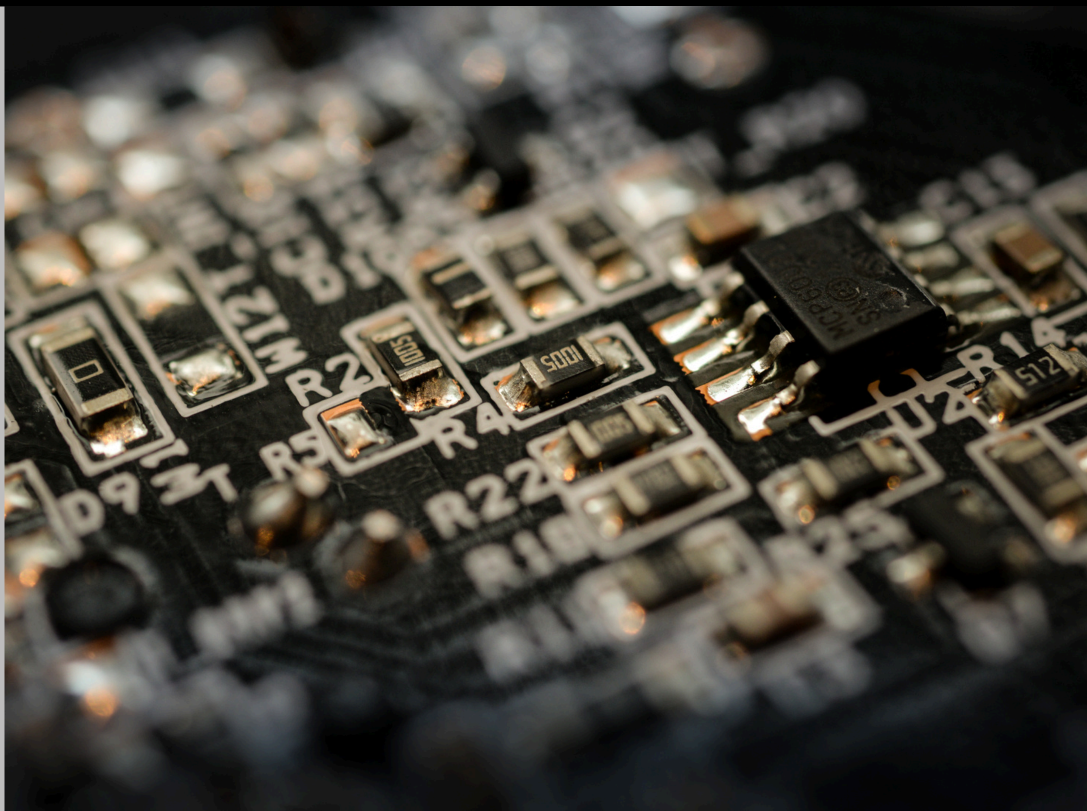
ENGLISH VOCABULARY AND GRAMMAR

FOR ELECTRICAL ENGINEERING



- Technical vocabulary
- Grammar for academic purposes
- Reading comprehension articles
- Grammar exercises

dr. Eva Boh

KOLOFON

English Vocabulary and Grammar for Electrical Engineering

Avtor: dr. Eva Boh

Format: PDF

Naslov URL:
https://alfabet.si/english-vocabulary-and-grammar-for-electrical-engineering.pdf

Kraj in leto izdaje: Celje, 2025

Izdal: Alfabet, d.o.o, Celje

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID 233956099
ISBN 978-961-07-2681-4 (PDF)

CONTENTS PAGE

Unit	Vocabulary	Grammar
Unit 1	Introduction to electricity	Present tenses
Unit 2	Energy, force, work and power	Past tenses Present and past tenses
Unit 3	Power generation	Future tenses Other expressions for future Time clauses for future
Unit 4	Energy Storage	Present Perfect Past Perfect
Answer key		

UNIT 1

INTRODUCTION TO ELECTRICITY

Electricity is a versatile form of energy resulting from the movement of charged particles, mainly electrons. It is essential to modern life, powering everything from household appliances to industrial machinery. Electricity can be generated through various methods, including chemical reactions in batteries, solar panels converting sunlight, and generators driven by wind, water, or steam.

The flow of electric charge is known as an electric current, measured in amperes (A). Voltage, measured in volts (V), is the potential difference that drives the current through a conductor. Conductors like copper and aluminum facilitate the flow of electricity, while insulators such as rubber and plastic prevent it, ensuring safety.

Electricity is indispensable in our daily lives, providing energy for lighting, heating, cooling, and powering electronic devices. Understanding the basics of electricity, including its generation, transmission, and safe usage, is crucial for harnessing its benefits and minimizing risks.

1.1 Transalte key terms related to electricity.

Current: ______________________________

Resistance: ___________________________

Ohm's Law: ___________________________

Conductors: ___________________________

Insulators: ____________________________

Circuit: _______________________________

Control Group: _________________________

Electrons: _____________________________

Power: ____________________________________

Electrons: _________________________________

Watt : _____________________________________

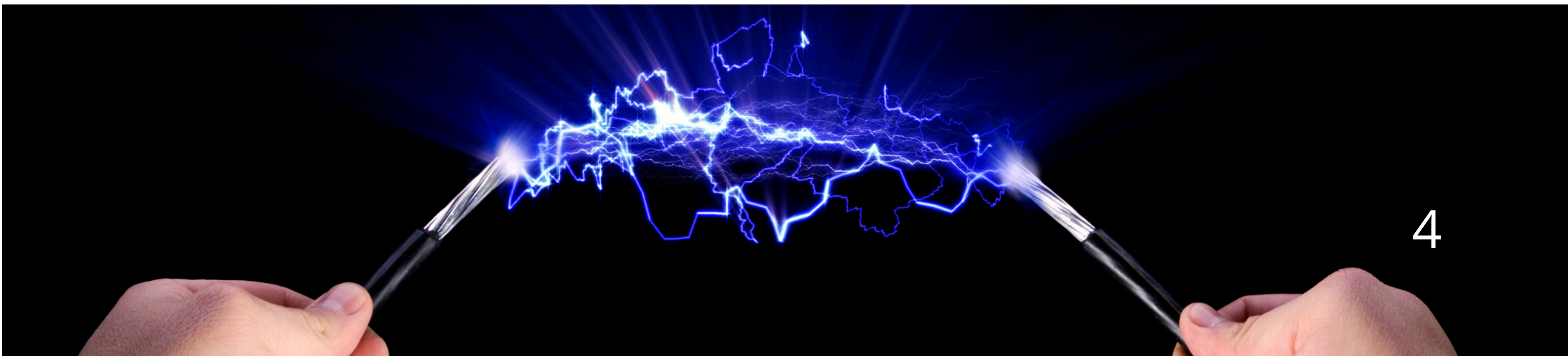
Amperes: __________________________________

Ohms: _____________________________________

Series Circuit: _____________________________

Parallel Circuit: ____________________________

Electromotive Force : _______________________



1.2 Match the words with their correct definitions.

Words	Definitions
1.Voltage (V) 2.Current (I) 3.Resistance (R) 4.Ohm's Law 5.Conductors 6.Insulators 7.Circuit 8.Electrons 9.Power (P) 10. Watt (W) 11. Amperes (A) 12. Ohms (Ω) 13. Series Circuit 14. Parallel Circuit 15. Electromotive Force (EMF)	A. A closed path through which electricity flows. B. The unit of electrical power. C. The opposition to the flow of electric current. D. The basic unit of electric charge, carried by subatomic particles. E. The force that pushes electric charge through a circuit. F. The unit used to measure resistance. G. The unit used to measure electric current. H. The unit used to measure electrical voltage. I. A circuit where components are connected one after another, so the same current flows through all. J. A circuit where components are connected across the same voltage source, allowing multiple paths for current. K. Materials that allow electric current to flow easily. L. Materials that do not allow electric current to flow easily. M. The relationship between voltage, current, and resistance, expressed as V = I × R. N. The total amount of energy transferred per unit of time in an electrical circuit. O. Another term for voltage, describing the energy per charge that moves through a circuit.

1.3 Fill in the blanks with the correct words from the list below.

Word Bank:

Amperes (A), Parallel Circuit, Voltage (V), Electromotive Force (EMF), Ohm's Law, Series Circuit, Power (P), Ohms (Ω), Electrons, Circuit, Resistance (R), Insulators, Conductors, Current (I), Watt (W)

Electricity is a form of energy that flows through a closed path called a (1) ________. The movement of (2) ________ through this path creates an electric (3) ________, measured in (4) ________. The force that pushes the current through the circuit is called (5) ________, and it's measured in volts ((6) ________).

Materials that allow electricity to flow easily are called (7) ________, while those that block the flow are known as (8) ________. The opposition that slows down the current is called (9) ________, and it's measured in (10) ________.

(11) ________ helps us understand the relationship between voltage, current, and resistance: V = I × R. The rate at which electrical energy is used or transferred is known as (12) ________, measured in (13) ________.

In a (14) ________, all components are connected one after the other, while in a (15) ________, they are connected alongside each other, offering multiple paths for current to flow.

Present Simple

The Present Simple is used to talk about:

·**Habits and routines: things that happen regularly.**

o Example: Engineers test circuits regularly.

o Example: We calibrate the equipment every morning.

·**General truths and facts: things that are always true or scientifically correct.**

o Example: Electricity flows through conductors.

o Example: Copper conducts electricity better than aluminum.

·**Schedules and timetables: often used for public transport, school, or events.**

o Example: The class starts at 8 a.m.

o Example: The power grid shuts down for maintenance every Sunday.

·**Instructions and directions: when giving steps or commands.**

- o Example: Connect the red wire to the positive terminal.

o Example: Turn off the main switch before you start working.

Present Continuous

·The Present Continuous is used to talk about:

Actions happening right now: for something that is happening at this moment.

o Example: The technician is testing the circuit.

o Example: Engineers are calibrating the equipment.

·Actions happening around now: temporary actions.

o Example: We are using a backup generator while the main power supply is being repaired.

o Example: The team is working on a new project this week.

·**Changing or developing situations: to describe something that is gradually changing.**

o Example: The voltage is increasing due to the added load.

o Example: The resistance is decreasing as the temperature rises.

·**Planned future actions (less common in scientific English)**

o Example: The company is launching a new product next month.

o Example: The professor is giving a lecture tomorrow.

GRAMMAR EXERCISES

1.4 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Simple or Present Continuous.

Luka is an electrotechnician. He usually (1) ________ (repair) electrical systems in industrial buildings. Right now, he (2) ________ (work) on a faulty circuit. He (3) ________ (wear) safety gloves and (4) ________ (check) each wire carefully.

He always (5) ________ (test) the voltage before he (6) ________ (replace) any part. Today, his colleague (7) ________ (help) him while they (8) ________ (inspect) the fuse box. Luka (9) ________ (know) that safety comes first.
They (10) ________ (follow) the wiring diagram, and the system (11) ________ (show) signs of damage. Luka (12) ________ (analyze) the problem and (13) ________ (look) for a solution. He usually (14) ________ (solve) problems quickly and (15) ________ (explain) everything to the client.

1.5 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Simple or Present Continuous.

Mark (1) ________ (study) to become an electrotechnician. Every day, he (2) ________ (attend) practical lessons at the workshop. Today, he (3) ________ (install) a new electrical panel. He (4) ________ (follow) safety procedures while his classmates (5) ________ (observe) his work.

The teacher always (6) ________ (check) their tools and (7) ________ (explain) the process step by step. Mark (8) ________ (enjoy) the hands-on experience. He (9) ________ (understand) how the system works and (10) ________ (apply) his knowledge in real situations.
Right now, he (11) ________ (connect) the wires, and the multimeter (12) ________ (show) the correct voltage. He (13) ________ (finish) the task soon. He always (14) ________ (take) his work seriously and (15) ________ (learn) from his mistakes.

1.6 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Simple or Present Continuous.

