству отвечают за производственный график и поток материалов.
4. Цифровые системы помогают отслеживать данные в реальном времени и координировать работу отделов.
5. Предприятия хранят материалы в цехах до начала обработки.
6. Конкурентоспособные предприятия сокращают потери и поддерживают затраты на низком уровне.
7. Менеджеры координируют рабочую нагрузку, чтобы сократить задержки.
8. Основная цель не изменилась: предприятие должно превращать входные ресурсы в нужную продукцию как можно эффективнее.

Grammar focus: Integrating Passive Voice, Participles and Comparisons

Table 16.1. Choosing a grammar structure in an operations report (Выбор грамматической конструкции)

Communicative purpose (Задача)	Useful structure (Конструкция)	Example (Пример)
describing a regular process (описание регулярного действия или процесса)	Present Simple Passive	Production figures <i>are recorded</i> every shift. – Производственные показатели <i>регистрируются</i> каждую смену.
reporting a completed change (сообщение об изменениях)	Past Simple / Present Perfect Passive	A digital system <i>was installed</i> last year. – Цифровая система <i>была установлена</i> в прошлом году. The schedule <i>has been revised</i> . – График <i>был пересмотрен</i> .

Communicative purpose (Задача)	Useful structure (Конструкция)	Example (Пример)
describing work in progress or a future change (описание работы в процессе выполнения или будущего изменения)	Present Continuous / Future Simple Passive	Material flow <i>is being monitored</i> . – Движение материалов <i>отслеживается</i> . A new line <i>will be installed</i> . – Новая линия <i>будет установлена</i> .
stating a requirement (формулировка требований)	Modal Passive	All measurements <i>must be recorded</i> . – Все измерения <i>должны быть записаны</i> .
adding an active compact detail (добавление информации, действительный залог)	Participle I	Managers <i>using</i> real-time data can identify delays earlier. – Менеджеры, <i>использующие</i> данные в реальном времени, могут выявлять задержки раньше.
adding a passive compact detail (добавление информации, страдательный залог)	Participle II	Data <i>collected</i> automatically are more reliable. – Данные, <i>собранные</i> автоматически, более надёжны.
comparing alternatives (сравнение вариантов)	comparative + one / ones; that / those	The new system is faster than the old <i>one</i> . – Новая система быстрее, чем старая (<i>система</i>). Its costs are lower than <i>those</i> of the previous system. – Его затраты ниже, чем (<i>затраты</i>) у предыдущей системы.

Table 16.2. Participles for compact technical description (Причастия, используемые для компактного технического описания)

Full form	Compact form
Workers <i>who operate</i> the new line require training.	Workers <i>operating</i> the new line require training.
The data <i>that are collected</i> automatically are compared with the target.	The data <i>collected</i> automatically are compared with the target.
<i>When all departments shared</i> real-time data, delays fell.	<i>With all departments sharing</i> real-time data, delays fell.
<i>After the schedule had been revised</i> , delivery time decreased.	<i>The schedule having been revised</i> , delivery time decreased.

12. Choose the form that best fits the meaning of each sentence.

1. The efficiency of the new boiler *is compared* / *compares* with the old model every month.
2. A new digital dashboard *introduced* / *was introduced* last month.
3. At the moment, the new equipment *is installing* / *is being installed* in the workshop.
4. All safety checks *must complete* / *must be completed* before production starts.
5. Managers *used* / *using* new tools can plan work better.
6. The report *prepared* / *preparing* by the operations team includes three

recommendations.

7. The new system is more flexible than the old *it / one*.

8. The energy costs of Plant A are lower than *that / those* of Plant B.

13. Rewrite the sentences using the structure in brackets.

1. Managers collect production data every shift. (*Present Simple Passive*)

2. The enterprise introduced digital planning systems last year. (*Past Simple Passive*)

3. Workers who check product quality must follow strict instructions. (*Participle I*)

4. The report that was prepared last week is more detailed. (*Participle II*)

5. When the department used the new system, output increased. (*with + noun + Participle I*)

6. The energy consumption of the new machine is lower than energy consumption of the old machine. (*that*)

14. Complete the operations report with the correct form of the verbs in brackets.

Last year, a digital planning system (**install**) _____ at a medium-sized factory. Since then, production schedules (**revise**) _____ more quickly, and real-time data (**share**) _____ by all departments. At the moment, material flow (**monitor**) _____ through one dashboard. Managers (**use**) _____ the new system have identified several recurring delays. The delays (**identify**) _____ in the report must be investigated, and a revised maintenance schedule (**introduce**) _____ next month.

15. Compare the two systems. Avoid unnecessary repetition by using *one / ones, that or those*.

Criterion	Old system	New system
Data entry	separate spreadsheets	one shared dashboard
Update time	once per day	real time
Delay detection	slow	fast
Training cost	low	medium
Maintenance planning	reactive	preventive

- The new system is more ... than the old one.
- The update time of the new system is shorter than that of ...
- The delay-detection methods are more reliable than those of ...
- It is important to consider ...

16. Translate the sentences into English using the grammar of the lesson.

1. Производственные показатели фиксируются автоматически каждую смену.

2. В прошлом году была установлена новая цифровая система.

3. Менеджеры, использующие данные в реальном времени, быстрее выявляют задержки.

4. Данные, собранные автоматически, сравниваются с плановыми показателями.

5. Поскольку все отделы обмениваются информацией, производственный график обновляется быстрее.
6. Новая система гибче старой, а её эксплуатационные затраты ниже, чем затраты предыдущей системы.

17. Pair work

Work in pairs. You are an operations manager and a department supervisor reviewing a new digital planning system. Student A describes the regular process, the completed changes and the work currently in progress. Student B asks questions, adds one compact description with a participle and compares the new system with the old one. Then swap roles.

Use at least two Passive Voice forms, one participial phrase and one comparison with one / that / those.

Useful language:

- Production figures are recorded ...
- A new system has been introduced ...
- At the moment, material flow is being ...
- Managers using real-time data ...
- The new system is more ... than the old one.
- Its costs are lower than those of ...

18. Case study

Coordinating a Digital Production System

A factory has introduced a shared digital dashboard, but delivery dates are still being missed. Production data are entered by every department, yet some updates are delayed. Two machines are standing idle while another workshop is working overtime. A new preventive-maintenance schedule will be introduced next month.

1. Which regular processes are already organised correctly, and which problems are still occurring?
2. Which data should be collected or shared more quickly?
3. Rewrite one finding with Participle I and one finding with Participle II.
4. Compare the current system with the previous one using one / that / those.
5. Recommend two actions and state how their results should be measured.

19. Writing

Write 7–8 sentences answering the question: How has a factory improved its operations management, and what should be done next?

Use at least four words or expressions from the lesson: operations management, production schedule, material flow, real-time data, supply chain, workload, delay, reduce waste, stand idle, coordinate, reorganise.

Use:

- at least three Passive Voice forms;
- one Participle I phrase;

- one Participle II phrase;
- one comparison with one / that / those;
- at least two linking words or phrases.

20. Translate the text into Russian in writing, using a dictionary.

The Production System

A production system can be seen as a chain of three stages: inputs, transformation and outputs. At the input stage, resources such as materials, labour and energy are collected and prepared. During transformation, these resources are processed and combined by machines and workers, and step by step they are turned into something new. At the output stage, the finished goods or services are obtained and delivered to customers.

Around this chain there is always a flow of information. Orders from customers tell the system what should be produced; reports from the workshop show how much has been made and how much material is left. By using this information, managers can monitor the system and make adjustments when something goes wrong. If one stage is poorly organised, the whole system works badly, so each stage must be carefully planned and controlled.

A good production system is therefore not only a set of machines. It is also a way of organising people, materials, energy and information so that they work together towards a common goal.

SEMESTER 2 GRAMMAR WORKSHOP

Putting it all together

During Semester 2, you have learned how to describe industrial processes in the **Passive Voice**, make technical descriptions more compact with **Participles**, and avoid unnecessary repetition with **it, one / ones, that / those**. This workshop brings these grammar tools together before the Semester 2 Progress Check.

Part 1. From Active to Passive

Main Passive Voice forms (Основные формы Passive Voice)

Form	Structure	Typical use	Example
Present Simple Passive	am / is / are + V3	regular process (регулярный процесс)	Output <i>is measured</i> every shift. – Выпуск продукции <i>измеряется</i> каждую смену.
Past Simple Passive	was / were + V3	completed past action (действие, совершенное в прошлом)	The system <i>was installed</i> last year. – Система <i>была установлена</i> в прошлом году.
Present Perfect Passive	have / has been + V3	completed result connected with now (завершенный результат, связанный с настоящим)	The schedule <i>has been revised</i> . – График <i>был пересмотрен</i> .
Present Continuous Passive	am / is / are being + V3	process happening now (процесс, протекающий в настоящий момент)	A trial batch <i>is being produced</i> . – <i>Производится</i> пробная партия
Past Continuous Passive	was / were being + V3	process at a past moment (процесс, протекавший в прошлом)	The line <i>was being tested</i> at noon. – В полдень линия <i>проходила испытания</i> .
Future Simple Passive	will be + V3	future process or result (будущий процесс или результат)	A new unit <i>will be installed</i> . – Новый агрегат <i>будет установлен</i> .
Modal Passive	modal + be + V3	requirement, possibility or advice (требование, возможность, совет)	All measurements <i>must be recorded</i> . – Все измерения <i>должны быть записаны</i> .

1. Complete the sentences with the correct Passive Voice form of the verbs in brackets.

1. Production figures (record) _____ automatically every shift.
2. The monitoring system (install) _____ last year.
3. Three production lines (upgrade) _____ already.
4. A trial batch (produce) _____ at the moment.
5. The machines (reset) _____ when the urgent order arrived.
6. A new robotic cell (install) _____ next year.
7. Defective products (must not / ship) _____ to customers.
8. The results (should / compare) _____ with the target.

Part 2. Making technical texts more compact

Participles in technical descriptions (Причастия в техническом описании)

Form	Meaning / function	Example
Participle I Active V-ing	an active action or process (активное действие или процесс)	Steam <i>flowing</i> through the pipe transfers heat. – Пар, <i>протекающий</i> по трубе, передаёт тепло.
Participle I Passive being + V3	a passive process in progress (пассивный процесс)	The unit <i>being tested</i> is not yet in service. – Агрегат, <i>проходящий испытания</i> , ещё не введён в эксплуатацию.
Participle II V3	a completed or passive characteristic (завершённое действие или пассивный признак)	Data <i>collected</i> automatically are more accurate. – Данные, <i>собранные</i> автоматически, более точны.
Perfect Participle having + V3 / having been + V3	an earlier action (предшествующее действие)	<i>Having completed</i> the inspection, the engineers prepared the report. – <i>Завершив</i> проверку, инженеры подготовили отчёт.
Absolute Participial Construction	a separate background condition with its own subject (фоновое условие с собственным подлежащим)	<i>The inspection completed</i> , the line was restarted. – <i>После того как</i> проверка была завершена, линия была перезапущена.