Tom is an experienced electrotechnician. He usually (1) ________ (work) on large electrical systems. Right now, he (2) ________ (repair) a power generator that (3) ________ (malfunction). He (4) ________ (know) exactly how to fix the issue, but he (5) ________ (examine) it carefully to make sure there is no further damage.
Tom (6) ________ (measure) the resistance of the wires. His assistant (7) ________ (take) notes on the readings. They always (8) ________ (test) the equipment before they finish the job.
Tom's team (9) ________ (install) a new transformer this week, and they (10) ________ (ensure) all connections are secure. He (11) ________ (work) closely with his colleagues to complete the project on time.
Today, Tom (12) ________ (supervise) the installation of a new circuit. It (13) ________ (require) a detailed inspection before activation. The system (14) ________ (function) properly once everything is in place. Tom always (15) ________ (take) pride in his work.

UNIT 2

ENERGY, FORCE, WORK AND POWER

Energy, force, and work are fundamental concepts in physics that describe how objects interact and change.
Energy is the capacity to do work or produce change. It exists in various forms, such as kinetic energy (energy of motion), potential energy (stored energy), thermal energy, and electrical energy. Energy can be transferred from one form to another but cannot be created or destroyed, according to the law of conservation of energy.
Force is a push or pull exerted on an object, causing it to move, stop, or change direction. It is measured in newtons (N) and can result from interactions like gravity, friction, or electromagnetic forces. Newton's laws of motion describe how forces affect the motion of objects. For example, the first law states that an object will remain at rest or in uniform motion unless acted upon by an external force.
Work is done when a force moves an object over a distance. It is calculated by multiplying the force by the distance over which it acts (Work = Force × Distance) and is measured in joules (J). Work transfers energy from one object to another or transforms it from one form to another. For instance, lifting a weight involves doing work against gravity, converting chemical energy in muscles to kinetic and potential energy.
Power is the rate at which work is done or energy is transferred, measured in watts (W). Understanding these concepts is crucial in fields like engineering, where they are applied to design systems that efficiently use energy, control forces, and perform work. They are also essential in everyday life, from powering homes to driving vehicles and operating machinery.

2.1 Match the following definitions with the correct technical word from the list.

Words	Definitions
1. Energy 2. Force 3. Work 4. Power 5. Kinetic Energy 6. Potential Energy 7. Newton 8. Joule 9. Watt 10. Mechanical Energy 11. Thermal Energy 12. Electrical Energy 13. Gravitational Force 14. Friction 15. Conservation of Energy	A. The unit of power, equal to one joule per second. B. Energy due to motion, calculated as 12mv221mv2. C. Principle stating energy cannot be created or destroyed. D. Unit of force, symbolized as N. E. Capacity to do work or produce change. F. Force opposing motion between surfaces. G. Internal energy due to the motion of atoms or molecules. H. Unit of work or energy, symbolized as J. I. Energy from electric charges moving through a conductor. J. Sum of kinetic and potential energy in an object. K. Force of attraction between two masses. L. Energy transfer when a force moves an object over a distance. M. Rate at which work is done or energy is transferred. N. Push or pull on an object, causing movement or change. O. Stored energy due to position or state.

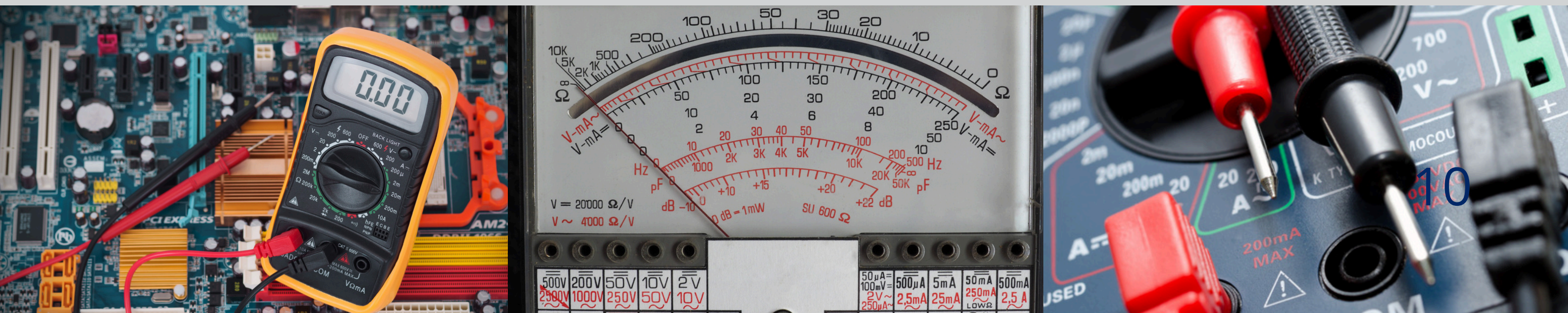
2.2 Translate the words.

English	Translation	English	Translation
Energy		Electricity	
Force		Mechanical Energy	
Work		Thermal Energy	
Power		Electrical Energy	
Kinetic Energy		Gravitational Force	
Potential Energy		Friction	
Transfer		Conservation of Energy	

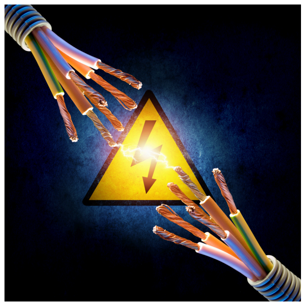
2.3 Fill in the gaps with the words from the word bank.

Word Bank:
alternating, capacitance, charge, current, difference, flow, force, opposition, power, rate, store, work.

Unit of Measurement	Symbol	What It Measures	Explanation
Volt	V	Electric potential or voltage	The ______________ in electric potential between two points.
Ampere	A	Electric ______________	The ______________ of electric charge per second.
Ohm	Ω	Electrical resistance	The ______________ to the flow of electric current.
Watt	W	______________	The ______________ at which energy is used or produced.
Joule	J	Energy or ______________	The amount of work done when a ______________ an object over a distance.
Coulomb	C	Electric charge	The quantity of electric ______________ .
Farad	F	______________	The ability of a system to ______________ electric charge.
Hertz	Hz	Frequency	The number of cycles per second in an ______________ current.

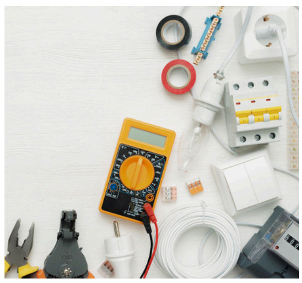


♟ 2.4 Choose the correct answer for each question.



1. What is the unit of energy?
   - A) Watt
   - B) Joule
   - C) Newton
   - D) Volt
2. Which of the following describes force?
   - A) The rate at which work is done
   - B) The capacity to do work
   - C) A push or pull exerted on an object
   - D) The flow of electric charge
3. What is the formula for work?
   - A) Work = Force × Distance
   - B) Work = Power × Time
   - C) Work = Energy × Time
   - D) Work = Voltage × Current

4. Which unit is used to measure power?
   - A) Joule
   - B) Newton
   - C) Watt
   - D) Ampere
5. What type of energy is associated with motion?
   - A) Potential Energy
   - B) Kinetic Energy
   - C) Thermal Energy
   - D) Electrical Energy
6. Which of the following is true about potential energy?
   - A) It is the energy of motion
   - B) It is stored energy due to position
   - C) It is the rate at which work is done
   - D) It is the flow of electric charge



7. What does the unit "Newton" measure?
   - A) Energy
   - B) Power
   - C) Force
   - D) Work
8. Which principle states that energy cannot be created or destroyed?
   - A) Conservation of Energy
   - B) Newton's First Law
   - C) Law of Motion
   - D) Principle of Work

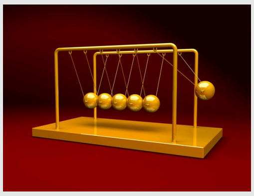
Modern advances in energy, work, force, and power

Modern advances in energy, work, force, and power are transforming various industries and paving the way for a more sustainable and efficient future. These advancements are driven by innovative technologies and scientific breakthroughs that address the growing demand for cleaner energy sources, improved efficiency, and enhanced performance.

Energy: One of the most significant areas of advancement is renewable energy. Solar power has seen remarkable progress with the development of high-efficiency photovoltaic cells and solar panels that can convert sunlight into electricity more effectively. Innovations like perovskite solar cells promise even higher efficiency and lower production costs. Wind energy is also advancing with the creation of larger and more efficient wind turbines that can generate more power from the same amount of wind. Additionally, energy storage technologies, such as lithium-sulfur batteries, are improving, allowing for better storage and utilization of renewable energy.

Work: In the realm of work, technology is revolutionizing how tasks are performed and managed. Automation and artificial intelligence (AI) are playing a crucial role in enhancing productivity and efficiency. AI-powered systems can analyze vast amounts of data to optimize workflows, predict maintenance needs, and improve decision-making processes. Robotics is another area where significant advancements are being made. Modern robots are capable of performing complex tasks with precision and consistency, reducing the need for human intervention in hazardous environments. These technologies are not only increasing productivity but also improving safety and reducing operational costs.

Force: Advances in force-related technologies are particularly evident in the military and aerospace sectors. The development of hypersonic systems, which can travel at speeds greater than Mach 5, is revolutionizing defense capabilities. These systems offer unprecedented speed and maneuverability, making them difficult to intercept. Additionally, the integration of AI and robotics in military operations is enhancing the effectiveness of force deployment. Autonomous drones and robotic systems can perform reconnaissance, surveillance, and combat tasks, reducing the risk to human soldiers. These technologies are reshaping the landscape of modern warfare and defense strategies.



Power: The field of power electronics is experiencing significant advancements, particularly with the adoption of wide-bandgap (WBG) semiconductors like gallium nitride (GaN) and silicon carbide (SiC). These materials offer superior efficiency and performance in power conversion applications, such as electric vehicle inverters and solar energy systems. AI integration in power electronics is also making strides, with intelligent power modules capable of predictive maintenance and real-time health monitoring. These advancements are leading to more reliable and efficient power systems, reducing downtime and improving overall performance.

Moreover, the development of ultra-WBG materials, such as diamond and gallium oxide, is expected to further enhance power conversion technologies7. These materials provide exceptional thermal conductivity and electrical properties, making them ideal for high-power applications. The combination of AI and advanced semiconductor materials is driving the next generation of power electronics, enabling smarter and more sustainable energy solutions.

In conclusion, modern advances in energy, work, force, and power are transforming industries and improving the quality of life. Renewable energy technologies are making significant strides, while automation and AI are revolutionizing the workplace. Force-related technologies are enhancing defense capabilities, and power electronics are becoming more efficient and reliable. These advancements are paving the way for a more sustainable and efficient future, addressing the growing demand for cleaner energy sources and improved performance across various sectors.

2.5 Answer the questions.

1. What are two significant advancements in renewable energy mentio
2. How is AI revolutionizing the realm of work?
3. What are hypersonic systems, and in which sectors are they particul
4. What materials are mentioned as wide-bandgap semiconductors in power electronics?
5. How are modern robots contributing to productivity and safety in the workplace?
6. What role do autonomous drones and robotic systems play in military operations?
7. What is the expected impact of ultra-wide-bandgap materials on power conversion technologies?
8. How are AI and advanced semiconductor materials driving the next generation of power electronics?

PAST TENSES

Past Simple

The past simple tense is used to describe actions or events that happened at a specific time in the past.

1. Completed Actions in the Past

Use the past simple to talk about actions that were completed at a specific time in the past.

Examples:

- The technician repaired the circuit yesterday.
- We installed the new software last week.

2. Series of Completed Actions

Use the past simple to describe a series of actions that happened one after the other in the past.

Examples:

- The engineer tested the system, adjusted the settings, and documented the results.
- They designed the prototype, built the model, and presented it to the team.

3. Specific time in the past

Use the past simple to talk about actions that happened at a specific period of time in the past.

Examples:

- The power outage occurred at 3 PM.
- The seminar started at 10 AM last Monday.

4. Habits in the Past

Use the past simple to describe habits or repeated actions in the past.

Examples:

- Engineers often worked late to meet project deadlines.
- We frequently calibrated the equipment before starting the experiments.

5. Past Facts or Generalizations

Use the past simple to state facts or generalizations about the past.

Examples:

- Engineers used analog tools in the 1980s.
- Electrical systems relied on DC generators before modern batteries.

Present Continuous

The past continuous tense is used to describe actions or events that were ongoing at a specific time in the past.

1. Actions in Progress at a Specific Time

Use the past continuous to describe actions that were in progress at a specific moment in the past.

Examples:

- The technician was repairing the circuit when the power went out.
- We were installing the new software while the system was still running.

2. Interrupted Actions

Use the past continuous to describe an action that was interrupted by another action in the past.

Examples:

- The team was calibrating the equipment when the supervisor arrived.
- I was analyzing the data when the computer crashed.

3. Parallel Actions

Use the past continuous to describe two or more actions that were happening at the same time in the past.

Examples:

- The students were conducting experiments while the professor was lecturing.
- Engineers were monitoring the voltage while others were checking the resistance.

4. Background Actions

Use the past continuous to set the scene or provide background information for another action in the past.

Examples:

- The engineer was testing the system when the alarm sounded.
- They were designing the prototype while discussing the project details.

GRAMMAR EXERCISES

2.6 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Simple or Past Continuous.

Last week, Alex (1) ________ (decide) to work on a new project. While he (2) ________ (study) the circuit diagrams, his friend Sam (3) ________ (call) him. They (4) ________ (talk) about the project when suddenly the power (5) ________ (go) out. Alex (6) ________ (realize) that he (7) ________ (forget) to check the backup generator. As he (8) ________ (fix) the issue, he (9) ________ (hear) a strange noise. It (10) ________ (turn) out that a wire (11) ________ (spark) dangerously. While he (12) ________ (work) on the repair, Sam (13) ________ (arrive) to help. Together, they (14) ________ (complete) the project successfully.

2.7 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Simple or Past Continuous.

Yesterday, Maria (1) ________ (decide) to test a new type of battery. While she (2) ________ (assemble) the components, her colleague John (3) ________ (notice) a problem with the wiring. They (4) ________ (discuss) the issue when the battery suddenly (5) ________ (explode). Maria (6) ________ (realize) that she (7) ________ (use) the wrong type of wire. As she (8) ________ (replace) the wire, she (9) ________ (hear) a loud buzzing sound. It (10) ________ (turn) out that the circuit (11) ________ (overheat). While she (12) ________ (cool) down the system, John (13) ________ (arrive) with a fire extinguisher. Together, they (14) ________ (finish) the experiment safely.

2.8 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Simple or Past Continuous.

Last month, a team of electrical engineers (1) ________ (start) a challenging project. While they (2) ________ (design) the new power grid, one of the engineers (3) ________ (discover) a flaw in the plan. They (4) ________ (discuss) the issue when the lead engineer (5) ________ (suggest) a solution. As they (6) ________ (implement) the changes, the system (7) ________ (begin) to malfunction. The team (8) ________ (work) tirelessly to fix it. While they (9) ________ (test) the system, another engineer (10) ________ (notice) an error in the code. They (11) ________ (correct) the mistake and (12) ________ (continue) with the testing. As they (13) ________ (monitor) the results, the power grid (14) ________ (stabilize). Finally, the team (15) ________ (celebrate) their success.

PRESENT AND PAST TENSES

Tips for Differentiating Between Past and Present Tenses

1. **Identify Time References:** Look for words or phrases that indicate a specific time in the past or present.
   - Past: yesterday, last week, in 2020, etc.
   - Present: today, now, currently, etc.
2. **Verb Forms**: Pay attention to the form of the verb.
   - Past Simple: Regular verbs often end in -ed (e.g., walked, played).
   - Present Simple: Base form of the verb (e.g., walk, play).
3. **Context Clues**: Consider the context of the sentence to determine if the action is ongoing or completed.
   - Past Continuous: Describes actions that were ongoing in the past (e.g., was/were + verb-ing).
   - Present Continuous: Describes actions that are ongoing in the present (e.g., am/is/are + verb-ing).
4. **Adverbs and Time Expressions**: Use typical adverbs and time expressions to help identify the tense.

Typical Adverbs and Time Expressions

Present Simple

- Always
- Usually
- Often
- Sometimes
- Never
- Every day/week/month/year

Examples:

- They always have meetings on Mondays.
- They usually analyze the errors in the morning.

Present Continuous

- Now
- Currently
- At the moment
- Right now
- Today

Examples:

- The engineer is making plans right now.
- They are analyzing the project at the moment.

Past Simple

- Yesterday
- Last week/month/year
- In 2020 (or any specific year)
- Ago (e.g., two days ago)
- When (used with a specific time in the past)

Examples:

- They presented the project yesterday.
- They analyzed the proposal last week.

Past Continuous

- While, when (used to describe an action that was interrupted)
- At that moment
- All day/week/month

Examples:

- They were in the middle of the meeting when the alarm went off.
- They were working when the power outage occurred.

2.9 Complete the sentences by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

1. The electrician ________ (install) new wiring in the building every day.
2. While the generator ________ (run) yesterday, it ________ (produce) a lot of noise.
3. They ________ (check) the voltage regularly.
4. The power ________ (go) out during the storm last night.
5. She ________ (repair) the circuit when the lights ________ (flicker) last week.
6. The engineers ________ (test) the new equipment right now.
7. He ________ (measure) the current flow at the moment.
8. While they ________ (inspect) the transformer yesterday, it ________ (overheat).
9. The technician ________ (explain) the safety procedures every month.
10. They ________ (upgrade) the electrical system last month.
11. The fuse ________ (blow) due to a short circuit last week.
12. While she ________ (connect) the wires this morning, the power ________ (restore).
13. The team ________ (discover) a fault in the wiring last year.
14. He ________ (test) the circuit when the breaker ________ (trip) yesterday.
15. The electrician ________ (record) the readings accurately every time.

2.10 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

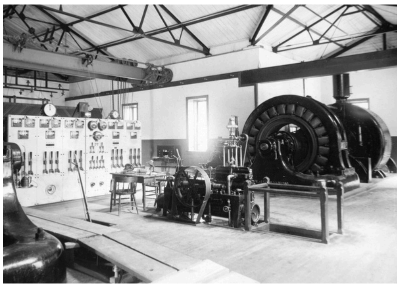
Last week, the team of electricians (1) ________ (start) a new project. They (2) ________ (install) new wiring in an old building every day. While they (3) ________ (work) on the main circuit yesterday, the generator (4) ________ (run) and (5) ________ (produce) a lot of noise. Suddenly, the power (6) ________ (go) out during the storm last night. One of the electricians (7) ________ (repair) the circuit when the lights (8) ________ (flicker) last week. Right now, the engineers (9) ________ (test) the new equipment, and one of them (10) ________ (measure) the current flow at the moment. While they (11) ________ (inspect) the transformer yesterday, it (12) ________ (overheat). The technician (13) ________ (explain) the safety procedures every month. Last month, they (14) ________ (upgrade) the electrical system. The fuse (15) ________ (blow) due to a short circuit last week. This morning, while she (16) ________ (connect) the wires, the power (17) ________ (restore). Last year, the team (18) ________ (discover) a fault in the wiring. Yesterday, he (19) ________ (test) the circuit when the breaker (20) ________ (trip). Every time, the electrician (21) ________ (record) the readings accurately.

♝ 2.11 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

Last month, the electrical team (1) ________ (undertake) a new project. They (2) ________ (assemble) a complex circuit every day. While they (3) ________ (calibrate) the equipment, the voltage (4) ________ (fluctuate) and (5) ________ (trigger) an alarm. Last night, the power (6) ________ (fail) unexpectedly. One of the electricians (7) ________ (diagnose) the issue when the lights (8) ________ (dim). Right now, the engineers (9) ________ (monitor) the system, and one of them (10) ________ (adjust) the settings. While they (11) ________ (inspect) the wiring yesterday, a capacitor (12) ________ (burst). The technician (13) ________ (demonstrate) the new procedures every week. Last month, they (14) ________ (integrate) a new control unit. The circuit (15) ________ (short-circuit) due to a fault last week. This morning, while she (16) ________ (configure) the new device, the power (17) ________ (stabilize). Last year, the team (18) ________ (identify) a recurring problem. Yesterday, he (19) ________ (verify) the connections when the breaker (20) ________ (activate). Every time, the electrician (21) ________ (log) the results carefully.

♝ 2.12 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

In the 18th century, scientists (1) ________ (begin) to understand electricity. Benjamin Franklin (2) ________ (conduct) his famous kite experiment in 1752. While he (3) ________ (fly) the kite, he (4) ________ (discover) that lightning is a form of electricity. In the 19th century, Thomas Edison (5) ________ (invent) the electric light bulb. He (6) ________ (work) tirelessly on his experiments. Right now, researchers (7) ________ (explore) new ways to generate electricity. Nikola Tesla (8) ________ (develop) alternating current (AC) in the late 1800s. While he (9) ________ (experiment) with AC, he (10) ________ (face) many challenges.



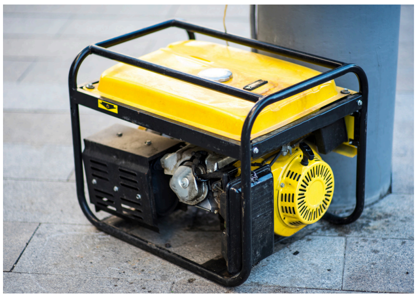
Today, engineers (11) ________ (use) Tesla's principles in modern power systems. In the early 20th century, electricity (12) ________ (become) widely available. While companies (13) ________ (build) power plants, cities (14) ________ (begin) to light up. Every year, advancements in technology (15) ________ (improve) the efficiency of electrical systems.

♝ 2.13 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

In the early 20th century, engineers (1) ________ (start) to build large power plants. They (2) ________ (generate) electricity using coal every day. While they (3) ________ (operate) the turbines, they (4) ________ (monitor) the output closely. Last year, a new hydroelectric plant (5) ________ (open) near the river. The workers (6) ________ (install) the turbines when the water levels (7) ________ (rise). Right now, scientists (8) ________ (research) renewable energy sources. In the 1950s, nuclear power (9) ________ (emerge) as a new technology. While they (10) ________ (develop) nuclear reactors, safety protocols (11) ________ (become) crucial. Today, wind farms (12) ________ (produce) a significant amount of electricity. Last month, engineers (13) ________ (complete) a large solar power project. While they (14) ________ (test) the solar panels, they (15) ________ (ensure) maximum efficiency.

♝ 2.14 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

Last year, the engineering team (1) ________ (undertake) a challenging project. They (2) ________ (design) a new type of generator every day. While they (3) ________ (test) the prototype, it (4) ________ (malfunction) and (5) ________ (cause) a fire. The project (6) ________ (fail) due to a critical error. One of the engineers (7) ________ (analyze) the data when the system (8) ________ (crash). Right now, the team (9) ________ (work) on identifying the problem. Last month, they (10) ________ (discover) a flaw in the design. While they (11) ________ (attempt) to fix it, another issue (12) ________ (arise). The manager (13) ________ (decide) to halt the project. Today, they (14) ________ (plan) a new approach. While they (15) ________ (discuss) the next steps, they (16) ________ (realize) the importance of thorough testing.