2. Rewrite the sentences using the form in brackets.

1. Workers who operate the new line require training. (*Participle I*)
2. The data that were collected during the test were incomplete. (*Participle II*)
3. After the engineers had completed the inspection, they restarted the unit. (*Perfect Participle*)
4. Because the cooling-water pump was operating normally, the outlet temperature remained stable. (*with + noun + Participle I*)
5. After all safety checks had been completed, the turbine was returned to service. (*Absolute Participial Construction*)
6. While the trial batch was being produced, the engineers monitored the sensors. (*Participle I Passive*)

Part 3. Referencing without repetition

It, one / ones, that / those

Form	Use	Example
it	the same object or situation (отсылка на один и тот же предмет или ситуацию)	The factory installed a new <i>meter</i> . <i>It</i> sends data automatically. – Завод установил новый <i>счётчик</i> . <i>Он</i> автоматически передаёт данные.
one / ones	another item or other items of the same type (отсылка на похожий предмет или предметы)	The new pump is more efficient than the old <i>one</i> . – <i>Новый насос</i> более эффективен, чем <i>старый (насос)</i> .
that / those	a singular or plural noun phrase in a formal comparison ((отсылка на похожий предмет или предметы в формальных контекстах)	<i>The costs are lower than those</i> of the previous system. – <i>Затраты</i> ниже, чем (<i>затраты</i>) у предыдущей системы.

3. Complete the sentences with *it*, *one*, *ones*, *that* or *those*.

1. The factory has installed a new dashboard. _____ displays data in real time.
2. The new machine is more reliable than the old _____.
3. Modern sensors are more accurate than older _____.
4. The operating cost of System A is lower than _____ of System B.
5. The maintenance requirements of digital systems are different from _____ of mechanical systems.
6. _____ is essential to verify the result after an improvement.

Part 4. Integrated technical report

4. Complete the report with the correct forms of the verbs and substitute words in brackets.

A production line (**modernise**) _____ last year. Since then, production data (**collect**) _____ automatically, and the results (**compare**) _____ with the monthly target. At the moment, a new sensor system (**test**) _____. Engineers (**monitor**) _____ the system have already identified two recurring faults. The faults (**identify**) _____ in the report must be corrected before the line returns to full load. The new system is more reliable than the old (**one**), and its measurements are more accurate than (**those**) of the previous system. The test (**complete**), the final settings will be approved.

5. Analyse the completed report.

1. Identify five Passive Voice forms and state their tenses.
2. Find one Participle I phrase and one Participle II phrase.
3. Expand the absolute construction into a full sentence.
4. Explain what one and those replace.
5. Translate the final two sentences into Russian.

PROGRESS CHECK II

Lessons 9-16

Recommended time: 25–30 minutes.

Complete, transform or identify the constructions as instructed.

1. The monthly figures (record) _____ automatically. (*Present Simple Passive*)
2. A new monitoring system (install) _____ last year. (*Past Simple Passive*)
3. The production schedule (revise) _____ already. (*Present Perfect Passive*)
4. A trial batch (produce) _____ at the moment. (*Present Continuous Passive*)
5. A new robotic line (install) _____ next year. (*Future Simple Passive*)
6. Defective items (must not / release) _____. (*Modal Passive*)
7. The workers (operate) _____ the new line require additional training.
(*Participle I*)
8. The data (collect) _____ during the test were incomplete. (*Participle II*)
9. **Rewrite with a Perfect Participle:** After the engineers had completed the inspection, they prepared the report.
10. **Expand into a full sentence:** The pressure rising, the operator opened the bypass valve.
11. The new control system is more reliable than the old _____. (*one / it*)
12. The operating costs of the new line are lower than _____ of the previous line.
(*that / those*)
13. **Rewrite in the Passive Voice:** Digital meters record the production figures.
14. **Identify the construction:** With the coolant circulating normally, the outlet temperature remained stable.

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ПРИЛОЖЕНИЕ

ФОНЕТИКО-ГРАММАТИЧЕСКИЙ СПРАВОЧНИК

Таблица П1. Английский алфавит

1	A a	[eɪ]	14	N n	[en]
2	B b	[bi:]	15	O o	[əʊ]
3	C c	[si:]	16	P p	[pi:]
4	D d	[di:]	17	Q q	[kju:]
5	E e	[i:]	18	R r	[ɑ:]
6	F f	[ef]	19	S s	[es]
7	G g	[dʒi:]	20	T t	[ti:]
8	H h	[eɪtʃ]	21	U u	[ju:]
9	I i	[aɪ]	22	V v	[vi:]
10	J j	[dʒeɪ]	23	W w	[ˈdʌbəlju:]
11	K k	[keɪ]	24	X x	[eks]
12	L l	[el]	25	Y y	[waɪ]
13	M m	[em]	26	Z z	[zed]

Таблица П2. Система звуков английского языка

Гласные звуки		
Короткие гласные	Долгие гласные	Дифтонги
[ɪ] – краткий ненапряжённый звук, близкий к русскому «и», но более открытый. <i>it, system, give, efficiency</i>	[i:] – долгий напряжённый звук «и». <i>heat, steam, team, green</i>	[eɪ] – переход от [e] к [ɪ], приблизительно «эй». <i>data, safety, make, rate</i>
[e] – краткий звук, близкий к русскому «э». <i>pen, ten, bed, energy</i>	[a:] – долгий задний звук «а». <i>car, start, plant, hard</i>	[aɪ] – переход от [a] к [ɪ], приблизительно «ай». <i>time, line, supply, design</i>
[æ] – широкий краткий звук между русскими «а» и «э». <i>factory, plan, batch, standard</i>	[ɔ:] – долгий огублённый звук «о». <i>more, order, source, store</i>	[aʊ] – переход от [a] к [ʊ], приблизительно «ау». <i>output, amount, house, how</i>
[ɒ] – краткий огублённый звук, близкий к краткому русскому «о». <i>hot, cost, job, stop</i>	[u:] – долгий напряжённый звук «у». <i>tube, cooling, school, blue</i>	[ɔɪ] – переход от [ɔ] к [ɪ], приблизительно «ой». <i>boiler, oil, point, noise</i>
[ʌ] – краткий центральный звук без точного русского соответствия. <i>sun, must, run, result</i>	[ɜ:] – долгий центральный звук без точного аналога в русском языке. <i>work, first, turn, learn</i>	[əʊ] – переход от [ə] к [ʊ], приблизительно «оу». <i>flow, home, load, total</i>
[ʊ] – краткий огублённый звук, близкий к краткому русскому «у». <i>book, good, put, full</i>		[ɪə] – переход от [ɪ] к [ə], приблизительно «иэ». <i>here, near, engineer, clear</i>
[ə] – нейтральный редуцированный звук безударного слога. <i>about, teacher, operator, production</i>		[eə] – переход от [e] к [ə], приблизительно «эа». <i>air, care, repair, compare</i>
		[ʊə] – переход от [ʊ] к [ə]; встречается главным образом в британских вариантах. <i>poor, sure, tour, cure</i>

Согласные звуки		
Группа	Глухие звуки	Звонкие и сонорные звуки
Взрывные	[p] – глухой губно-губной; в начале ударного слога обычно произносится с придыханием. <i>pen, pump, map, stop</i>	[b] – звонкий губно-губной. <i>boiler, batch, job, absorb</i>
	[t] – глухой переднеязычный; кончик языка касается альвеол. <i>tea, test, heat, time</i>	[d] – звонкий переднеязычный. <i>data, design, bed, did</i>
	[k] – глухой заднеязычный; в начале ударного слога часто произносится с придыханием. <i>cost, coolant, black, key</i>	[g] – звонкий заднеязычный. <i>gas, give, bag, good</i>
Щелевые	[f] – глухой губно-зубной. <i>flow, fan, safe, life</i>	[v] – звонкий губно-зубной. <i>valve, improve, have, move</i>
	[θ] – глухой межзубный; кончик языка находится между зубами. <i>thermal, three, method, both</i>	[ð] – звонкий межзубный; кончик языка находится между зубами. <i>this, that, with, weather</i>
	[s] – глухой переднеязычный щелевой. <i>system, process, mass, safety</i>	[z] – звонкий переднеязычный щелевой. <i>zero, rise, has, these</i>
	[ʃ] – глухой шипящий, близкий к русскому «ш», но мягче. <i>pressure, production, machine, insulation</i>	[ʒ] – звонкий шипящий. <i>measure, usual, vision, pleasure</i>
	[h] – глухой гортанный; лёгкий выдох без русского «х». <i>heat, high, how, house</i>	
Аффрикаты	[tʃ] – глухая аффриката, близкая к русскому «ч». <i>change, check, temperature, match</i>	[dʒ] – звонкая аффриката, близкая к сочетанию «дж». <i>energy, engineer, adjust, bridge</i>
Назальные (носовые)	[m] – губно-губной носовой: <i>material, steam, time, pump</i> [n] – переднеязычный носовой: <i>energy, insulation, line, fan</i> [ŋ] – заднеязычный носовой; обычно не произносится как [нг]: <i>heating, flowing, long, ring</i>	
Сонорные	[l] – боковой сонорный: <i>loss, flow, boiler, line</i> [r] – переднеязычный сонорный; не вибрирует: <i>radiation, rate, run, correct</i>	
	[j] – близок к русскому «й»: <i>unit, use, university, yes</i> [w] – губы округлены; точного русского аналога нет: <i>water, work, waste, will</i>	

1. Read the abbreviations and match them with their meanings.

R&D, CEO, HR, IT, GDP, KPI, CAD, HVAC, CHP, PPE, QC, PDF

1. computer-aided design
2. combined heat and power
3. chief executive officer
4. gross domestic product
5. heating, ventilation and air conditioning
6. human resources
7. information technology
8. key performance indicator
9. personal protective equipment
10. quality control
11. research and development
12. portable document format

2. Read the words in transcription, translate them into Russian.

- | | |
|---------------------|--------------------|
| 1. ['stju:dənt] | 12. [ə'næləsis] |
| 2. [ˌju:nɪ'vɜ:səti] | 13. ['meθəd] |
| 3. [ˌedʒʊ'keɪʃən] | 14. ['mæniɔʒmənt] |
| 4. ['stʌdi] | 15. [rɪ'sɜ:ʃ] |
| 5. ['prəʊses] | 16. [ɪ'kwɪpmənt] |
| 6. ['sɪstəm] | 17. [dɪ'veləpmənt] |
| 7. ['enədʒi] | 18. [ɪ'fɪʃənsi] |
| 8. [tek'nɒlədʒi] | 19. [ˌɒpə'reɪʃən] |
| 9. [ˌi:kə'nɒmɪk] | 20. [ˌɪnfə'meɪʃən] |
| 10. [prə'dʌkʃən] | 21. ['nɒlɪdʒ] |
| 11. ['ɪndəstri] | 22. [rɪ'zɔ:s] |

Таблица ПЗ. Чтение гласных букв в четырех типах ударных слогов

Гласная	Открытый слог (1-й тип)	Закрытый слог (2-й тип)	Гласная + r (3-й тип)	Гласная + r + e (4-й тип)
а	[eɪ] name, make, late, face, table, basic, data Исключения: have [hæv], any ['eni], many ['meni]	[æ] cat, plan, factory, hand, matter, standard	ar [ɑ:] car, park, start, large, market, department	are [eə] care, share, prepare, compare, rare
е	[i:] he, be, me, she, even, legal Исключения: were [wɜ:], there [ðeə], where [weə]	[e] pen, test, help, well, centre, member	er [ɜ:] her, term, verb, serve, perfect, prefer	ere [ɪə] here, atmosphere, sphere, severe, sincere, interfere
и / у	[aɪ] final, pilot, cycle, my, rely, apply Исключения: give [gɪv], city ['sɪti], busy ['bɪzi]	[ɪ] him, film, system, symbol, physics, typical	ir [ɜ:] bird, first, firm, third, circle, confirm	ire [aɪə] fire, tyre, wire, desire, require, inspire
о	[əʊ] no, go, home, phone, role, open Исключения: do [du:], does [dʌz], two [tu:], who [hu:]	[ɒ] hot, job, stop, box, possible, modern Исключения: both [bəʊθ], don't [dəʊnt], won't [wəʊnt]	or [ɔ:] sport, form, north, order, important, normal Исключения: word [wɜ:d], work [wɜ:k], world [wɜ:ld]	ore [ɔ:] more, before, restore, explore, store, core
и	[ju:] student, music, human, unit, uniform, produce После r, l, j часто [u:]: rule, true, blue, June	[ʌ] but, bus, run, must, under, result Исключения: put [pʊt], pull [pʊl], push [pʊʃ], full [fʊl]	ur [ɜ:] turn, return, burn, purpose, surface, urgent	ure [jʊə] pure, cure, secure, ensure, endure, during

Примечание: схема четырёх типов чтения является учебным упрощением и не охватывает все модели английской орфографии. Частотные исключения указаны в соответствующих ячейках таблицы; произношение незнакомых слов следует проверять по словарю.