♟ 2.15 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

Shift to Renewable Energy

In the early 21st century, many countries (1) ________ (begin) to shift from non-renewable to renewable energy sources. Governments (2) ________ (invest) heavily in renewable technologies every year. While they (3) ________ (develop) new solar panels, researchers (4) ________ (discover) more efficient materials. Last year, a major wind farm (5) ________ (open) in the coastal region. Engineers (6) ________ (install) the turbines when a storm (7) ________ (hit). Right now, scientists (8) ________ (explore) the potential of wave energy. In the past, coal plants (9) ________ (dominate) the energy sector. While they (10) ________ (burn) fossil fuels, they (11) ________ (release) large amounts of CO2. Today, solar and wind power (12) ________ (provide) a significant portion of electricity. Last month, a new geothermal plant (13) ________ (start) operations. While they (14) ________ (drill) for geothermal energy, they (15) ________ (encounter) technical challenges. Governments (16) ________ (implement) policies to support renewable energy. In the 1990s, renewable energy (17) ________ (be) a small part of the energy mix. While companies (18) ________ (build) new infrastructure, they (19) ________ (face) opposition. Today, public opinion (20) ________ (favor) renewable energy. Last week, a major breakthrough (21) ________ (occur) in battery storage technology. While researchers (22) ________ (test) the new batteries, they (23) ________ (achieve) impressive results.

The transition (24) ________ (accelerate) as technology improves. In the past, oil and gas (25) ________ (be) the primary energy sources. While they (26) ________ (extract) oil, they (27) ________ (cause) environmental damage. Now, renewable energy (28) ________ (reduce) dependence on fossil fuels. Last year, the government (29) ________ (announce) new incentives for renewable projects. While they (30) ________ (implement) these policies, the renewable sector (31) ________ (grow) rapidly.

2.16 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past and Present tenses.

Development of Nuclear Energy

In 1895, Wilhelm Roentgen (1) ________ (discover) x-rays while experimenting with a cathode ray tube. The following year, Henri Becquerel (2) ________ (find) that uranium salts could produce radiation on their own. Marie and Pierre Curie (3) ________ (isolate) two new elements, Polonium and Radium. In 1938, Otto Hahn and Fritz Strassmann (4) ________ (achieve) nuclear fission by bombarding uranium with neutrons. During World War II, the Manhattan Project (5) ________ (develop) the first nuclear weapons. In 1951, the Experimental Breeder Reactor I (6) ________ (generate) the first electricity from nuclear energy. While scientists (7) ________ (work) on peaceful applications, the Atomic Energy Commission (8) ________ (authorize) the construction of nuclear power plants. In the 1970s, nuclear energy (9) ________ (become) a significant part of the energy mix. While engineers (10) ________ (improve) reactor designs, safety concerns (11) ________ (grow). Today, nuclear power plants (12) ________ (provide) about 10% of the world's electricity. Last year, researchers (13) ________ (make) advancements in nuclear fusion technology. While they (14) ________ (experiment) with fusion, they (15) ________ (face) many technical challenges. Governments (16) ________ (continue) to invest in nuclear energy research. In the 1980s, the Chernobyl disaster (17) ________ (highlight) the risks of nuclear power. While cleanup efforts (18) ________ (take) place, the industry (19) ________ (implement) stricter safety protocols. Today, new reactor designs (20) ________ (aim) to be safer and more efficient. Last month, a new generation of small modular reactors (21) ________ (receive) approval for construction. While the debate over nuclear energy (22) ________ (persist), its role in reducing carbon emissions (23) ________ (become) more important. In the future, nuclear fusion (24) ________ (have) the potential to provide limitless clean energy. Researchers (25) ________ (work) tirelessly to overcome the challenges of fusion. Last year, a major breakthrough (26) ________ (occur) in fusion research. While the technology (27) ________ (advance), the world (28) ________ (look) to nuclear energy as a key part of the solution to climate change. Governments (29) ________ (support) nuclear energy initiatives through funding and policy. Every year, new developments (30) ________ (bring) us closer to a sustainable energy future.

UNIT 3

POWER GENERATION

Power generation is the process of producing electricity from various energy sources. The most common method involves using steam turbines driven by heat engines, which are fueled by combustion or nuclear fission. Globally, about 67% of electricity is generated from fossil fuels, such as coal, natural gas, and oil. These thermal power plants convert the chemical energy of fuels into mechanical energy, which then drives the turbines to produce electricity.

Renewable energy sources are increasingly contributing to global power generation. Wind and solar photovoltaics (PV) are the fastest-growing sources, driven by technological advancements and decreasing costs. Wind turbines convert the kinetic energy of wind into electrical energy, while solar PV panels convert sunlight directly into electricity using semiconductor materials.

Hydropower is another significant renewable source, accounting for about 16% of global electricity generation. It harnesses the energy of flowing water, typically from rivers or dams, to turn turbines and generate electricity. Geothermal power plants, which use heat from the Earth's interior, and biomass power plants, which burn organic materials, also contribute to the renewable energy mix.

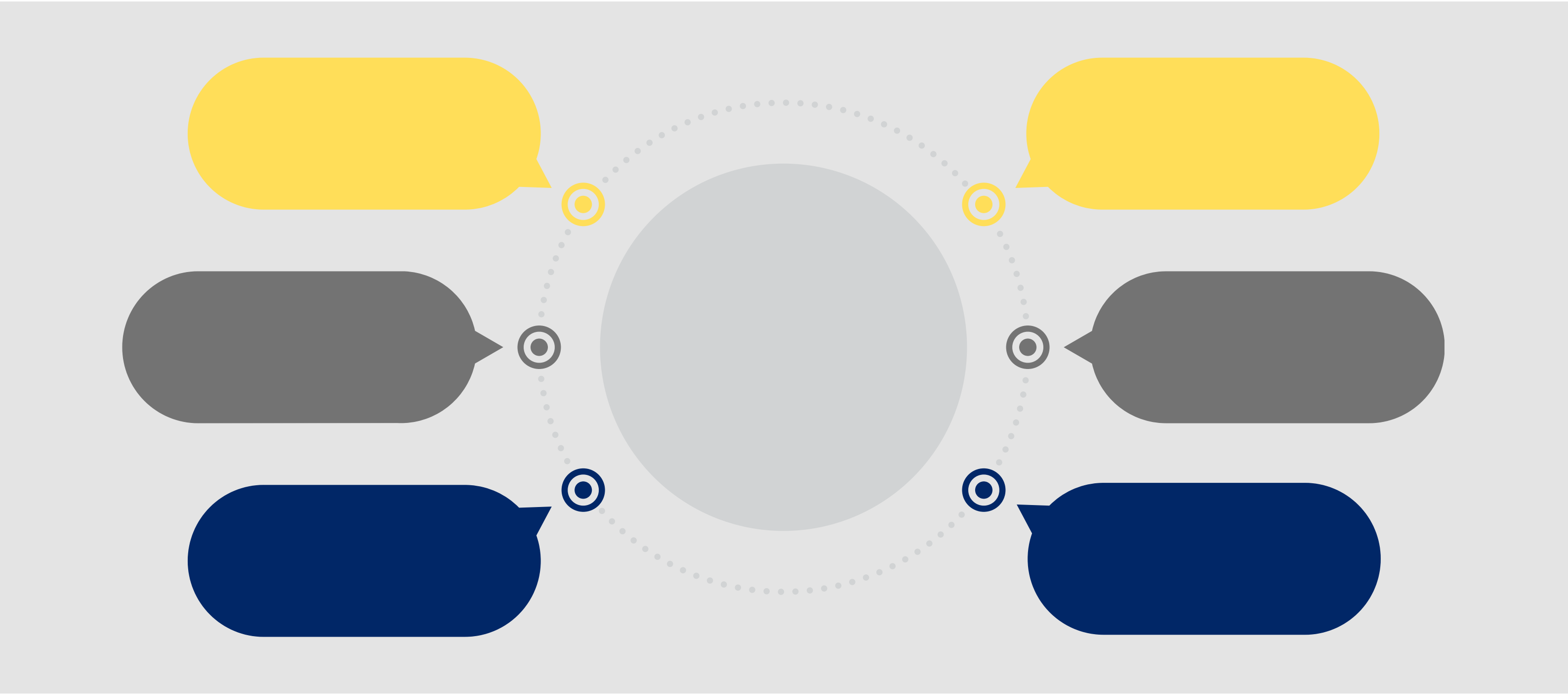
Nuclear power remains a key player in the energy sector, providing about 10% of the world's electricity. Nuclear reactors use the heat produced by nuclear fission to generate steam, which then drives turbines to produce electricity. Despite concerns about safety and radioactive waste, nuclear power is valued for its low greenhouse gas emissions and ability to provide a stable, continuous power supply.

The transition to cleaner energy sources is crucial for reducing greenhouse gas emissions and combating climate change. Innovations in energy storage, such as batteries and pumped-storage hydroelectricity, are essential for managing the intermittent nature of renewable energy sources. As the global demand for electricity continues to rise, the shift towards sustainable and efficient power generation methods is more important than ever.





3.1 Read the text on the previous page and make a mind map.



3.2 Translate and define the words.

English	Translation	Definition
Fossil Fuels		
Renewable Energy		
Wind Turbines		
Solar Photovoltaics		
Hydropower		
Geothermal Power		
Nuclear Fission		
Energy Storage		

3.3 Read the text and fill in the words from the box.

Word bank:

penstock, head, generator, flow rate, turbine, efficiency, greenhouse gas, storage, ecosystems, micro-hydropower, kinetic, run-of-river, turbine, electrical, head.

Hydropower is a renewable energy source that uses the energy of moving water to generate electricity. The process begins when water from a reservoir is released through a _______ (1), which directs it to the _______ (2). As the water flows, it strikes the blades of the _______ (3), causing it to spin. This motion converts the _______ (4) energy of the water into mechanical energy. The mechanical energy is then converted into _______ (5) energy by a _______ (6), which is connected to the turbine. This electricity is transmitted to homes and businesses via power lines. The potential energy of the water depends on two factors: the _______ (7) and the _______ (8). The head refers to the difference in elevation between the water's source and the turbine. The flow rate, or the volume of water flowing, also plays a key role in energy production. There are different types of hydropower systems. The most common is the _______ (9) dam, which stores large amounts of water. Another type is _______ (10) hydropower, which does not require a reservoir. Smaller systems, such as _______ (11) plants, are used for local power generation. Hydropower is considered a clean energy source, as it does not produce _______ (12) emissions. However, it can impact local _______ (13) and wildlife, as dams may block fish migration. The efficiency of a hydropower system depends on its _______ (14) and design.

3.4 Match each term (1-13) with the correct definition (A-M).

Word	**Definition**
1. Penstock 2. Head 3. Generator 4. Flow rate 5. Turbine 6. Efficiency 7. Storage 8. Micro-hydropower 9. Kinetic 10. Run-of-river	A. The height difference between the water source and the turbine. B. A device that converts mechanical energy into electrical energy. C. The amount of water passing through the system per unit time. D. A machine that converts the energy of flowing water into mechanical energy. E. The ratio of useful energy output to total energy input. F. The process of retaining water for future use. G. Small-scale hydro-power systems suitable for individual homes or communities. H. Energy possessed by an object due to its motion. I. A type of hydro-power system that uses the natural flow of the river without significant storage. J. A pipe that carries water to the turbine.

FUTURE TENSES

Future Simple

1.**Predictions:** Use the future simple tense to make predictions about the future.

- Example: The new circuit design will improve the efficiency of the power supply.
- Example: Engineers will develop more advanced renewable energy systems.

2. **Spontaneous Decisions**: Use the future simple tense for decisions made at the moment of speaking.

- Example: I will check the voltage levels right now.
- Example: We will test the new prototype tomorrow.

Adverbs that tyically occur with this tense are:

- Definitely: Engineers will definitely improve the efficiency of solar panels.
- Probably: The new circuit design will probably reduce power consumption.
- Soon: We will start the installation of the new transformer soon.
- Eventually:I will test the upgraded electrical system eventually.

Going to Future

1. **Plans and Intentions**: Use "going to" for plans or intentions that have already been decided.

- Example: We are going to install the new transformer next week.
- Example: I am going to study the impact of electromagnetic interference on circuit performance.

2. **Evidence-Based Predictions**: Use "going to" for predictions based on current evidence.

1. Example: The battery is going to fail soon; its voltage is dropping rapidly.
2. Example: The system is going to shut down if the current exceeds the limit.

Adverbs that tyically occur with this tense are:

1. Look! Watch out! Be careful!: Watch out, the circuit is going to short-circuit.
2. Definitely: She is definitely going to inspect the electrical wiring next week.
3. Soon: The voltage is soon going to stabilize once we adjust the settings.
4. Clearly: The system is clearly going to overload if we don't reduce the current.

Study tip

When writing academic papers in electrical engineering, use the future simple tense for predictions, with adverbs like "definitely" and "probably" (e.g., "The new circuit design will probably reduce power consumption"). Use "going to" future tense for planned projects, with adverbs such as "certainly" and "soon" (e.g., "The team is going to investigate the effects of power consumption next month"). This distinction enhances clarity and precision in your writing.

3.5 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple and Going to Future.

1. The engineers are definitely _______ (install) the new solar panels next week.
2. We will probably _______ (test) the circuit for faults tomorrow.
3. The voltage is soon _______ (stabilize) once we adjust the settings.
4. She is definitely _______ (analyze) the power consumption data soon.
5. The new design will definitely _______ (reduce) energy loss significantly.
6. I will definitely _______ (check) the wiring for any issues later today.
7. The system is clearly _______ (shut down) if the current exceeds the limit.
8. They are definitely _______ (upgrade) the electrical grid next month.
9. The battery is soon _______ (fail); its voltage is dropping rapidly.
10. We will soon _______ (start) the installation process.
11. The new transformer will definitely _______ (improve) the efficiency of the power supply.
12. He is definitely _______ (inspect) the electrical components next week.
13. The circuit is clearly _______ (short-circuit) if we don't fix the insulation.
14. The engineers will definitely _______ (develop) more advanced renewable energy systems.
15. The voltage will probably _______ (increase) when we add more load to the circuit.

3.6 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple and Going to Future.

Next week, the engineering team (1) ________ (install) a new solar panel system on the roof of the building. They (2) ________ (start) the installation process early in the morning. The new system (3) ________ (reduce) the building's energy consumption significantly. The team (4) ________ (test) the system thoroughly to ensure it works efficiently.

The project manager is confident that the new panels (5) ________ (generate) enough electricity to power the entire building. Additionally, they (6) ________ (upgrade) the electrical wiring to handle the increased load. The team (7) ________ (complete) the project by the end of the week.

♟ 3.7 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple and Going to Future.

1. Next week, the electrical engineering team ________ (start) work on a new automation system.
2. They ________ (install) smart sensors across the factory floor.
3. The lead engineer says the system ________ (improve) energy efficiency by 30%.
4. We ________ (test) all connections before switching on the main circuit.
5. I ________ (help) with programming the microcontrollers.
6. Later, we ________ (run) a full diagnostic to detect any faults.
7. Be careful — the voltage regulator ________ (overheat) if we skip a step.
8. Once we're done, the team ________ (submit) the final report to the client.

♟ 3.8 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple and Going to Future.

Next week, the electrical engineering team (1) ________ (start) work on a new automation system. They (2) ________ (install) smart sensors across the factory floor. The lead engineer says the system (3) ________ (improve) energy efficiency by 30%. We (4) ________ (test) all connections before switching on the main circuit. I (5) ________ (help) with programming the microcontrollers. Later, we (6) ________ (run) a full diagnostic to detect any faults. Be careful — the voltage regulator (7) ________ (overheat) if we skip a step. Once we're done, the team (8) ________ (submit) the final report to the client.

The IT department (9) ________ (set up) a backup server to store system data. Engineers (10) ________ (review) all feedback from the pilot test next week. I'm sure the client (11) ________ (appreciate) the new automated features. We (12) ________ (not / shut down) the main system until everything is stable. One of the teams (13) ________ (present) the results in next Friday's meeting. We (14) ________ (need) to document each step for the certification audit. After this project, our department (15) ________ (start) work on a similar system for the northern facility.

OTHER EXPRESSIONS FOR FUTURE

Present Simple for future

Rule: The present simple tense is used **for scheduled events or timetables.**

Examples:

1. The session starts at 9 AM on Monday.
2. The engineering conference begins on the 5th of May.

Present Continuous for future

Rule: The present continuous tense is used **for planned or arranged events in the near future**.

Examples:

- We are installing new energy-efficient light bulbs next Monday.
- The engineers are upgrading the power grid this weekend.

GRAMMAR EXERCISES

3.9 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple, Going to Future, Present Simple and Present Continuous.

1. The electrician ________ (arrive) tomorrow to fix the wiring.
2. We ________ (install) solar panels next week.
3. The power company ________ (upgrade) the grid every year.
4. The technician ________ (check) the circuit breaker later today.
5. They ________ (replace) the old transformers next month.
6. The new wind turbines ________ (generate) electricity starting next year.
7. We ________ (use) energy-efficient appliances from now on.
8. The engineers ________ (work) on the new power plant this weekend.
9. The government ________ (invest) in renewable energy sources soon.
10. The solar panels ________ (produce) more electricity during sunny days.
11. The team ________ (conduct) an energy audit next Friday.
12. The new regulations ________ (come) into effect next January.
13. The company ________ (launch) a campaign to promote energy conservation next month.
14. The smart meters ________ (provide) real-time data starting next week.
15. The technicians ________ (inspect) the electrical systems tomorrow morning.

♝ 3.10 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple, Going to Future, Present Simple and Present Continuous.

John, a chemistry researcher, is thrilled about his new experiment. He (1) ________ (organize) the lab equipment tomorrow afternoon. The experiment (2) ________ (start) next Tuesday. John (3) ________ (gather) materials from various suppliers over the weekend. On Thursday, he (4) ________ (analyze) the samples using advanced techniques. The findings (5) ________ (provide) insights into molecular structures. Each day, he (6) ________ (record) his observations carefully. Next Wednesday, he (7) ________ (present) his findings to his colleagues. The team (8) ________ (debate) the significance of the results during the meeting. They (9) ________ (design) new experiments based on the initial data. John (10) ________ (compile) a detailed report by the end of the month. The report (11) ________ (contain) comprehensive data and interpretations. The team (12) ________ (submit) the report to the head of the department next Tuesday. The head (13) ________ (examine) the report and give feedback. John (14) ________ (incorporate) the suggestions in the next phase of the experiment. The team (15) ________ (acknowledge) their achievements at the end of the semester.

♝ 3.11 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Future Simple, Going to Future, Present Simple and Present Continuous.

Next week, the city (1) ________ (host) an energy fair to promote sustainable electricity use. The mayor (2) ________ (give) a speech at the opening ceremony. Many companies (3) ________ (participate) in the event, showcasing their latest innovations.

Right now, the organizers (4) ________ (prepare) the venue for the fair. They (5) ________ (set up) booths and displays all day today. Tomorrow, the electricians (6) ________ (install) the lighting and sound systems.

During the fair, a new solar panel technology (7) ________ (be) unveiled. The developers (8) ________ (demonstrate) how it works and explain its benefits. They (9) ________ (answer) questions from the audience as well.

In addition, the city council (10) ________ (announce) new incentives for households to switch to renewable energy. They (11) ________ (offer) subsidies for solar panel installations starting next month.

On the second day of the fair, a workshop on energy efficiency (12) ________ (take place). Experts (13) ________ (teach) participants how to reduce their electricity consumption. The workshop (14) ________ (begin) at 10 AM and (15) ________ (last) for three hours.

Meanwhile, the local power company (16) ________ (launch) a campaign to encourage energy conservation. They (17) ________ (distribute) free energy-saving kits to attendees. The kits (18) ________ (include) LED bulbs and smart plugs.

TIME CLAUSES FOR FUTURE

1. Future time clauses are used to **describe actions that will happen in the future, often introduced by conjunctions** like "when," "as soon as," "before," "after," "until," and "while." The main clause uses the future tense, while the time clause uses the present simple.

Examples:

- When the experiment is completed, we will analyze the results.
- As soon as the new equipment arrives, we will start the synthesis process.

2. Future time clauses can also **indicate conditions that must be met** before another future action occurs. These clauses often use "if" or "unless."

Examples:

- If the chemical reaction is successful, we will proceed with further testing.
- Unless the samples are contaminated, we will publish the findings.

Present Perfect in Time Clauses for future

1. Use the present perfect to indicate that one **action will be completed before another future action begins**.

Examples:

- When we have finished the synthesis, we will test the new compound.
- After the researchers have analyzed the data, they will publish their findings.

2. Use the present perfect to show that a **condition must be met before a future action can occur**.

Examples:

- As soon as the lab has received the new reagents, we will start the experiment.
- Until the team has completed the preliminary tests, they will not proceed with the main experiment.

GRAMMAR EXERCISES

3.12 Complete the sentences by filling in the blanks with the correct form of the verb in brackets to form time clauses.

1. I will turn off the lights when I ________ (leave) the room.
2. As soon as the power ________ (come) back, we will restart the computer.
3. We will call the electrician after we ________ (notice) any issues with the wiring.
4. The technician will check the fuse box before he ________ (start) the repair.
5. They will install the new generator once they ________ (receive) it.
6. We will save more energy if we ________ (use) LED bulbs.
7. The company will launch the new product as soon as they ________ (finish) testing it.
8. When the sun ________ (rise), the solar panels will begin to generate electricity.

3.13 Complete the sentences by filling in the blanks with the correct form of the verb in brackets to form time clauses for future.

1. We ________ (install) the new generator as soon as it ________ (arrive).
2. The technician ________ (check) the wiring before he ________ (leave).
3. When the power ________ (come) back, we ________ (restart) the computer.
4. The electrician ________ (fix) the circuit breaker after he ________ (inspect) it.
5. As soon as the sun ________ (rise), the solar panels ________ (start) generating electricity.
6. We ________ (call) the power company if the outage ________ (continue).
7. The engineers ________ (upgrade) the system once they ________ (receive) the new parts.
8. When the wind ________ (blow), the turbines ________ (generate) electricity.
9. The company ________ (launch) the new product after they ________ (finish) testing it.
10. We ________ (save) more energy if we ________ (use) smart meters.
11. The team ________ (conduct) an audit as soon as they ________ (arrive) at the site.
12. The technician ________ (replace) the fuse before he ________ (start) the repair.
13. When the battery ________ (charge), the device ________ (be) ready to use.
14. The government ________ (announce) new policies once they ________ (complete) the review.
15. We ________ (switch) to renewable energy when the new regulations ________ into effect.
16. The power company ________ (upgrade) the grid after they ________ (r funding.

17. When the generator ________ (start), it ________ (provide) backup power.
18. The electrician ________ (install) the new lights before he ________ (leave) the building.
19. As soon as the storm ________ (pass), we ________ (check) the power lines.
20. The team ________ (analyze) the data after they ________ (collect) it.
21. When the technician ________ (arrive), he ________ (inspect) the electrical systems.
22. We ________ (replace) the old bulbs if they ________ (burn) out.
23. The company ________ (offer) discounts once they ________ (launch) the new product.
24. When the power ________ (fail), the backup generator ________ (activate).
25. The engineers ________ (test) the new equipment after they ________ (install) it.
26. We ________ (monitor) the energy usage as soon as the smart meters ________ (be) installed.
27. The technician ________ (fix) the issue before he ________ (leave) the site.
28. When the solar panels ________ (be) operational, they ________ (reduce) our electricity bills.

♝ 3.14 Complete the sentences by filling in the blanks with the correct form of the verb in brackets.