3. Read the words and identify the type of syllable.

a – add, shade, rare, prepare, start, fare, farm, large, part, map, save, act, sap, agent, dark, sand, card, fact, came, grammar, bark, than, carbon, age, land, paper, plastics, matter, spare, handle, art, artist, bank, regard, harm, candle, market, department, pare, share, ban, tape, fan, pale, sale, tannin, rags, fact, case, article, rate, hardly, trash.

e – less, let, nerve, here, melt, term, verb, mere, left, herb, eve, cell, prefer, dense, spell, these, observe, vessel, elect, tense, sense, fed, prevent, inert, merge, wet, sphere, serve, stem, press, collect, net, adhere.

i, y – mill, mile, try, mine, style, still, hide, timber, hire, lime, type, fire, entire, dye, wire, admire, wide, tip, birch, line, fir, cycle, recycle, system, dry, pine, inspire, instant, third, gym, split, shine, final, dirt, price, fly, desire, rise, rely, wide, inch, fill, size, trip, twice, print, circle."

u – cubic, cut, secure, such, true, fuse, glue, dust, pollute, include, rude, pulp, structure, much, furnish, due, furnace, mature, fun, urgent, music, us, burner, consume, reduce, spruce, unit, unite, pump, fume, solution, rub, lumber, rust, further, tune, burn, jute, pure, curve, burst, fund, must, result.

o – ore, drop, shore, cost, stone, top, hole, orbit, explore, more, crop, forty, so, bottom, before, north, odd, tone, torn, short, phone, cone, cotton, corn, cross, form, slot, storm, stock, sort, dome, stove, mole, strong, report, store, promote, inform, log.

4. Read the sentences, paying attention to the types of syllables.

1. She sits here and reads a long book.
2. He works in a big plant near the port.
3. Turn the page and read the next chapter.
4. Drive carefully on the narrow road in the dark.
5. Try to find a place for the new table.
6. The music sounds beautiful in the large hall.
7. Bring the book and put it on the shelf.
8. Write your name on the first page of the notebook.
9. The student studies hard for the final exam.
10. Live and learn every day of your life.
11. The man takes a red pen from the table.
12. The student takes a test at the university.

Таблица П4. Правила чтения сочетаний согласных букв

Сочетание	Звук	Правило	Примеры
ck	[k]	всегда	<i>black, clock, back, ticket</i>
ch / tch	[tʃ]	в большинстве случаев	<i>children, teacher, watch, change, cheap, match, much</i>
ch	[k]	в словах греческого и латинского происхождения	<i>school, chemistry, chemical, chemist, mechanical, technology, character, chrome, architect, scheme</i>
ch	[ʃ]	в словах французского происхождения	<i>machine [məˈʃiːn], schedule [ˈʃedjuːl] / [ˈskedjuːl]</i>
cc	[ks]	перед гласными e, i, y	<i>accept, succeed, success</i>
dg	[dʒ]	всегда	<i>bridge, judge, edge, budget</i>
ng	[ŋ]	в большинстве случаев	<i>sing, song, ring, thing, reading, translating, spring, bring, long, evening</i>
	[ŋg]	перед звуками [l], [r], [w]	<i>English, England, single, language, angle, hungry, angry</i>
nk	[ŋk]	всегда	<i>think, bank, thank, link</i>
ph	[f]	всегда	<i>phone, sulphur, photograph, physics, physicist, philosophy</i>
sh	[ʃ]	всегда	<i>she, ship, finish, show, wish</i>
qu	[kw]	в большинстве случаев	<i>quick, question, quite, require, square</i>
	[k]	редко (в основном, в словах французского происхождения)	<i>unique [juːˈniːk], opaque [əvˈpeɪk], cheque [tʃek], technique [tekˈniːk]</i>
th	[θ]	в большинстве случаев	<i>thin, thick, think, three, depth, tenth, eleventh, third, mathematics</i>
	[ð]	в служебных словах, местоимениях, между гласными	<i>the, they, this, that, with, bathe, then, than</i>
sc	[s]	перед гласными e, i, y (c is silent)	<i>science, scientist, scientific, scene, scenery, scent</i>
xc	[ks]	перед e, i, y (с не произносится)	<i>excellent, exceed, excess, except, exception</i>

5. Group the words according to the pronunciation of “ch”: [tʃ], [k], or [ʃ].

Children, teacher, watch, change, cheap, match, much, school, chemistry, chemical, chemist, mechanical, technology, character, chrome, architect, scheme, machine, schedule

6. Group the words according to the pronunciation of “th”: [θ] or [ð].

Thin, thick, think, three, depth, tenth, eleventh, third, mathematics, the, they, this, that, with, bathe, then, than.

7. Read the transcription and write the correct word with the correct consonant combination.

- | | |
|----------------|------------|
| 1. [blæk] | 8. [ʃi:] |
| 2. [klɒk] | 9. [ʃɪp] |
| 3. ['tʃɪldrən] | 10. [sɪŋ] |
| 4. ['ti:tʃə] | 11. [sɒŋ] |
| 5. [wɒtʃ] | 12. [θɪŋk] |
| 6. [tʃeɪndʒ] | 13. [bæŋk] |
| 7. ['fɪzɪks] | 14. [θæŋk] |

8. Read the sentences, paying attention to the combinations of consonants.

1. The black clock is on the back of the ticket desk.
2. The children watch the teacher as she changes the match.
3. Chemistry and technology are taught at school by a chemist.
4. The machine has a schedule for maintenance every week.
5. I accept that success comes from hard work and excellent planning.
6. The bridge was built by a judge who lived near the edge of the budget.
7. The singer is singing a song about spring and long evenings.
8. I think the bank will thank you for your link to the project.
9. The phone and the photograph are on the physics teacher's desk.
10. She will ship the goods and show you how to finish the work.
11. The unique technique was developed by a cheque payment system.
12. I think that three thin books are on the third shelf.

Таблица П5. Произношение окончаний

Окончание	Произношение	Условие	Примеры
-s / -es	[s]	после глухих согласных, кроме свистящих и шипящих	<i>works, pumps, checks</i>
-s / -es	[z]	после гласных и звонких согласных, кроме свистящих и шипящих	<i>plays, valves, runs</i>
-s / -es	[ɪz]	после [s], [z], [ʃ], [ʒ], [tʃ], [dʒ]	<i>uses, changes, measures</i>
-ed	[t]	после глухих согласных, кроме [t]	<i>checked, reduced, stopped</i>
-ed	[d]	после гласных и звонких согласных, кроме [t],[d]	<i>installed, measured, designed</i>
-ed	[ɪd]	после [t] и [d]	<i>tested, recorded, added</i>

9. State the pronunciation of the ending: [s], [z], [ɪz], [t], [d] or [ɪd].

1. tanks
2. flows
3. changes
4. pipes
5. speeds
6. boxes
7. fixed
8. invented
9. tested
10. reduced
11. provided
12. calibrates
13. pressed
14. filled

10. Mark the expected final intonation: rising (↑) or falling (↓).

1. Is the new sensor working?
2. Where is the maintenance report?
3. Who approved the revised procedure?
4. Will the team repair the pump or replace it?
5. The pressure is stable, isn't it?
6. The readings are not complete, are they?

Таблица П6. Артикли и определяющие слова

Форма	Употребление	Пример
a / an	один неопределённый исчисляемый предмет	<i>a modern boiler; an efficient process</i>
the	конкретный или уже упомянутый предмет	<i>the new production line</i>
нулевой артикль	существительное во множественном числе или неисчисляемое существительное в общем значении	<i>Energy is a production resource.</i>
some / any / no	количество в утверждении, вопросе / отрицании или прямое отрицание	<i>some data; any defects? no delays</i>

11. Fill in the gaps with *a / an, the, some, any, no, there is or there are*. Use one negative word in each sentence where indicated.

- _____ inspection report on the desk.
- The plant uses _____ natural gas and electricity.
- Are there _____ defects in this batch?
- _____ separate control room near the turbine hall.
- The workshop has _____ automatic valve at the inlet.
- _____ operators are absent today; the full team is present.
- The engineer does not record _____ data without checking the sensor.
- _____ two emergency exits in the laboratory.

Таблица 7. Слова-заменители

Form	Use	Example
one / ones	Заменяет исчисляемое существительное из предыдущего контекста	the old pump and the new one ; these sensors and the old ones
that / those	Заменяет исчисляемое существительное из предыдущего контекста, особенно при сравнении	The output of Line A is higher than that of Line B.
it / they	Заменяет существительное из предыдущего контекста, выступающего в роли подлежащего или дополнения	The new sensor is accurate. It records data automatically.

12. Complete the sentences with *one / ones or that / those*.

- The output of the automated line is higher than _____ of the manual line.
- These sensors are more accurate than the old _____.
- The maintenance costs in Workshop 2 are lower than _____ in Workshop 1.
- We compared the damaged valve with a new _____.
- The results obtained in winter differed from _____ obtained in summer.
- The company selected the smaller pump, not the larger _____.

Таблица П8. Порядок слов в утвердительных предложениях

Тип предложения	Структура	Пример
Простое утверждение	Подлежащее + Сказуемое + Дополнение	The turbine produces electricity.
С обстоятельством места	Подлежащее + Сказуемое + Дополнение + Место	The engineer checks the pressure in the control room.
С обстоятельством времени	Подлежащее + Сказуемое + Дополнение + Время или Время + Подлежащее + Сказуемое + Дополнение	The plant operates at full capacity every day. Yesterday, the team completed the installation.
С обстоятельством частоты	Подлежащее + Наречие частотности + Сказуемое + Дополнение <i>Примечание:</i> наречие частотности стоит <u>перед</u> смысловым глаголом, но <u>после</u> глагола "to be"	The system usually operates at high pressure. The boiler is always under high pressure during operation.
С обстоятельством образа действия	Подлежащее + Сказуемое + Дополнение + Образ действия	The technician repaired the valve carefully.
С косвенным дополнением (без предлога)	Подлежащее + Сказуемое + Косвенное дополнение + Прямое дополнение	The engineer gave the technician a new task.
С косвенным дополнением (с предлогом)	Подлежащее + Сказуемое + Прямое дополнение + Предлог + Косвенное дополнение	The engineer gave a new task to the technician.
С обстоятельствами места и времени	Подлежащее + Сказуемое + Дополнение + Место + Время	The operator checks the gauges in the control room every hour.
С конструкцией "There is/are"	There + be + Подлежащее + Место/Время	There is a heat exchanger in the system.

13. Put the words in the correct order. Underline the subject and the predicate.

1. the readings / every hour / records / the operator / carefully / in the control room
2. usually / the factory / its energy use / monitors
3. near the boiler house / is / the control panel
4. has / the department / three trained technicians
5. every week / maintenance checks / the team / carries out

6. the report / ready / is / not
7. in the laboratory / students / practical work / do
8. available resources / the plant / efficiently / uses
9. every morning / checks / the engineer / the equipment
10. electricity / produces / efficiently / the turbine
11. the system / in the control room / monitor / the operators
12. new equipment / last month / installed / the plant
13. new instructions / the operators / gave / the manager
14. a heat exchanger / there is / in the system
15. a cooling system / there is / in the workshop
16. a new method / the research team / developed / for energy saving

14. Using the words from the table, create as many correct sentences as possible. Each sentence must contain one item from each column.

Subject	Verb	Object	Adverbial (Place / Manner)	Adverbial (Time / Frequency)
The government	analyses	the findings	in the office	next week
The economist	prepares	market data	for the company	every quarter
The lecturer	presents	new policies	to the students	gradually
The team	explains	new strategies	carefully	during the lecture
The researcher	introduces	economic models	in the energy sector	this semester
The manager	develops	the budget	at the conference	at the end of the year

Таблица П9. Типы вопросов в английском языке

Тип	Структура	Пример
1. Общий вопрос (General / Yes-No question)	Вспомогательный глагол + подлежащее + ...?	Has <u>the company</u> reduced its energy use?
2. Специальный вопрос (Special question / Wh-question)	Вопросительное слово (When / Why / How / Where / What / Which) + вспомогательный глагол + подлежащее + ...?	Why is <u>the pressure</u> rising? When will <u>you</u> be free?
3. Вопрос к подлежащему (Subject question)	Who / What + сказуемое	Who checks the safety valves? What has been completed?
4. Альтернативный вопрос (Alternative question)	Общий вопрос + or + альтернатива?	Is <u>wind</u> or <u>solar power</u> the most promising energy technology of the future? Do <u>they</u> use low or medium pressure to carry out this reaction?
5. Разделительный вопрос (Disjunctive question / Tag question)	Утверждение + противоположный разделительный вопрос?	<u>The boiler</u> operates efficiently, doesn't it ? <u>The engineers</u> have tested the system, haven't they ? <u>The boiler</u> doesn't operate efficiently, does it ? <u>The engineers</u> haven't tested the system, have they ?

15. Read each question and identify its type: General, Special, Alternative, Tag, or Subject.

- Does the government regulate energy prices?
- What does the engineer calculate during the design phase?
- The professor explains the law of thermodynamics, doesn't he?
- Does the company invest in renewable energy or fossil fuels?
- Who prepares the annual efficiency report?
- Does the economist study market behaviour every year?
- When does the maintenance team inspect the boiler?

8. The new turbine operates efficiently, doesn't it?
9. Does the plant use coal or natural gas as fuel?
10. What does the operator monitor in the control room?

16. Write the required question for each sentence.

1. The plant produces 420 units a day. (How many units ...?)
2. The engineers are testing the new turbine. (Who ...?)
3. The pressure is rising because the outlet valve is closed. (Why ...?)
4. The company uses gas and biomass. (Alternative question)
5. The monitoring system records data every minute. (General question)
6. A sensor controls the inlet temperature. (What ...?)
7. The operations manager is meeting the supplier tomorrow. (When ...?)
8. The line is not operating today. (Tag question)
9. The researcher studies the effects of temperature on efficiency. (What ...?)
10. The new heat exchanger operates without any problems. (Tag question)

17. Write the required question for each sentence.

1. The company has introduced a digital dashboard. (General question)
2. The engineers have been analysing data for four months. (How long ...?)
3. The production manager has revised the schedule. (Who ...?)
4. The factory has reduced waiting time by 11 per cent. (By how much ...?)
5. The team has been monitoring the material flow since April. (Since when ...?)
6. The enterprise has replaced the conveyor, not repaired it. (Alternative question)
7. A delay has affected the supply chain. (What ...?)

18. Complete the tag questions.

1. The company has revised the procedure, ... ?
2. The engineers have been collecting data, ... ?
3. The old line was removed last year, ... ?
4. The schedule is not flexible, ... ?
5. Digital tools can reduce delays, ... ?
6. The plant will modernise the warehouse, ... ?
7. The operators did not waste material, ... ?
8. The main objective has not changed, ... ?

Таблица П10. Функции глагола “to be”

Функция и значение	Примеры	Перевод
1) Глагол-связка «быть», «являться»	The law of supply and demand is a fundamental concept in economics.	Закон спроса и предложения является фундаментальным понятием в экономике.
2) Смысловой глагол «находиться»	The boiler is in the boiler room.	Котёл находится в котельной.
3) Вспомогательный глагол для образования времен группы Continuous и страдательного залога	The inflation rate is being monitored by the central bank. The budget was approved by the parliament.	Уровень инфляции отслеживается центральным банком. Бюджет был утверждён парламентом.
4) Эквивалент модального глагола must	The country is to reduce its budget deficit by 3 %.	Страна должна сократить свой бюджетный дефицит на 3 %.
5) Входит состав оборота “there + be” переводится как «есть», «имеется», «существует».	There are several factors that affect economic growth.	Существует / Есть несколько факторов, влияющих на экономический рост.

19. Identify the functions of the verb “to be”. Translate the sentences into Russian.

1. The new equipment is in the workshop.
2. The new standards are to be introduced next year.
3. The workers are testing the new turbine.
4. There are several types of production processes.
5. The aim of the project is to reduce energy consumption.
6. The engineers are to complete the design by Friday.
7. The quality of the products is excellent.
8. The students are conducting research on energy markets.
9. There are several factors that affect the price of electricity.
10. The results of the experiment were published in a scientific journal.
11. The demand for energy is increasing rapidly.
12. The plant is located near the river.

Таблица П11. Функции глагола “to have”

Функция в предложении и значение	Примеры	Перевод
1) Смысловой глагол «иметь», «обладать», «у... есть»	The procedure has a number of drawbacks.	У метода есть ряд недостатков. / Метод имеет ряд недостатков.
2) Вспомогательный глагол для образования времен группы Perfect .	They have developed a new test system.	Они разработали новую систему тестирования.
3) Эквивалент модального глагола must (в сочетании с инфинитивом с частицей “to”).	We had to postpone the meeting.	Нам пришлось отложить встречу.

Таблица П12. Функции глагола “to do”

Функция в предложении и значение	Примеры	Перевод
1) Смысловой глагол «делать», «выполнять».	Scientists do calculations to support their theoretical models.	Ученые выполняют расчёты для подтверждения своих теоретических моделей.
2) Вспомогательный глагол для образования вопросительной и отрицательной формы времен Present Simple и Past Simple.	Do you attend lectures every day as part of your program?	Вы посещаете лекции каждый день в рамках своей программы?
3) Эмфатический “do”, подчеркивает значение смыслового глагола.	I do understand what you are trying to say.	Я действительно понимаю, о чем вы говорите.

20. Identify the functions of the verb “to have”. Translate the sentences into Russian.

1. The university has a large library with many books.
2. The new boiler has several important features.
3. The price of oil has increased this year.
4. The laboratory has modern equipment for experiments.
5. The engineers have to check all the safety systems.
6. The demand for electricity has grown significantly.
7. The plant has a capacity of 100 megawatts.
8. The researchers have conducted several tests.
9. This method has many advantages over traditional ones.

10. The manager has to make an important decision.
11. The production costs have decreased this year.
12. The students have to complete their coursework on time.

21. Identify the functions of the verb “to do”. Translate the sentences into Russian.

1. Scientists do experiments to test their hypotheses.
2. Do you attend all your lectures regularly?
3. I do believe that this method is more efficient.
4. The students do their homework every evening.
5. We do not use this equipment for our experiments.
6. The engineer does understand the problem well.
7. The researchers do a lot of calculations every day.
8. I do hope that the project will be successful.
9. The factory does not produce enough energy.
10. Do you have any questions about the test?
11. Did the team finish the project on time?
12. The researchers did not find any significant errors.

22. Identify the function of “to be”, “to have” or “to do” in each sentence. Translate the sentences into Russian.

1. The workshop has two production lines.
2. Engineers do regular safety checks.
3. Does the system record pressure automatically?
4. The pump is near the storage tank.
5. The coolant is circulating through the test loop.
6. The sensors have detected an unusual vibration.
7. The inspection has three stages.
8. The final report is complete.
9. The measurements were recorded electronically.
10. The operator did not stop the line.

Таблица П13. Времена английского глагола в действительном залоге

	Время	Утвердительная форма	Отрицательная форма	Вопросительная форма	Маркеры
Simple - facts	Present	<i>I/You/We/They study. He/She/It studies.</i>	<i>I/You/We/They do not (don't) study. He/She/It does not (doesn't) study.</i>	Do <i>I/you/we/they study?</i> Does <i>he/she/it study?</i>	<i>usually, always, often, sometimes, never, every day/ week/month, regularly, usually, sometimes, hardly ever</i>
	Past	<i>I/You/He/She/It/We/They studied (taught).</i>	<i>I/You/He/She/It/We/They did not (didn't) study (teach).</i>	Did <i>I/you/he/she/it/we/they study (teach)?</i>	<i>yesterday, last week/month/year, in 2020, ago, then</i>
	Future	<i>I/You/He/She/It/We/They will study (teach).</i>	<i>I/You/He/She/It/We/They will not (won't) study (teach).</i>	Will <i>I/you/he/she/it/we/they study (teach)?</i>	<i>tomorrow, next week/month/year, in 2030, soon</i>
Continuous – processes <i>be + Ving</i>	Present	<i>I am studying. You/We/They are studying. He/She/It is studying.</i>	<i>I am not studying. You/We/They are not (aren't) studying. He/She/It is not (isn't) studying.</i>	Am <i>I studying?</i> Are <i>you/we/they studying?</i> Is <i>he/she/it studying?</i>	<i>now, at the moment, currently, today, this week/month</i>
	Past	<i>I/He/She/It was studying (teaching). You/We/They were studying (teaching).</i>	<i>I/He/She/It was not (wasn't) studying (teaching). You/We/They were not (weren't) studying (teaching).</i>	Was <i>I/he/she/it studying (teaching)?</i> Were <i>you/we/they studying (teaching)?</i>	<i>at 5 pm yesterday, while, when</i>
	Future	<i>I/You/He/She/It/We/They will be studying (teaching).</i>	<i>I/You/He/She/It/We/They will not (won't) be studying (teaching).</i>	Will <i>I/you/he/she/it/we/they be studying (teaching)?</i>	<i>at 5 pm tomorrow, this time next week, in the future</i>

	Время	Утвердительная форма	Отрицательная форма	Вопросительная форма	Маркеры
Perfect – results <i>have + V3</i>	Present	<i>I/You/We/They have studied (taught). He/She/It has studied (taught).</i>	<i>I/You/We/They have not (haven't) studied (taught). He/She/It has not (hasn't) studied (taught).</i>	Have <i>I/you/we/they</i> studied? Has <i>he/she/it</i> studied (taught)?	<i>already, yet, just, ever, never, since, for, recently, so far, recently, this (week, month)</i>
	Past	<i>I/You/He/She/It/We/They had studied (taught).</i>	<i>I/You/He/She/It/We/They had not (hadn't) studied (taught).</i>	Had <i>I/you/he/she/it/we/they</i> studied (taught)?	<i>by the time, before, after, already, just, by 2020</i>
	Future	<i>I/You/He/She/It/We/They will have studied (taught).</i>	<i>I/You/He/She/It/We/They will not (won't) have studied (taught).</i>	Will <i>I/you/he/she/it/we/they</i> have studied (taught)?	<i>by the end of this year, by 2030, by the time</i>
Perfect Continuous – result + process <i>have been + Ving</i>	Present	<i>I/You/We/They have been studying. He/She/It has been studying.</i>	<i>I/You/We/They have not (haven't) been studying. He/She/It has not (hasn't) been studying.</i>	Have <i>I/you/we/they</i> been studying? Has <i>he/she/it</i> been studying?	<i>for, since, lately, recently, all day/week, how long</i>
	Past	<i>I/You/He/She/It/We/They had been studying.</i>	<i>I/You/He/She/It/We/They had not (hadn't) been studying.</i>	Had <i>I/you/he/she/it/we/they</i> been studying?	<i>for, since, before, by the time, how long</i>
	Future	<i>I/You/He/She/It/We/They will have been studying.</i>	<i>I/You/He/She/It/We/They will not (won't) have been studying.</i>	Will <i>I/you/he/she/it/we/they</i> have been studying?	<i>by the end of this year, for, by the time</i>

НЕ ПУТАЙТЕ 1. PRESENT SIMPLE И PRESENT CONTINUOUS

Present Simple описывает факты, закономерности и регулярные процессы.