1. The technician ________ (repair) the faulty wiring as soon as he ________ (arrive).
2. We ________ (upgrade) the software when the new version ________ (be) available.
3. The power company ________ (send) a team to inspect the lines after the storm ________ (pass).
4. When the new regulations ________ (come) into effect, we ________ (switch) to renewable energy.
5. The engineers ________ (test) the equipment once they ________ (finish) the installation.
6. We ________ (save) energy if we ________ (use) smart thermostats.
7. The electrician ________ (check) the fuse box before he ________ (leave) the house.
8. When the battery ________ (be) fully charged, the device ________ (work) efficiently.
9. The company ________ (launch) the new product after they ________ (complete) the final tests.
10. We ________ (monitor) the energy consumption as soon as the smart meters ________ (be) installed.
11. The team ________ (analyze) the data after they ________ (collect) it from the sensors.
12. When the technician ________ (arrive), he ________ (inspect) the electrical systems thoroughly.
13. We ________ (replace) the old equipment if it ________ (fail) during the test.
14. The government ________ (announce) new incentives once they ________ (review) the proposals.
15. The power company ________ (upgrade) the infrastructure after they ________ (receive) the necessary approvals.

♝ 3.15 Complete the sentences by filling in the blanks with the correct form of the verb in brackets.

Next month, the city (1) ________ (host) an energy conference to discuss advancements in electricity. The mayor (2) ________ (give) a keynote speech at the opening ceremony. Many experts (3) ________ (participate) in the event, sharing their latest research.
Right now, the organizers (4) ________ (prepare) the venue for the conference. They (5) ________ (set up) booths and displays all day today. Tomorrow, the electricians (6) ________ (install) the lighting and sound systems.
During the conference, a new battery technology (7) ________ (be) unveiled. The developers (8) ________ (demonstrate) how it works and explain its benefits. They (9) ________ (answer) questions from the audience as well.

READING COMPREHENSION

Hydropower Generation: History and Modern Times

Hydropower, the generation of electricity using the energy of flowing water, has a rich history and remains a vital part of the renewable energy landscape today. The concept of harnessing water power dates back thousands of years. Ancient civilizations, such as the Greeks and Romans, used water wheels for grinding grain and other mechanical tasks. The first recorded use of hydropower for electricity generation was in 1878 at Cragside, a country house in Northumberland, England, where a water turbine powered a single lamp.

The development of modern hydropower technology began in the 19th century. In 1827, French engineer Benoit Fourneyron developed the first reaction turbine, producing around 6 horsepower. This was followed by the invention of the Pelton wheel by American inventor Lester Allan Pelton in the 1870s, which significantly improved the efficiency of water turbines. The Francis turbine, developed by British-American engineer James Francis in 1849, remains one of the most widely used water turbines today.

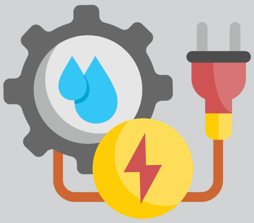
The first large-scale hydropower plants were built in the late 19th and early 20th centuries. The Redlands Power Plant in California, established in 1893, was the first commercial installation using alternating current technology. By the early 20th century, hydropower plants were being constructed worldwide, including notable projects like the Hoover Dam and Grand Coulee Dam in the United States.

In modern times, hydropower continues to play a crucial role in the global energy mix. There are three main types of hydropower facilities: impoundment, diversion, and pumped storage. Impoundment facilities, the most common type, use dams to store water in reservoirs. Water released from the reservoir flows through turbines, generating electricity.

Diversion facilities, also known as run-of-river systems, channel a portion of a river through a canal or penstock to generate power. Pumped storage facilities act like giant batteries, storing energy by pumping water to a higher elevation during low demand periods and releasing it to generate electricity during peak demand.

Emerging technologies are enhancing the efficiency and flexibility of hydropower. Innovations such as variable speed turbines, digitalization, and fish-friendly technologies are being developed to improve performance and reduce environmental impact. Hydropower modernization efforts include upgrading outdated components and implementing advanced control systems to optimize operations.

Overall, hydropower remains a reliable and sustainable source of energy, contributing significantly to the reduction of greenhouse gas emissions and the transition to a cleaner energy future.



3.16 Read the text and answer the questions.

1. What ancient civilizations first used water wheels for mechanical tasks?
2. Where was the first recorded use of hydropower for electricity generation?
3. Who developed the first reaction turbine and when?
4. What is the Pelton wheel and who invented it?
5. Which turbine developed by James Francis is still widely used today?
6. What was significant about the Redlands Power Plant in California?
7. Name two notable hydropower projects built in the early 20th century in the United States.
8. What are the three main types of hydropower facilities?
9. How do impoundment facilities generate electricity?
10. What is the function of pumped storage facilities?
11. Mention two emerging technologies in hydropower.
12. What are hydropower modernization efforts focused on?

Write your answers here:

READING COMPREHENSION

Solar Panels and Solar Power Generation

Solar panels, also known as photovoltaic (PV) panels, are devices that convert sunlight directly into electricity. They are a key component of solar power generation, which is a clean and renewable energy source. The technology behind solar panels has evolved significantly since their invention, making them more efficient and affordable.

The basic principle of solar power generation involves the photovoltaic effect. When sunlight hits the solar cells in a panel, it excites electrons, creating an electric current. This direct current (DC) is then converted into alternating current (AC) by an inverter, making it suitable for use in homes and businesses.

Solar panels are typically made from silicon, a semiconductor material. There are two main types of solar panels: monocrystalline and polycrystalline. Monocrystalline panels are made from a single crystal structure, making them more efficient but also more expensive. Polycrystalline panels are made from multiple silicon crystals and are generally less efficient but more cost-effective.

One of the major advantages of solar power is its environmental benefits. Solar energy is abundant and produces no greenhouse gas emissions during operation. This makes it a sustainable alternative to fossil fuels, which contribute to climate change. Additionally, solar panels have a long lifespan, often exceeding 25 years, and require minimal maintenance.

The adoption of solar power has been growing rapidly worldwide. Countries like Germany, China, and the United States have made significant investments in solar energy infrastructure. Government incentives, such as tax credits and subsidies, have also played a crucial role in promoting solar power adoption.

Despite its benefits, solar power generation faces some challenges. One of the main issues is the intermittent nature of sunlight. Solar panels can only generate electricity when the sun is shining, which means they are less effective during cloudy days or at night. To address this, energy storage solutions like batteries are being developed to store excess energy generated during sunny periods for use when sunlight is not available.

Another challenge is the initial cost of installation. Although the prices of solar panels have decreased significantly over the years, the upfront investment can still be substantial. However, the long-term savings on electricity bills and the potential for selling excess power back to the grid can offset these costs.

In conclusion, solar panels and solar power generation represent a promising and sustainable energy solution. With ongoing advancements in technology and supportive government policies, the future of solar energy looks bright.

♟ 3.17 Read the text. Find words or hrases form the text that match with these definitions.

1. A device that converts direct current (DC) into alternating current (AC).

____

2. A material that has electrical conductivity between that of a conductor and an insulator. ____________________

3. Financial assistance provided by the government to support a specific industry.

____

4. The release of gases that trap heat in the atmosphere, contributing to climate change. ____________________

5. A type of solar panel made from a single crystal structure.

____

6. A type of solar panel made from multiple silicon crystals.

____

7. The basic physical and organizational structures needed for the operation of a society or enterprise. ____________________

8. Capable of being maintained over the long term without depleting resources or causing severe ecological damage. ____________________

9. Occurring at irregular intervals; not continuous or steady.

____

10. Relating to the conversion of light into electricity.

____

READING COMPREHENSION

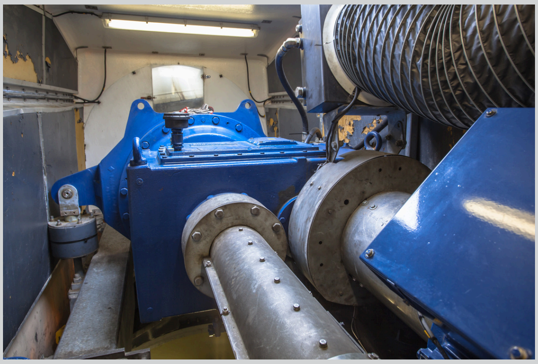
Wind Power Generation: Advantages and Disadvantages

Wind power generation harnesses the kinetic energy of wind to produce electricity. This process involves using wind turbines, which are large structures with blades that rotate when the wind blows. The rotation of the blades turns a generator, producing electricity. Wind power is one of the fastest-growing sources of renewable energy worldwide, contributing significantly to the reduction of greenhouse gas emissions.

One of the primary advantages of wind power is its renewable and sustainable nature. Wind is an inexhaustible resource, making wind power a sustainable energy source. Unlike fossil fuels, wind energy does not deplete over time. Additionally, wind power generation produces no air or water pollution. It does not emit greenhouse gases during operation, making it an environmentally friendly alternative to fossil fuels. The wind industry also creates jobs in manufacturing, installation, and maintenance, providing additional income for landowners who lease their land for wind farms. Furthermore, once installed, wind turbines have low operational and maintenance costs, making wind power one of the cheapest sources of electricity in many regions. Wind power also reduces dependence on imported fuels, enhancing energy security for countries that invest in this technology.

Despite these advantages, wind power generation faces several challenges. One of the main issues is the intermittency of wind. Wind power generation is dependent on wind availability, which can be unpredictable. This intermittency means that wind power cannot always provide a consistent supply of electricity. Another challenge is the high initial costs associated with the installation of wind turbines and related infrastructure. Although costs have decreased significantly over the years, the upfront investment can still be substantial. Wind turbines can also pose a threat to birds and bats, particularly if they are located near migratory paths. Additionally, wind turbines generate noise, which can be a nuisance for nearby residents, and some people find the appearance of wind farms to be visually unappealing. Wind farms require large areas of land, which can impact local ecosystems and land use patterns.

Advancements in technology and supportive policies are helping to mitigate some of the disadvantages of wind power. Innovations such as more efficient turbines, better site selection, and improved grid integration are enhancing the viability of wind energy. In conclusion, wind power generation offers numerous benefits, including sustainability, environmental protection, and economic growth. While there are challenges to overcome, the continued development of wind energy technology promises a cleaner and more sustainable energy future.



3.18 Read the text. Find words or hrases form the text that match with these definitions.

1. Multiple Choice Reading Exercise
What is one of the main advantages of wind power?
   - A) It produces greenhouse gases.
   - B) It is a non-renewable resource.
   - C) It is cost-effective.
   - D) It has high operational costs.

2. Which of the following is a disadvantage of wind power?
   - A) It has low initial costs.
   - B) It is dependent on wind availability.
   - C) It produces air pollution.
   - D) It does not impact wildlife.

3. How does wind power contribute to energy independence?
   - A) By reducing the need for imported fuels.
   - B) By increasing reliance on fossil fuels.
   - C) By requiring large areas of land.
   - D) By generating noise.

4. What is a common environmental benefit of wind power?
   - A) It emits greenhouse gases.
   - B) It produces no air or water pollution.
   - C) It depletes natural resources.
   - D) It has high maintenance costs.

5. Why can wind power generation be inconsistent?
   - A) Because of high operational costs.
   - B) Due to the unpredictability of wind.
   - C) Because it requires large areas of land.
   - D) Due to its visual impact.

Tidal Power Generation

Paragraph A

Heading: ______________________________

Tidal power generation can have significant environmental impacts, particularly when using tidal barrages. These structures can alter tidal levels, increase water turbidity, and affect marine life habitats. The construction of tidal barrages can disrupt local ecosystems and navigation routes. However, advancements in technology are helping to mitigate these impacts. For example, newer tidal stream turbines are designed to be more efficient and less harmful to marine life

Paragraph B

Heading: ______________________________

There are two primary methods of generating tidal power: tidal barrages and tidal stream systems. Tidal barrages operate similarly to dams, trapping water in a basin during high tide and releasing it through turbines during low tide to generate electricity. Tidal stream systems, on the other hand, use the kinetic energy of moving water to turn turbines, much like underwater wind turbines. These systems are typically placed in areas with strong tidal currents

Paragraph C

Heading: ______________________________

The concept of harnessing tidal energy dates back centuries. People in Europe used tidal mills to grind grain as early as the 11th century. The first large-scale tidal power plant, the La Rance Tidal Power Station in France, began operation in 1966 and remains one of the largest tidal power stations in the world. This plant uses a barrage system to generate electricity and has a capacity of 240 megawatts

Paragraph D

Heading: ______________________________

One of the significant advantages of tidal power is its predictability. Unlike wind and solar power, which can be intermittent, tidal power is highly predictable due to the regularity of tidal cycles. This predictability helps in planning and integrating tidal power into the energy grid. Additionally, tidal power generation produces no greenhouse gas emissions during operation, making it an environmentally friendly option.