Present Continuous описывает временный процесс, действие сейчас или текущую тенденцию.

Сравните: The controller stores data locally. (факт) / **This week**, it is sending data to a cloud server (на этой неделе).

НЕ ПУТАЙТЕ 2. PAST SIMPLE И PRESENT PERFECT

Past Simple связан с завершённым моментом или периодом в прошлом.

Present Perfect описывает результат к настоящему моменту или незавершённый период.

Сравните: Engineers replaced the pump **in March** (действие произошло в указанный момент в прошлом). / Engineers have completed three upgrades **this year** (Этот год ещё не завершён).

НЕ ПУТАЙТЕ 3. PRESENT PERFECT SIMPLE И PRESENT PERFECT CONTINUOUS

Present Perfect Simple подчёркивает завершённый результат или количество.

Present Perfect Continuous подчёркивает длительность или продолжающийся процесс.

Сравните: The team has analysed 240 records (действие произошло). / The team has been analysing the database since 9 a.m (действие продолжает происходить).

Таблица П14. Способы выражения будущего времени.

Форма	Функция	Пример
will	прогноз или решение, принятое в момент речи	<i>Experts believe that fuel prices will rise.</i>
be going to	заранее принятый план	<i>The company is going to install a heat-recovery unit.</i>
Present Continuous	зафиксированная договорённость; дополнительное употребление	<i>The engineers are meeting the supplier on Friday.</i>
Present Simple	расписание или официальный график	<i>The conference begins on Monday.</i>

23. Complete the sentences with the correct Present Simple form of the verbs in brackets.

1. A heat exchanger _____ (**transfer**) heat between two fluids.
2. The maintenance team _____ (**not / ignore**) unusual readings.
3. _____ the plant _____ (**generate**) electricity every day?
4. The laboratory _____ (**have**) three types of sensors.
5. The operations manager usually _____ (**review**) the weekly schedule.
6. Defective parts _____ (**not / enter**) the final assembly area.
7. _____ a pressure gauge _____ (**measure**) the system pressure?
8. The company _____ (**evaluate**) its suppliers every year.

24. Complete the sentences with the correct Present Simple or Present Continuous form of the verbs in brackets.

1. The line normally _____ (**operate**) at a constant speed.
2. At the moment, engineers _____ (**inspect**) the conveyor drive.
3. Energy demand usually _____ (**increase**) in cold weather.
4. This month, the factory _____ (**run**) a temporary night shift.
5. The quality standard _____ (**define**) the permitted tolerance.
6. Look! Steam _____ (**escape**) from the damaged joint.
7. The company currently _____ (**evaluate**) a new supplier.
8. A good conductor _____ (**transfer**) thermal energy easily.
9. The control system _____ (**connect**) to the network now.
10. The manager _____ (**not / make**) the final decision today.

25. Choose the correct Present Simple or Present Continuous form. Pay attention to stative verbs.

1. The company **owns / is owning** two warehouses.
2. I **understand / am understanding** the calculation now.
3. The engineers **need / are needing** additional data.
4. The supervisor **believes / is believing** that the test result is reliable.
5. The laboratory **has / is having** a safety inspection this week.
6. The system **belongs / is belonging** to the energy department.

26. Complete the sentences with the correct Past Simple form of the verbs in brackets.

1. The company _____ (**install**) its first automated line in 2016.
2. Engineers _____ (**find**) several faults during the initial test.
3. The old boiler _____ (**not / produce**) enough steam for the expanded workshop.
4. _____ the team _____ (**complete**) the project on time?
5. The plant _____ (**introduce**) a new maintenance schedule last March.
6. The sensor _____ (**send**) an incorrect signal during the night shift.
7. The manager _____ (**contact**) the supplier after the inspection.
8. The technicians _____ (**replace**) the damaged cable and restarted the unit.
9. The factory _____ (**not / generate**) electricity from the grid before 1985.
10. When _____ the laboratory _____ (**adopt**) the new test method?

27. Read the mini-report. Correct the false statements using did not + V1 and a correct Past Simple sentence.

In 2019, West Plant replaced two old pumps. In 2020, the engineering team introduced digital pressure monitoring. The plant did not expand production until 2022. Last year, employees completed a new safety-training programme.

1. West Plant replaced the pumps in 2021.
2. The engineering team introduced digital monitoring in 2020.
3. The plant expanded production before the new monitoring system was introduced.
4. Employees completed the safety programme last year.

28. Complete the sentences with the correct Past Simple or Past Continuous form of the verbs in brackets.

1. While the technician _____ (**replace**) the filter, the pump suddenly _____ (**stop**).
2. The operators _____ (**record**) the readings when the alarm _____ (**sound**).
3. At 8 p.m., the night team _____ (**clean**) the heat exchanger.
4. The pressure _____ (**fall**) while the valve _____ (**open**) slowly.
5. When the supervisor _____ (**enter**) the workshop, the workers _____ (**restart**) the line.
6. Two engineers _____ (**update**) the software while a third engineer _____ (**calibrate**) the sensor.
7. The steam leak _____ (**appear**) while the unit _____ (**operate**) at full load.
8. The team _____ (**finish**) the inspection before the weather _____ (**become**) worse.

29. Complete the experiment report with the correct Past Simple or Past Continuous forms.

Yesterday, the students 1) _____ (**heat**) a small water tank. While one student 2) _____ (**measure**) the temperature, another student 3) _____ (**record**) the time. At 10:15, the water 4) _____ (**reach**) 80 C. The group 5) _____ (**continue**) the experiment when the power supply suddenly 6) _____ (**switch**) off. The teacher 7) _____ (**check**) the connection and 8) _____ (**restart**) the heater.

30. Complete the sentences with the most suitable future form: will, be going to, Present Continuous or Present Simple.

1. The board has approved the project. The company _____ (**build**) a new boiler house.
2. Experts believe that industrial electricity demand _____ (**grow**) next year.
3. The engineers _____ (**meet**) the supplier on Friday at 10 a.m.
4. According to the conference programme, the opening session _____ (**begin**) at 9 a.m.
5. I think the new insulation _____ (**reduce**) heat loss significantly.
6. The plant has purchased all the necessary equipment and _____ (**install**) it in August.

7. The maintenance team _____ (**meet**) the contractor tomorrow afternoon; the meeting has already been arranged.
8. The train to the power plant _____ (**leave**) at 7:30 tomorrow morning.

31. Write one sentence for each situation using the form indicated.

1. A decision has already been made to replace the compressor. (**be going to**)
2. An expert predicts lower maintenance costs. (**will**)
3. A meeting with the contractor is fixed for Tuesday at 11 a.m. (**Present Continuous**)
4. According to the official timetable, the train to the plant leaves at 7:30 tomorrow morning. (**Present Simple**)
5. The company has decided to install a new heat-recovery unit next year. (**be going to**)
6. The engineers have arranged a meeting with the equipment supplier for Friday afternoon. (**Present Continuous**)

32. Complete the sentences with the correct Present Simple, Past Simple or Future Simple form of the verbs in brackets. Pay attention to the time markers. Write a general question for each sentence.

1. Our team _____ (**finish**) the project two days ago.
2. The university _____ (**open**) a new research centre next year.
3. The manager _____ (**not / attend**) the conference last month.
4. The boiler _____ (**produce**) steam at high pressure every day.
5. The engineer _____ (**calculate**) the efficiency of the system yesterday.
6. The factory _____ (**operate**) 24 hours a day.
7. The company _____ (**launch**) a new product next spring.
8. The researchers _____ (**collect**) data for their study every month.
9. The professor _____ (**give**) a lecture on physics every Monday.
10. The price of electricity _____ (**increase**) in 2022.
11. The students _____ (**take**) a test at the end of each module.
12. The engineers _____ (**test**) the new turbine next month.

33. Complete the sentences with the correct Present Perfect or Past Simple form of the verbs in brackets.

1. The factory _____ (**reduce**) its energy use by 9 per cent this year.
2. The factory _____ (**complete**) its first energy audit in 2021.
3. Engineers _____ (**test**) three new control strategies since January.
4. The company _____ (**replace**) the main pump last Friday.
5. Demand for district heating _____ (**grow**) steadily over the last decade.
6. The supplier _____ (**send**) the final documents yesterday.
7. We _____ (**not / use**) this type of sensor before.
8. The plant _____ (**have**) two shutdowns last March.
9. _____ you ever _____ (**operate**) a thermal camera?
10. When _____ you _____ (**use**) it for the first time?

34. Fill in the gaps with *just, already, yet, since, for, recently, this year or ever*. Use each option once.

1. The maintenance team has _____ completed the inspection; they finished it only a few minutes ago.
2. Has the laboratory _____ tested this material?
3. The company has not approved the final budget _____.
4. Engineers have monitored the outlet temperature _____ Monday.
5. The same pump has operated reliably _____ six years.
6. The plant has _____ introduced a new reporting system; it started two weeks ago.
7. Three workshops have reduced electricity use _____.
8. The supplier has _____ delivered the replacement valves, although they were not due until Friday.

35. Write a *Have you ever ...?* question and a Past Simple follow-up question for each prompt.

1. operate a boiler simulator / when
2. take part in an energy audit / where
3. analyse production costs / which project
4. visit a power plant / which plant

36. Complete the sentences with the correct Past Perfect or Past Simple form of the verbs in brackets.

1. By the time the inspector arrived, the operator _____ (**isolate**) the damaged item.
2. The team _____ (**restart**) the unit after the pressure _____ (**fall**) to a safe level.
3. The company _____ (**contact**) the supplier before it _____ (**recall**) the faulty batch.
4. After the engineers _____ (**analyse**) the heat losses, they _____ (**prepare**) an insulation plan.
5. The pump _____ (**stop**) because the filter _____ (**block**) completely.
6. When the manager _____ (**receive**) the report, the laboratory _____ (**verify**) all measurements.
7. The workers _____ (**not / start**) the line until the safety officer _____ (**give**) permission.
8. The digital archive _____ (**lose**) several records because the backup system _____ (**fail**).

37. Combine each pair of sentences into one sentence using *after, before* or *by the time*. Use the Past Perfect for the earlier action.

1. The laboratory checked the samples. The company released the batch.
2. The pump lost pressure. The alarm sounded.
3. The finance team estimated the payback period. Management approved the project.

4. The workers removed the old insulation. They installed the new material.
5. The engineer reached the control room. The automatic shutdown had begun.
6. The supplier sent the certificate. The inspection team accepted the equipment.

38. Complete the sentences with the correct Present Perfect Simple or Present Perfect Continuous form of the verbs in brackets.

1. The factory _____ (**introduce**) a new production schedule.
2. The operations team _____ (**monitor**) material flow since Monday.
3. The logistics department _____ (**identify**) four recurring delivery problems this quarter.
4. The laboratory _____ (**analyse**) vibration data for several weeks.
5. The plant _____ (**reduce**) fuel consumption by 6 per cent.
6. The company _____ (**own**) the same site for ten years.
7. How long _____ the engineers _____ (**test**) the new control logic?
8. The main objective of the project _____ (**not / change**).

39. Read each sentence. Find the predicate(s) and identify the tense of each verb form.

1. The demand for energy usually rises during extreme weather conditions.
2. The operations manager has already approved the budget for the next quarter.
3. By the end of next year, the plant will have installed all the new insulation.
4. The company has been reducing its energy consumption for the past three years.
5. The workers will replace the old conveyor belts next Friday.
6. The market price of natural gas fluctuates daily based on supply and demand.
7. The researchers had already completed the initial analysis before the new data arrived.
8. At 10 a.m. tomorrow, the operators will be testing the new system.
9. The factory produced over 50,000 units during the last financial year.
10. When the manager arrives, he will review the production plan.
11. The engineers designed a more efficient condenser for the thermal power plant.
12. The operators are currently adjusting the sensors to improve efficiency.

40. Complete the sentences with the correct tense form of the verbs in brackets.

1. The manager _____ (**just / approve**) the new schedule.
2. The demand for electricity _____ (**rise**) sharply during the winter months.
3. The students _____ (**prepare**) their presentations while the teacher was giving instructions.
4. The team _____ (**work**) on the project for three years before they achieved success.
5. Every year, the plant _____ (**consume**) over 500,000 tonnes of coal.
6. The technicians _____ (**replace**) all the old sensors by the end of next month.
7. The company _____ (**order**) the new turbines for the power station this year.

8. The university library _____ (**open**) at 8 a.m. every weekday.
9. He _____ (**already / publish**) three articles this year.
10. According to the official programme, the conference _____ (**take place**) next month in Moscow.
11. The results _____ (**not / confirm**) the original hypothesis yet.
12. The research group _____ (**work**) on this project for three years.
13. The students _____ (**prepare**) for their presentations at the moment.
14. The team _____ (**complete**) the experiment before the deadline arrived.
15. The university _____ (**host**) an international conference next month; the dates have already been confirmed.

Таблица П15. Значения модальных глаголов и их эквивалентов

Модальный глагол/ эквивалент	Значение	Пример	Перевод
can	способность (умственная/физическая)	<i>A good engineer can solve complex technical problems.</i>	<i>Хороший инженер умеет решать сложные технические задачи</i>
	просьба	<i>Can you explain this concept in more detail?</i>	<i>Можете ли вы объяснить эту концепцию более подробно?</i>
	запрет (в отрицательной форме)	<i>You cannot enter the laboratory without safety training.</i>	<i>Вы не можете войти в лабораторию без инструктажа по технике безопасности.</i>
	разрешение	<i>You can use the library resources for your research.</i>	<i>Вы можете использовать материалы библиотеки для своего исследования.</i>
	возможность (общая)	<i>New technology can improve production efficiency.</i>	<i>Новые технологии могут повысить эффективность производства.</i>
	сомнение/недоверие (в отрицательной форме)	<i>He cannot have completed the project so quickly!</i>	<i>Не может быть, что он завершил проект так быстро!</i>
could	способность в прошлом	<i>In the past, engineers could only rely on manual calculations.</i>	<i>В прошлом инженеры могли полагаться только на ручные расчёты</i>
	предположение	<i>This approach could lead to significant cost savings.</i>	<i>Этот подход, возможно, приведёт к значительной экономии средств.</i>
	просьба	<i>Could you review my report for errors?</i>	<i>Не могли бы вы проверить мой доклад на наличие ошибок?</i>
may	предположение	<i>He may be attending a conference this week.</i>	<i>Возможно, на этой неделе он на конференции.</i>
	разрешение	<i>You may submit your report by the end of the week.</i>	<i>Вы можете сдать свой отчёт к концу недели.</i>
	официальный запрет (в отр. форме)	<i>Students may not use mobile phones during the exam.</i>	<i>Студентам нельзя пользоваться мобильными телефонами во время экзамена</i>
	просьба о разрешении	<i>May I leave earlier today?</i>	<i>Могу ли я уйти пораньше сегодня?</i>

Модальный глагол / эквивалент	Значение	Пример	Перевод
might	предположение	<i>You might be wrong.</i>	<i>Возможно, вы ошибаетесь.</i>
must	обязательство	<i>Students must attend all practical sessions.</i>	<i>Студенты должны посещать все практические занятия.</i>
	дедуктивный вывод	<i>They must have been invited to the conference.</i>	<i>Должно быть, их пригласили на конференцию.</i>
	запрет (в отр. форме)	<i>You must not use your cellphone during the exam.</i>	<i>Во время экзамена нельзя пользоваться мобильным телефоном.</i>
should	совет	<i>Students should plan their research carefully.</i>	<i>Студентам следует тщательно планировать своё исследование.</i>
	уверенное предположение	<i>The system should be working correctly now.</i>	<i>Система, должно быть, работает правильно сейчас</i>
	упрек	<i>You should have been more attentive during the test.</i>	<i>Вам следовало бы быть внимательнее во время тестирования.</i>
ought to	совет	<i>They ought to apologize.</i>	<i>Им следует извиниться.</i>
	уверенное предположение	<i>There ought to be some valuable lectures at the conference this week.</i>	<i>Наверняка на конференции на этой неделе будут полезные лекции.</i>
	запрет (в отр. форме)	<i>Such things ought not to be allowed.</i>	<i>Такие вещи нельзя допускать.</i>
have to	необходимость в связи с обстоятельствами	<i>The company has to comply with new regulations.</i>	<i>Компания должна соблюдать новые нормативные требования</i>
	отсутствие необходимости (в отр. форме)	<i>You don't have to be a scientist to understand this principle.</i>	<i>Не обязательно быть ученым, чтобы понять этот принцип.</i>
be to	необходимость в связи с договоренностью	<i>They are to conduct a series of experiments this month.</i>	<i>В этом месяце они должны провести серию экспериментов</i>
need to	практическая необходимость	<i>We need to review the literature before starting.</i>	<i>Нам нужно изучить литературу перед началом работы.</i>
	отсутствие необходимости (в отр. форме)	<i>You don't need to include all the details in the report.</i>	<i>Вам не нужно включать все детали в доклад.</i>

НЕ ПУТАЙТЕ 4. MUST, HAVE TO, MUST NOT И DO NOT HAVE TO

must и have to выражают необходимость, **но have to часто связано с внешним правилом или обстоятельствами.**
must not означает запрет.

do not / does not have to означает, что действие выполнять необязательно.

Сравните: Visitors must not enter (это запрещено). / The whole line does not have to stop (это можно и не делать).

Таблица П16. Изменение модальных глаголов и их эквивалентов в различных временах

	Present	Past	Future
must	must	—	—
have to	have/has to	had to	will have to
be to	am/is/are to	was/were to	—
can	can	could	—
be able to	am/is/are able to	was/were able to	will be able to
may	may	might	—
be allowed to	am/is/are allowed to	was/were allowed to	will be allowed to

41. Fill in the gaps with a suitable modal verb or equivalent. Use each option once.

can, could, have to, had to, may, must, must not, should

1. According to the environmental permit, the plant _____ record weekly emissions data.
2. The laboratory _____ repeat the pressure test yesterday because the first record was incomplete.
3. A thermal camera _____ reveal overheated electrical contacts without stopping the line.
4. Visitors _____ enter the high-voltage room without an escort.
5. The delivery _____ arrive one day late because of the storm.
6. Managers _____ review near-miss reports before changing the safety procedure.
7. Before the upgrade, the old controller _____ process only one signal at a time.
8. This is an emergency instruction: operators _____ close the isolation valve immediately.

42. Complete the sentences with a suitable modal verb in the affirmative or negative form. More than one answer may be possible. Translate the sentences into Russian.

must, have to, should, ought to, be to, can, be able to, may, could, might.

1. First-year students _____ attend the laboratory safety briefing before using the equipment.
2. You _____ find lecture materials on the university learning platform.
3. Every engineering student _____ learn how to read technical drawings.
4. This software _____ help you calculate the efficiency of a power plant.
5. Students _____ submit their laboratory reports by Friday.
6. We _____ arrange an online consultation if you cannot attend the lesson.
7. Before starting the experiment, you _____ check whether all the instruments are working properly.
8. Engineers _____ always consider safety when designing industrial equipment.
9. A good manager _____ communicate effectively with both engineers and economists.
10. During the first year, students _____ improve both their technical English and presentation skills.
11. The data _____ also be presented in the form of graphs and charts.
12. You _____ ignore the teacher's instructions during laboratory work.
13. Renewable energy sources _____ become even more important in the future.
14. After completing this course, students _____ explain the basic operation of a thermal power plant in English.

43. Complete the sentences with *mustn't* or *don't have to / needn't*.

1. You _____ touch electrical equipment with wet hands.

2. First-year students _____bring their own calculators because the university provides them during the examination.
3. Visitors _____enter the laboratory without permission.
4. You _____learn all the technical terms by heart before the first lesson. They will be practised during the course.
5. Students _____eat or drink in the laboratory.
6. You _____finish the whole project today. The deadline is next week.
7. Engineers _____ignore safety regulations when working with high-pressure equipment.
8. Laboratory instruments _____be removed from the laboratory without permission.
9. The workers _____ come to work on Saturday; it's a day off.
10. The factory _____ produce more units this month; demand is low.
11. Visitors _____ enter the workshop without a guide.
12. We _____ order new raw materials this week; we still have enough in stock.

44. Translate the sentences into Russian. Pay attention to the different forms of the infinitive after modal verbs.

1. The students must have completed the laboratory work before the lecture began.
2. You needn't have printed the report because the teacher accepted electronic copies.
3. The engineer ought to have checked the calculations more carefully.
4. The manager may have received the financial report yesterday.
5. The new software might have reduced the time needed for data analysis.
6. You should have been more careful when measuring the temperature.
7. The engineer might have overlooked a small error in the calculations.
8. The necessary information may have been included in the previous report.
9. The students must have been preparing for the examination for several weeks.
10. The laboratory equipment could have been damaged if the safety rules had not been followed.

Таблица П17. Степени сравнения прилагательных и наречий

Положительная степень	Сравнительная степень	Превосходная степень	Перевод слова “most”
1. Односложные прилагательные / наречия, двухсложные прилагательные / наречия, заканчивающиеся на гласный звук			1) This is the most interesting book I have ever read. – Это самая интересная книга, которую я когда-либо читал. (<i>Превосходная степень после артикля “the” и перед прилагательным</i>) 2) It’s a most interesting book. – Это весьма / очень интересная книга. (<i>Высокая степень выраженности признака без артикля “the” перед прилагательным</i>) 3) Most people like reading. – Большинство людей любят читать. (<i>«Большинство/большая часть» перед существительным</i>)
big – большой clever – умный	bigger – больше cleverer – умнее	the biggest – самый большой / наибольший the cleverest – самый умный	
2. Многосложные прилагательные			
important – важный	more important – более важный less important – менее важный	the most important – самый важный the least important – наименее важный	
3. Исключения			
good – хороший well – хорошо bad – плохой far – далеко/далекий much/many – много little – мало/маленький	better – лучший better – лучше worse – хуже further – дальнейший more – больше less – меньше	the best – самый лучший the best – лучше всего the worst – наихудший – the most – больше всего the least – меньше всего	
4. Сравнительные конструкции			
As ... as ... – такой же... как: <i>Line A is as reliable as Line B.</i> Not so... as... – не такой... как: <i>Line A is not as reliable as Line B.</i> The... -er the... -er – чем..., тем...: <i>The more reliable the line is, the better.</i> As... as possible – настолько : <i>The line should be as reliable as possible.</i>			

45. Complete the sentences with the correct positive, comparative or superlative form of the words in brackets.

1. The new pump is _____ (**reliable**) than the old one.
2. Line C has the _____ (**low**) defect rate.
3. This insulation is _____ (**expensive**) than mineral wool.
4. The digital meter gives _____ (**accurate**) readings than the mechanical one.
5. Option B is not as _____ (**flexible**) as Option A.
6. The latest procedure is the _____ (**good**) of the three.
7. A serious leak is _____ (**bad**) than a minor pressure fluctuation.
8. This method uses _____ (**little**) energy than the previous method.
9. The northern workshop is _____ (**far**) from the boiler house than the laboratory.
10. The automated line works _____ (**fast**) than the manual line.