Paragraph E
Heading: ______________________________
Despite its advantages, tidal power generation faces several challenges. The high initial costs of building tidal power plants can be a barrier to widespread adoption. Tidal power is also location-specific, requiring sites with a high tidal range or strong tidal currents to be economically viable. However, ongoing research and development are focused on reducing costs and improving the efficiency of tidal power systems. With continued technological advancements and supportive policies, tidal power has the potential to play a significant role in the transition to a cleaner energy future.

Paragraph F
Heading: ______________________________
Tidal power generation harnesses the energy from the natural rise and fall of ocean tides to produce electricity. This process involves using turbines, which are large structures with blades that rotate when the tide flows in and out. The rotation of the blades turns a generator, producing electricity. The gravitational pull of the moon and the sun, along with the rotation of the Earth, causes the tides, making tidal power a reliable and predictable source of energy.

3.19 Read the text. Find the corret heading for each paragraph.

1. Types of Tidal Power Systems
2. How Tidal Power Works
3. Historical Development
4. Environmental Impact
5. Challenges and Future Prospects
6. Advantages of Tidal Power

UNIT 4

Energy Storage

Energy storage is a crucial component in modern energy systems, providing solutions for home use, industry, and power generation.

Home energy storage systems, such as the Tesla Powerwall and Enphase IQ Battery, store electricity for later use, often paired with solar panels. These systems allow homeowners to use stored energy during power outages or peak demand times, reducing reliance on the grid and lowering electricity bills. The median cost of home batteries is around $999/kWh, but incentives can significantly reduce this price. Home batteries can store excess solar energy, making it possible to achieve higher long-term savings and faster return on investment

In industrial applications, energy storage systems (ESS) are used to manage energy demand, integrate renewable energy sources, and provide backup power . The global energy storage market is expected to grow significantly, driven by the increasing adoption of renewable energy and advancements in battery technology. ESS in industry helps stabilize the grid, reduce peak demand charges, and improve energy efficiency. Technologies like lithium-ion batteries, pumped-storage hydroelectricity, and thermal energy storage are commonly used.

Energy storage systems play a vital role in power generation by storing electricity generated from renewable sources like wind and solar. These systems ensure a stable and reliable supply of electricity, even when renewable generation is intermittent. Types of ESS used in power generation include batteries, compressed-air storage, and flywheels. Long-duration storage technologies are essential for supporting decarbonized grids and require federal support for development. Energy storage enables deep decarbonization of electricity systems, making it a key strategy in combating climate change.

Energy storage is transforming how we generate, store, and use electricity, paving the way for a more sustainable and resilient energy future.

4.1 Fill the gaps with the correct words from the word bank.

Word bank:

capacitor, distributed generation, electrochemical storage, energy density, inverter, load shifting, microgrid, power outage, smart grid, supercapacitor.

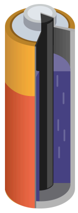
1. A ________ is a device that stores electrical energy in an electric field, often used for short-term energy storage.
2. An ________ converts direct current (DC) from batteries into alternating current (AC) for use in homes and businesses.
3. A ________ is an advanced electrical grid that uses digital communication technology to detect and react to local changes in usage.
4. A ________ is a high-capacity capacitor that can store and release energy quickly, used in applications requiring rapid bursts of power.
5. ________ refers to the amount of energy stored in a given system or device per unit volume.
6. ________ is a strategy used to shift energy consumption from peak demand times to off-peak times, reducing strain on the grid.
7. ________ involves storing energy through chemical reactions, commonly seen in batteries.
8. ________ refers to the generation of electricity from multiple small sources, often renewable, spread across a region.
9. A ________ is a localized grid that can operate independently from the main grid, providing reliable power to a specific area.
10. A ________ occurs when there is a temporary loss of electrical power in a region.

4.2 Match the following definitions with the correct technical word from the list.

Words	**Definitions**
1. Battery 2. Grid 3. Renewable Energy 4. Peak Demand 5. Lithium-ion 6. Pumped-storage Hydro 7. Thermal Energy Storage 8. Flywheel 9. Backup Power 10. Decarbonization	A. A type of energy storage that uses rotating mechanical devices to store energy. B. The process of reducing carbon dioxide emissions from energy systems. C. A system that stores energy in the form of heat. D. A device that stores electrical energy for later use. E. The network that delivers electricity from producers to consumers. F. Energy sources that are naturally replenished, such as solar and wind. G. A type of battery commonly used in energy storage systems. H. The highest level of energy demand at a specific time. I. A method of storing energy by moving water between reservoirs at different elevations. J. Power that is available in case of a primary power source failure.

4.3 Choose the correct answer.

1. Who invented the first modern battery in 1800?
A) Thomas Edison
B) Alessandro Volta
C) Nikola Tesla
D) Benjamin Franklin



2. What is the main chemical reaction that occurs in a battery to produce electricity?
A) Combustion
B) Photosynthesis
C) Redox (Reduction-Oxidation)
D) Fermentation

3. Which type of battery is commonly used in electric vehicles and portable electronics due to its high energy density?
A) Alkaline
B) Lead-Acid
C) Nickel-Cadmium
D) Lithium-Ion

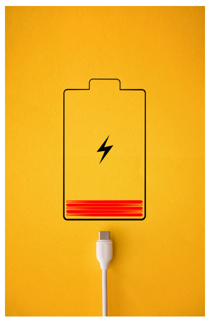
4. What is the alternative name for a battery, named after its inventor?
A) Galvanic Cell
B) Voltaic Cell
C) Faraday Cell
D) Ampere Cell

5. Which type of battery is known for its ability to store and release energy quickly, often used in applications requiring rapid bursts of power?
A) Supercapacitor
B) Alkaline
C) Nickel-Metal Hydride
D) Zinc-Carbon

6. How many main components does a typical battery have?
A) 2
B) 3
C) 4
D) 5

7. What is the environmental impact of improperly disposing of batteries?
A) They decompose harmlessly
B) They can pollute water and soil
C) They turn into compost
D) They evaporate

8. Which university has a battery-powered bell that has been ringing continuously for over 175 years?
A) Harvard University
B) Oxford University
C) Stanford University
D) Cambridge University



READING COMPREHENSION

Electric vehicles (EVs) are revolutionizing the automotive industry, largely due to advancements in battery technology, range capabilities, and charging infrastructure.

The heart of an EV is its battery, typically a lithium-ion type, known for its high energy density and long cycle life. These batteries power the electric motor and other vehicle systems. Innovations in battery chemistry, such as lithium iron phosphate (LFP) and lithium nickel manganese cobalt oxide (Li-NMC), are enhancing performance and sustainability. The cost of EV batteries has significantly decreased, falling by 87% since 2010, making EVs more affordable. Additionally, solid-state batteries are emerging as a promising technology, offering higher energy density and improved safety compared to conventional lithium-ion batteries.

Range anxiety, the fear of running out of battery before reaching a charging station, is diminishing as EV technology improves. Modern EVs can travel between 150 to over 400 miles on a single charge, depending on the model and driving conditions. For instance, the Tesla Model S Long Range can achieve up to 405 miles per charge. Factors such as driving habits, weather, and terrain can affect the actual range. Manufacturers are continuously working on increasing the range of EVs, with some models like the Lucid Air promising up to 520 miles on a single charge.

Charging infrastructure is expanding rapidly, making it easier to recharge EVs. There are three main types of charging: Level 1, Level 2, and DC Fast Charging. Level 1 chargers use standard household outlets and are the slowest, adding about 5 miles of range per hour. Level 2 chargers, often found in homes and public places, use 240-volt outlets and can add about 25 miles of range per hour. DC Fast Chargers are the quickest, providing 100-300+ miles of range in just 30 minutes. The cost of charging varies, with home charging generally being the most economical option. Public charging stations are becoming more prevalent, with networks like Tesla Superchargers, Electrify America, and ChargePoint expanding their reach. Additionally, advancements in wireless charging technology are being explored, which could further simplify the charging process.

♟ 4.5 Read the instructions and the essay written by a student.

Your teacher has asked you to write a for-and-against essay about owning an electric car. In up to 400 words describe the advantages and disadvantages of electric cars.

Electric cars have become increasingly popular as a sustainable alternative to traditional internal combustion engine vehicles. They offer numerous benefits, including reduced emissions and lower operating costs. **However**, there are also challenges and drawbacks associated with their adoption.

On the one hand, there are many advantages of owning an electric car. One of the most significant advantages of electric cars is their environmental impact. Electric vehicles (EVs) produce zero tailpipe emissions, which helps reduce air pollution and greenhouse gas emissions. This is crucial in the fight against climate change and improving urban air quality. **Additionally**, EVs are generally more energy-efficient than gasoline-powered cars, converting a higher percentage of energy from the battery to power the wheels. **Another benefit** is the lower operating costs. Electric cars have fewer moving parts, which means less maintenance and lower repair costs. The cost of electricity is also typically lower than gasoline, resulting in significant savings over the vehicle's lifetime. **Furthermore**, governments around the world offer incentives and subsidies to encourage the adoption of electric cars, making them more accessible to consumers.

On the other hand, **despite** their benefits, electric cars also have several drawbacks. **One of the main challenges** is the limited range of EVs compared to traditional vehicles. Although modern electric cars can travel between 150 to over 400 miles on a single charge, range anxiety remains a concern for many potential buyers. The availability and convenience of charging infrastructure are also issues. While charging networks are expanding, they are still not as widespread or convenient as gasoline stations. Charging times can be lengthy, especially with Level 1 and Level 2 chargers, which can be inconvenient for long-distance travel. **What is more**, the production of electric car batteries involves the extraction of raw materials like lithium, cobalt, and nickel, which can have significant environmental and ethical implications. The disposal and recycling of batteries also pose challenges, as improper handling can lead to environmental contamination.

In conclusion, electric cars offer numerous advantages, including environmental benefits, lower operating costs, and government incentives. **However**, they also face challenges such as limited range, charging infrastructure, and environmental concerns related to battery production and disposal. Having considered all the factors **I believe** that buying an electric car is a great idea.

♟ 4.6 Check the meaning of linking words in bold and explain how they are used and try to find as many synonyms as possible. Check the use of linking words on the opposite page.

- however:
- on the one hand:
- on the otehr hand:
- additionally:
- another benefit
- furthermore
- despite:
- one of the mail challenges:
- what is more:
- in conclusion:
- I believe:

♟ 4.7 Study the outline of an essay with at title "Advantages and Disadvantages of Installing Solar Panels on Your House" and write the essay of up to 400 words.

Introduction
- Introduce solar panels and their growing popularity.
- State the essay's purpose: to discuss pros and cons of residential solar panel installation.

Paragraph 1: Advantages
- Cost Savings: Reduced electricity bills.
- Environmental Benefits: Lower carbon footprint.
- Energy Independence: Less reliance on the grid.
- Property Value: Increased resale value.

Paragraph 2: Disadvantages
- High Initial Costs: Significant upfront investment.
- Weather Dependence: Efficiency affected by weather.
- Space Requirements: Need for sufficient roof space.
- Maintenance: Ongoing upkeep and limited lifespan.

Conclusion
- Summarize key points.
- Provide a balanced view.
- Conclude on overall viability considering individual circumstances.