46. Use the data to write six comparisons. Include one superlative and one not as ... as sentence.

Production line	Output	Defect rate	Energy consumption	Upgrade cost
Line A	120 units/day	5 %	900 kWh/day	RUB 80,000
Line B	150 units/day	3 %	850 kWh/day	RUB 95,000
Line C	140 units/day	2 %	780 kWh/day	RUB 110,000

47. Complete the sentences with the correct form of the word in brackets. Use the positive, comparative or superlative degree.

1. The new boiler is _____ (**efficient**) than the old one.
2. This is _____ (**reliable**) machine in the factory.
3. The steam flows _____ (**fast**) through the new pipes.
4. The old equipment was _____ (**expensive**) to maintain.
5. This is _____ (**good**) way to insulate the pipes.
6. The new workers are _____ (**skilled**) than the previous team.
7. The temperature in the boiler is _____ (**high**) than in the condenser.
8. This is _____ (**difficult**) project we have ever undertaken.
9. The turbine operates _____ (**smoothly**) with the new bearings.
10. The factory produces _____ (**much**) output than it did last year.

48. Complete the sentences with the correct comparative form of the words in brackets. Use the “the ... the ...” construction. Translate the completed sentences into Russian.

1. _____ (**efficient**) the machine, _____ (**low**) the energy consumption.
2. _____ (**good**) the insulation, _____ (**low**) the heat loss.
3. _____ (**many**) units we produce, _____ (**low**) the cost per unit.
4. _____ (**skilled**) the workers, _____ (**few**) defects they make.
5. _____ (**hot**) the steam, _____ (**much**) energy it carries.
6. _____ (**modern**) the equipment, _____ (**high**) the productivity.
7. _____ (**fast**) the turbine rotates, _____ (**much**) electricity it generates.
8. _____ (**careful**) the operator, _____ (**safe**) the production process.

9. _____ **(high)** the quality, _____ **(satisfied)** the customers are.
10. _____ **(well)** the machines are maintained, _____ **(long)** they last.
11. _____ **(much)** energy we save, _____ **(good)** it is for the environment.
12. _____ **(high)** the demand, _____ **(high)** the price.

49. Translate the sentences into Russian, paying attention to the different meanings of *most*.

1. This is the most efficient boiler on the market.
2. Most students attend lectures regularly.
3. It was a most interesting lecture on energy efficiency.
4. The most important factor is the cost of production.
5. Most engineers agree that safety is a priority.
6. She presented a most convincing argument.
7. The most difficult part of the project was data analysis.
8. It is a most useful tool for researchers.
9. The most common problem is overheating.
10. Most experiments require careful planning.
11. He gave a most detailed explanation of the process.
12. Most large factories in the region are located in industrial zones.

Таблица П18. Времена английского глагола в страдательном залоге

Форма	Структура	Употребление	Пример	Перевод
Present Simple Passive	am / is / are + V3	регулярный процесс или описание	<i>The readings are recorded every hour.</i>	<i>Показания записываются каждый час.</i>
Past Simple Passive	was / were + V3	завершённый процесс в прошлом	<i>The pump was replaced last week.</i>	<i>Насос был заменён на прошлой неделе.</i>
Future Simple Passive	will be + V3	будущий процесс или результат	<i>The line will be upgraded next year.</i>	<i>Линия будет модернизирована в следующем году.</i>
Present Continuous Passive	am / is / are being + V3	процесс, происходящий сейчас	<i>The system is being tested.</i>	<i>Система испытывается в данный момент.</i>
Past Continuous Passive	was / were being + V3	процесс в определённый момент прошлого	<i>The boiler was being inspected at noon.</i>	<i>Котёл осматривали в полдень.</i>
Present Perfect Passive	have / has been + V3	завершённый результат, связанный с настоящим	<i>The procedure has been revised.</i>	<i>Процедура была пересмотрена (только что).</i>
Past Perfect Passive	had been + V3	действие, завершённое до другого действия в прошлом	<i>The turbine had been installed before the winter began.</i>	<i>Турбина была установлена до того, как началась зима.</i>
Future Perfect Passive	will have been + V3	действие, которое будет завершено к определённому моменту в будущем	<i>The project will have been completed by December.</i>	<i>Проект будет завершён к декабрю.</i>

НЕ ПУТАЙТЕ 5. BEEN, BEING И BY + AGENT В PASSIVE VOICE

В Perfect Passive используется been: has been installed.
В Continuous Passive используется being: is being tested.

Таблица П19. Страдательный залог с модальными глаголами

Структура	Значение	Пример	Перевод
must be / must not be + V3	обязанность запрет	<i>Every batch must be inspected. The boiler must not be operated without training.</i>	<i>Каждая партия должна быть проверена. / Каждую партию необходимо проверить.</i>
can / could be + V3	возможность способность	<i>Routine measurements can be recorded automatically.</i>	<i>Обычные измерения могут записываться автоматически.</i>
may / might be + V3	возможность	<i>The result may be checked again.</i>	<i>Результат может быть проверен ещё раз. / Результат можно проверить ещё раз.</i>
should be + V3	рекомендация	<i>The cause should be investigated.</i>	<i>Причину следует расследовать.</i>
have / has to be + V3	внешнее требование	<i>The measurements have to be recorded.</i>	<i>Измерения должны быть записаны. / Измерения необходимо записывать.</i>
need to be + V3	практическая необходимость	<i>The instruments need to be calibrated.</i>	<i>Приборы необходимо откалибровать.</i>

Таблица П20. Особые случаи перевода страдательного залога

Глаголы без предлога в английском языке, переводящиеся с предлогом на русский		
affect	The quality of the final product is affected by the precision of the machinery.	На качество конечного продукта влияет точность оборудования.
influence	The selection of suppliers is influenced by delivery times and cost.	На выбор поставщиков влияют сроки поставки и стоимость.
follow	The assembly of components is followed by final inspection.	За сборкой компонентов следует финальная проверка.
<i>Другие глаголы: answer – отвечать на, approach – подходить к, attend – присутствовать на.</i>		
Глаголы с предлогом в английском языке, переводящиеся с предлогом на русский		
speak about	Flexibility in production is often spoken about in modern industry.	О гибкости в производстве часто говорят в современной промышленности.
insist on	Regular maintenance of equipment is insisted on .	На регулярном обслуживании оборудования настаивают .
refer to	Industry standards are referred to during audits.	На отраслевые стандарты часто ссылаются во время аудитов.
<i>Другие глаголы: rely upon – полагаться на, act upon – действовать на, deal with – иметь дело с, учитывать.</i>		

50. Choose the correct Active or Passive Voice form.

1. Digital meters **record / are recorded** production data automatically.
2. Production data **record / are recorded** every hour.
3. The inspection *team* **identified / was identified** several defective units yesterday.
4. Several defective units **identified / were identified** during the final check.
5. Technical staff **maintain / are maintained** the machines regularly.
6. The machines **maintain / are maintained** according to a fixed schedule.
7. The manager **compared / was compared** the monthly results.
8. The monthly results **compared / were compared** with the target.

51. Rewrite the sentences in the Passive Voice. Omit the agent when it is not important.

1. Operators record the inlet pressure every shift.
2. The company installed new digital meters last year.
3. The quality team checks all final reports.
4. Technicians repaired the conveyor after the breakdown.
5. Economists calculate labour productivity every month.
6. The laboratory tested the material in March.
7. The operations department stores the production data.
8. Workers removed three defective parts yesterday.

52. Open the brackets, using Active or Passive Voice and the tense in brackets.

1. The new equipment _____ (test) before it is put into operation. – The engineers _____ (test) the new equipment before it is put into operation. (*Future Simple*)
2. The old machines _____ (replace) last year. – The company _____ (replace) the old machines last year. (*Past Simple*)
3. The quality of the products _____ (check) by the control team. – The control team _____ (check) the quality of the products. (*Present Simple*)
4. The project _____ (complete) next year. – The team _____ (complete) the project next year. (*Future Simple*)
5. The materials _____ (order) from the supplier every quarter. – The department _____ (order) the materials every quarter. (*Present Simple*)
6. The raw materials _____ (deliver) to the factory every morning. – The suppliers _____ (deliver) the raw materials every morning. (*Present Simple*)
7. The new system _____ (introduce) next month. – The management _____ (introduce) the new system next month. (*Future Simple*)
8. The instructions _____ (give) to all employees yesterday. – The manager _____ (give) the instructions to all employees yesterday. (*Past Simple*)
9. The new production line _____ (install) last month. – The engineers _____ (install) the new production line last month. (*Past Simple*)

53. Choose the correct Passive Voice form.

1. The old pressure sensor **was replaced / has been replaced** two weeks ago.
2. The main pipeline **is being inspected / has been inspected at** the moment.

3. The final test results **will be published** / **have been published** tomorrow.
4. All the required measurements **have already been recorded** / **are already being recorded**, so the report can now be prepared.
5. At 11 a.m. yesterday, the new control system **was being tested** / **has been tested**.
6. The maintenance schedule **has not been approved** / **is not being approved** yet, so the work cannot start.
7. New temperature sensors **will be installed** / **were being installed** during next month's maintenance shutdown.
8. The ventilation system **is being repaired** / **has been repaired** now, so the laboratory is temporarily closed.

54. Complete the modernisation report with the correct Passive Voice forms.

A packaging factory is modernising its production system. A flexible manufacturing cell 1) _____ (install) last month, and four employees 2) _____ already _____ (train) to operate it. At the moment, a trial batch 3) _____ (produce). The sensors 4) _____ (test) while the process is monitored. The results 5) _____ not _____ (analyse) yet. If the trial is successful, the old line 6) _____ (replace) next year. During the installation, production 7) _____ (transfer) to another workshop, and at 2 p.m. the temporary line 8) _____ (adjust).

55. Transform the sentences, using the Passive Voice. Omit the agent, where possible. Translate the sentences in the Passive Voice into Russian.

Example: *The level of automation **influences** the cost. – The cost **is influenced** by the level of automation.*

1. Industry analysts often speak about the rise of automation.
2. The logistics department deals with shipping delays.
3. The reliability of suppliers affects the entire supply chain.
4. The annual budget accounts for equipment upgrades.
5. The engineering team insists on precise measurements.
6. The final report accounts for all production losses.
7. The experience of the workforce influences the quality of output.
8. The quality inspection follows the completion of each batch.
9. The production team can rely on accurate data from sensors.
10. The project manager often refers to the production guidelines.

56. Rewrite the sentences in the Modal Passive. Omit the agent when it is not important.

1. Safety staff must inspect every emergency exit.
2. The control system can store the readings automatically.
3. Engineers should review the alarm settings.
4. The laboratory has to keep all calibration certificates.
5. Technicians may replace a damaged pressure gauge.
6. The contractor must not disconnect the protective earth.
7. The maintenance department needs to test the backup pump.
8. The chief engineer might approve the revised shutdown plan.

Таблица П21. Формы и функции Participle I

Форма	Функция	Значение	Принцип перевода	Пример и перевод
Participle I Active V-ing	Определение: - одиночное определение перед существительным; - причастный оборот после существительного	Существительное само совершает действие; действие одновременно с действием сказуемого.	Действительное причастие (на -щий/ -вший); придаточное определятельное предложение).	<i>The increasing temperature affects the efficiency.</i> – <i>Повышающаяся температура влияет на эффективность.</i> <i>The engineer designing the system is very experienced.</i> – <i>Инженер, проектирующий систему, очень опытный.</i> / <i>Инженер, который проектирует систему, очень опытный.</i>
	Обстоятельство	Подлежащее само совершает действие; действие одновременно с действием сказуемого.	Деепричастие несовершенного вида (на -я / -а); придаточное обстоятельственное.	<i>(When / While) Working on the project, the team faced many challenges.</i> – <i>Работая над проектом, команда столкнулась со многими трудностями.</i> / <i>Когда команда работала над проектом, она столкнулась со многими трудностями.</i>
	Часть сказуемого	Образует времена группы Continuous.	Отдельно не переводится.	<i>The team is developing a new model.</i> – <i>Команда разрабатывает новую модель.</i>

Форма	Функция	Значение	Принцип перевода	Пример и перевод
Participle I Passive being + V3	Определение	Существительное испытывает действие; действие одновременно с действием сказуемого.	Страдательное причастие настоящего времени (на -мый, -щийся); придаточное определительное.	<i>The equipment being tested is state-of-the-art. – Оборудование, испытываемое в данный момент, является современным. / Оборудование, которое испытывается в данный момент, является современным.</i>
	Обстоятельство	Подлежащее испытывает действие; действие одновременно с действием сказуемого.	Будучи + причастие; придаточное обстоятельственное	<i>Being cooled, the metal contracted. – Будучи охлаждённым, металл сжался. / Когда металл охлаждали, он сжимался.</i>
Perfect Participle Active having + V3	Обстоятельство	Подлежащее само совершает действие; действие завершилось до действия сказуемого.	Деепричастие совершенного вида (на -в / -я); придаточное обстоятельственное: После того, как...	<i>Having analysed the data, the researcher wrote the report. – Проанализировав данные, исследователь написал отчёт. / После того как исследователь проанализировал данные, он написал отчёт.</i>
Perfect Participle Passive having been + V3	Обстоятельство	Подлежащее испытывает действие; действие завершилось до действия сказуемого.	Будучи + причастие; придаточное обстоятельственное: После того как...	<i>Having been tested, the new turbine was installed. – После того как новая турбина была испытана, её установили. / Будучи испытанной, новая турбина была установлена.</i>

Таблица П22. Функции Participle II

Форма	Функция	Значение	Рекомендации по переводу	Пример и перевод
Participle II (Past Participle) V3 (V-ed)	Определение: - одиночное определение перед существительным; - одиночное определение после существительного; - причастный оборот после существительного	Существительное испытывает действие; действие завершено.	Страдательное причастие прошедшего времени (на -нный / -тый); придаточное определительное.	<i>The adjusted valve works perfectly. – Отрегулированный клапан работает отлично. / Клапан, который был отрегулирован, работает отлично.</i> <i>The data collected are reliable. – Собранные данные – надежные. / Данные, которые были собраны, – надежные.</i> <i>The results obtained from the experiment were promising. – Результаты, полученные в ходе эксперимента, были обнадеживающими.</i>
	Обстоятельство	Существительное испытывает действие; действие завершено.	Будучи + причастие; придаточное обстоятельственное: Когда / Так как...	<i>(When) Heated, the water turns into steam. – Будучи нагретой, вода превращается в пар. / Когда воду нагревают, она превращается в пар.</i>
	Часть сказуемого	Образует времена группы Perfect и страдательный залог.	Отдельно не переводится.	<i>The technician has repaired the boiler. – Техник отремонтировал котёл.</i> <i>The boiler was repaired last week. – Котёл был отремонтирован на прошлой неделе.</i>
	Именная часть сказуемого	Стоит после глагола-связки (<i>to be, to seem, to remain</i>) и описывает подлежащее.	Страдательное причастие на -нный / -тый .	<i>The valve is / remains closed. – Клапан остаётся закрытым.</i>

57. Identify the functions of Participle I.

1. The coolant is flowing through the test loop.
2. The coolant flowing through the test loop removes heat.
3. Flowing through the test loop, the coolant absorbs energy.
4. Technicians are adjusting the airflow in the test chamber.
5. Engineers testing the exchanger are recording outlet temperatures.
6. A pump supplying hot water maintains circulation in the loop.

58. Replace the active relative clause with a Participle I phrase.

1. Technicians *who monitor the furnace* record the surface temperature.
2. The water *that leaves the condenser* enters the storage tank.
3. A blower *that supplies combustion air* increases the flame intensity.
4. The gas *that passes across the tube bank* loses thermal energy.
5. Engineers *who evaluate insulation* compare heat-loss data.
6. The coolant *that returns from the process* has a lower temperature.
7. Workers *who fit reflective screens* wear protective clothing.
8. The steam *that flows towards the header* passes through a control valve.

59. Identify the function of Participle II in each sentence.

1. The installed sensors send data to the control unit.
2. The sensors installed near the outlet measure temperature.
3. The outlet valve is closed.
4. The outlet valve is closed by the operator at the end of each shift.
5. The heated water enters the storage tank.
6. The water is heated in the boiler.
7. The results obtained during the trial were satisfactory.
8. The revised procedure is available in the laboratory.

60. Replace the passive relative clause with a Participle II phrase.

1. The samples *that were collected during the night shift* were analysed in the morning.
2. The equipment *that was installed last month* is operating reliably.
3. The heat *that is recovered from the exhaust gases* is used in the process.
4. The measurements *that were recorded by the digital system* were compared with the target.
5. The steam *that is produced in the boiler* enters the main line.
6. The insulation *that was damaged during maintenance* must be replaced.
7. The report *that was approved by the manager* was sent to the customer.
8. The valves *that are fitted to the vessel* prevent excessive pressure.

61. Translate the sentences into Russian, paying attention to the form and function of the participles.

1. Heated by the sun, the metal roof became too hot to touch.
2. Having absorbed the heat, the fluid expanded significantly.
3. Circulating through the system, the coolant removed excess heat.
4. Being polished, the surface reflected most of the radiation.

5. Having been cooled, the liquid returned to its original volume.
6. Having been heated, the metal bar glowed red.
7. Designed for high temperatures, the material performed well.
8. Moving through the pipe, the steam transferred energy to the turbine.
9. Being forced by the pump, the water circulated through the system.
10. Having given off its energy, the steam condensed back into water.
11. Insulated with mineral wool, the pipes lost very little heat.
12. Using a fan, the engineer speeded up the convection current.

62. Rewrite each sentence by replacing the underlined adverbial clause with a participle phrase.

Example: While the coolant circulated through the engine, it absorbed excess heat.
 (Participle I) – Circulating through the engine, **the coolant** absorbed excess heat.

1. *When the metal bar was cooled*, it contracted slightly. (Participle II)
2. *Because the system was designed properly*, it operated without any issues. (Participle II)
3. *While the heated water rose to the top*, it created a convection current. (Participle I Active)
4. *Because the hot gases passed through the heat exchanger*, they warmed the incoming air. (Participle I Active)
5. *While the liquid was being stirred*, it cooled down more quickly. (Participle I Passive)
6. *While the materials were being tested*, they showed different levels of conductivity. (Participle I Passive)
7. *After the fluid had reached the target temperature*, it stopped heating. (Perfect Participle Active)
8. *When the steam had passed through the turbine*, it entered the condenser. (Perfect Participle Active)
9. *When the pipes had been cleaned*, they allowed better flow of the liquid. (Perfect Participle Passive)
10. *After the equipment had been checked*, it was ready for operation. (Perfect Participle Passive)

Таблица П23. Независимый причастный оборот

Позиция в предложении	Структура	Пример и перевод
В начале предложения (причина, условие, время)	Сущ. + Participle	<i>The pressure rising, the operator opened the valve. – <u>Так как давление повышалось</u>, оператор открыл клапан.</i> <i>The new equipment having been installed, the plant resumed operation. – <u>После того как новое оборудование было установлено</u>, завод возобновил работу</i>
	With + сущ. + Participle	<i>With The tests completed, the team submitted the report. – <u>После того как испытания были завершены</u>, команда сдала отчёт.</i> <i>With the engineer having finished the calculations, the project moved forward. – <u>После того как инженер закончил расчёты</u>, проект продвинулся вперёд.</i>
В конце предложения (сопутствующее обстоятельство)	Сущ. + Participle;	<i>The system worked, <u>all sensors monitoring the pressure</u>. – Система работала, <u>при этом все датчики контролировали</u> давление.</i> <i>The engineer left the workshop, (with) his colleagues having completed the repairs. – Инженер покинул цех, <u>и его коллеги завершили ремонт</u>.</i>
	With + сущ. + Participle	<i>The experiment was concluded, <u>with all the necessary measurements taken</u>. – Эксперимент был завершён, <u>причём необходимые измерения были выполнены</u>.</i> <i>The technicians finished the maintenance work, <u>with all the worn-out parts having been replaced</u>. – Техники завершили техническое обслуживание, <u>при этом все изношенные детали были заменены</u>.</i>

63. Identify the Absolute Participial Construction. Expand it into a full clause and translate the sentence.

1. The pressure rising, the safety valve opened automatically.
2. The water being heated, steam was produced continuously.
3. The inspection having been completed, the unit was restarted.
4. The deposits removed, heat transfer became more efficient.
5. The pump operating continuously, the coolant circulated through the system.
6. All measurements having been taken, the engineers prepared the report.
7. The valve being closed, the pressure gradually dropped.
8. The steam having been superheated, the operator directed it into the turbine.

64. Rewrite each sentence using with + noun + Participle I / II.

1. While the pump was operating, the coolant circulated continuously.
2. Because the outlet valve was closed, the pressure remained stable.
3. While the workers were monitoring the instruments, the trial continued.
4. Because the pipes were insulated, heat loss was lower.
5. While the turbine was running at full load, the engineers measured vibration.
6. Because the emergency system was activated, the unit stopped safely.

65. Analyse the dense technical sentences.

1. The measurements recorded during the trial having been verified, the revised control settings were approved by the engineering team.
2. With the cooling-water pump operating normally, the outlet temperature was being monitored by two independent sensors.
3. The insulation damaged during maintenance being replaced, the boiler was returned to service.
4. The production target having been reached, the line was stopped for a scheduled inspection.

Учебное издание

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Кириллова Виктория Витальевна
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**Иностранный язык. Английский язык
Economics and Management
for Energy Enterprises**

Учебное пособие для I курса

Редактор и корректор А. А. Чернышева
Техн. редактор М. Д. Баранова

Учебное электронное издание сетевого распространения

Системные требования:
электронное устройство с программным обеспечением
для воспроизведения файлов формата PDF

Режим доступа: http://publish.sutd.ru/tp_get_file.php?id=202016, по паролю.
— Загл. с экрана.

Дата подписания к использованию 06.10.2026 г. Рег. № 5393/26

Высшая школа технологии и энергетики СПбГУПТД
198095, СПб., ул. Ивана Черных, 4.