LINKING WORDS

Linking words, also known as transition words or phrases, are used to connect ideas and ensure the flow of an essay. They help guide the reader through the text and clarify the relationships between different points. Here are some common types of linking words:

SEQUENCE/ORDER:
To begin with, for one thing, in the first place, firstly, next, then, secondly, thirdly, finally, lastly, in the end, to conclude.

CONCLUSION/SUMMARY:
To conclude, to sum up, to summarize, in sum, in summary, finally, in the end, in the final analysis, on the whole, altogether, overall, in short, in a word, in brief, thus, so, then, therefore.

EXPLANATION/REFORMULATION:
So, in other words, that is to say, in fact, as a matter of fact, actually, namely.

EXAMPLE/ILLUSTRATION:
For example, for instance, such as, to illustrate, specifically, namely.

ADDITIONAL SUPPORT/EVIDENCE:
Again, also, and, as well, besides, equally important, moreover, further, furthermore, in addition, additionally, above all, what is more, then.

CAUSE AND EFFECT: posledice
So, therefore, consequently, in consequence, as a result, thus, hence, accordingly.

REFERING/POINTING:
With regard to/regarding, as far as...is considered, talking about, with reference to, in terms of.

EMPHASIS:
Indeed, in fact, of course, truly, even.

NARROWING DOWN:
Particularly, especially, including.

GENERALIZATION:
Generally, on the whole, in most cases, broadly speaking, as a rule.

SHOWING THE ATTITUDE:
In my opinion, personally, I believe, frankly, no doubt, I'm afraid, regretfully, sadly, luckily, fortunately.

EXCEPTION/CONTRAST:
But, yet, still, however, at the same time, although, in spite of, despite, on the one hand ...on the other hand, nevertheless, nonetheless, notwithstanding, thogh, in contrast, by contrast, on the contrary, conversely.

EXPRESSING SIMILARITY:
Similarly, likewise, not only...but also, also, in the same way, just as ... so to.

TIME EXPRESSIONS:
Before, easily, now, currently, then, subsequently, later, after, afterward, immediately, during, siultaniously, recently, meanwhile, at last, nowadays.

FOR-AND-AGAINST ESSAY

A for-and-against essay states advanteges and disadvanteges of a certain topic. It is usually written with linking words in this manner:

INTRODUCTION:

1. Nowadays there more and more...+TOPIC (state the topic)
2. There are several advantages to ..., however there are also some arguments against it which we should consider. (state the type of essay-for/against)

MAIN BODY PARAGRAPH:

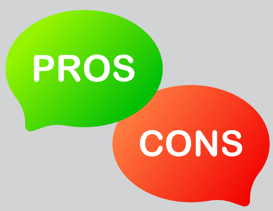
3. On the one hand, there are several advantages to +TOPIC it. (topic sentence)
4. Firstly, +ARGUMENT FOR #1
5. To illustrate, /As a result, + JUSTIFY ARGUMENT #1
6. Secondly, +ARGUMENT FOR #2
7. For instance, /Consequently, + JUSTIFY ARGUMENT #2
8. Thirdly, +ARGUMENT FOR #3
9. To exemplify, /In this manner, + JUSTIFY ARGUMENT #3

MAIN BODY PARAGRAPH:

10. On the other hand, ...TOPIC... has certain disadvantages which should be taken into account.
11. To begin with, +ARGUMENT AGAINST #1
12. For example, /Therefore, +JUSTIFY ARGUMENT #1
13. Furthermore, +ARGUMENT AGAINST #2
14. Specifically, / In this way, +JUSTIFY ARGUMENT #2
15. Above all, + ARGUMENT AGAINST #3
16. Due to this/Thus, +JUSTIFY ARGUMENT #3

CONCLUSION:

17. All things considered, although there are (dis)advantages to ...TOPIC..., I am convinced that +YOUR OPINION.
18. Therefore, + JUSTIFY YOUR OPINION



PRESENT PERFECT

The Present Perfect tense is used to describe actions or events that have occurred at an unspecified time before now. The exact time is not important.

Rules for Present Perfect Tense:

1. **To describe an action that happened at an unspecified time in the past**:
   - Example: I have installed solar panels on my roof.
   - Example: She has upgraded her home's electrical system.
2. **To describe an action that started in the past and continues up to the present**:
   - Example: They have used renewable energy for years.
   - Example: We have relied on battery storage since last year.
3. **To describe a repeated action that has occurred several times before now**:
   - Example: The team has conducted multiple tests to improve the battery's performance.
   - Example: They have measured the voltage several times to ensure consistency.
4. **To describe an action that has a present result or relevance**:
   - Example: The development of lithium-ion batteries has transformed the electric vehicle industry.
   - Example: The new inverter has enhanced the efficiency of the solar power system.

In academic writing, the Present Perfect tense may be used in the following examples related to electricity:

Unspecified Time in the Past:

- Scientists have discovered new ways to enhance battery life.
- Researchers have developed innovative methods for improving solar panel efficiency.

Action Continuing Up to the Present:

- Engineers have been studying the impact of renewable energy integration on the grid for years.
- The power plant has maintained its high standards of efficiency since its inception.

Repeated Action:

- The team has conducted multiple tests to optimize the performance of electric motors.
- They have inspected the electrical systems several times to ensure reliability.

Present Result or Relevance:

- The development of smart grid technology has transformed energy distribution.
- The new battery technology has significantly increased the range of electric vehicles.

Present Perfect Continuous

The Present Perfect Continuous tense is used to describe actions that started in the past and are still continuing or have recently stopped but have a present relevance.

PRESENT PERFECT

Rules for Present Perfect Continuous Tense:

To describe an action that started in the past and is still continuing:

- Example 1: Scientists have been researching the impact of renewable energy on the electrical grid.
- Example 2: The team has been analyzing the performance data of the new solar panels for weeks.

To describe an action that has recently stopped but has a present relevance:

- Example 1: Engineers have been working on improving battery storage systems, and they just presented their findings.
- Example 2: Technicians have been studying the efficiency of electric vehicle chargers, and their results are now published.

Key Differences between the Present Perfect Simple and Continuous tense:

- **Result vs. Duration**: Present Perfect Simple focuses on the result, while Present Perfect Continuous focuses on the duration.
- **Completion vs. Continuation**: Present Perfect Simple is used for completed actions, while Present Perfect Continuous is used for actions that are still continuing or have recently stopped.
- **Specific vs. Ongoing**: Present Perfect Simple can indicate specific instances (how many times), while Present Perfect Continuous emphasizes ongoing or repeated actions.

GRAMMAR EXERCISES

♟ 4.8 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Perfect and Present Perfect Continuous.

1. Scientists ________ (discover) new ways to store electricity efficiently.
2. Engineers ________ (work) on improving the efficiency of solar panels for years.
3. The team ________ (install) advanced battery systems in several homes.
4. Researchers ________ (study) the impact of electric vehicles on the grid since last year.
5. The company ________ (develop) a new type of inverter for renewable energy systems.
6. Technicians ________ (monitor) the performance of the wind turbines all week.
7. Homeowners ________ (benefit) from lower electricity bills due to solar panel installations.
8. The power plant ________ (upgrade) its equipment to reduce emissions.

♝ 4.9 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Perfect and Present Perfect Continuous.

John is an electrical engineer who has been working on a new project. He (1) ________ (design) a smart grid system that can efficiently manage electricity distribution. His team (2) ________ (test) the system for several months. They (3) ________ (identify) several areas for improvement and (4) ________ (implement) changes accordingly.
Recently, John (5) ________ (receive) recognition for his innovative work. He (6) ________ (give) presentations at various conferences to share his findings. His colleagues (7) ________ (support) him throughout the project, and they (8) ________ (contribute) valuable insights.
Meanwhile, the company (9) ________ (invest) in renewable energy sources to complement the smart grid. They (10) ________ (install) solar panels and wind turbines at multiple locations. The new system (11) ________ (reduce) energy costs and (12) ________ (increase) efficiency.
John's team (13) ________ (monitor) the performance of the smart grid continuously. They (14) ________ (collect) data to analyze its effectiveness. The results (15) ________ (show) significant improvements in energy management.
John (16) ________ (plan) to expand the project to other regions. He (17) ________ (collaborate) with other experts to enhance the system further. The success of the project (18) ________ (demonstrate) the potential of smart grids in transforming energy distribution.

♝ 4.10 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Present Perfect and Present Perfect Continuous.

Sarah is a technician who has been addressing power shortages in her community. She (1) ________ (identify) the main causes of frequent outages. Her team (2) ________ (work) on solutions to stabilize the power supply. They (3) ________ (install) backup generators at critical locations.
Recently, Sarah (4) ________ (receive) feedback from residents about the improvements. She (5) ________ (organize) community meetings to discuss further steps. Her colleagues (6) ________ (support) her efforts by providing technical expertise.
Meanwhile, the utility company (7) ________ (upgrade) the infrastructure to prevent future shortages. They (8) ________ (monitor) the power grid continuously. The new measures (9) ________ (reduce) the frequency of outages.
Sarah's team (10) ________ (collect) data to analyze the effectiveness of the upgrades. The results (11) ________ (show) significant improvements in power reliability.

PAST PERFECT

The past perfect tense is used to describe actions that were completed before another action in the past.

Rules for Past Perfect Tense

1. **To indicate an action that was completed before another action in the past**:
   - Example 1: The electrician had repaired the circuit before the power outage occurred.
   - Example 2: By the time the technician arrived, the engineers had already tested the new equipment.
2. **To show an action that happened before a specific time in the past**:
   - Example 1: The utility company had restored power by 5 PM yesterday.
   - Example 2: The maintenance team had completed the upgrades before the storm last week.
3. T**o express a condition in the past that led to a result**:
   - Example: The power outage occurred because the transformer had overheated.
   - Example: The circuit had failed because the wires had not been connected properly.
4. **To describe an action that was completed before another action in a narrative**:
   - Example: After the engineer had repaired the generator, the power supply was restored.
   - Example: Once the technician had installed the new fuse, the electrical system functioned correctly.

GRAMMAR EXERCISES

4.11 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Perfect and Past Simple.

1. The lights ________ (go out) because the electrician ________ (not fix) the wiring properly.
2. After the power plant ________ (generate) enough electricity, the city ________ (have) a stable power supply.
3. The technician ________ (check) the circuit after the fuse ________ (blow).
4. Once the engineer ________ (install) the new transformer, the voltage ________ (stabilize).
5. The computer ________ (shut down) because the battery ________ (run out) of charge.

♟ 4.12 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Perfect and Past Simple.

1. The technician ________ (repair) the circuit after the power ________ (go out).
2. The engineer ________ (finish) the installation before the electricity ________ (come back).
3. The lights ________ (turn off) because the electrician ________ (not connect) the wires properly.
4. After the generator ________ (start), the building ________ (have) power again.
5. The computer ________ (restart) after the technician ________ (replace) the faulty component.
6. The power ________ (fail) because the transformer ________ (overheat).
7. The technician ________ (test) the system after the fuse ________ (blow).
8. The engineer ________ (complete) the repairs before the power ________ (return).
9. The lights ________ (flicker) because the voltage ________ (fluctuate).
10. After the battery ________ (charge), the device ________ (work) properly.
11. The power ________ (go out) because the circuit breaker ________ (trip).
12. The technician ________ (check) the wiring after the lights ________ (dim).
13. The generator ________ (start) after the engineer ________ (fix) the issue.
14. The computer ________ (shut down) because the battery ________ (deplete).
15. The power ________ (restore) after the technician ________ (repair) the fault.
16. The lights ________ (come on) because the electrician ________ (resolve) the problem.
17. After the voltage ________ (stabilize), the equipment ________ (operate) smoothly.
18. The technician ________ (inspect) the system after the power ________ (surge).
19. The generator ________ (fail) because the fuel ________ (run out).
20. The power ________ (cut off) because the technician ________ (not replace) the damaged cable.
21. The lights ________ (brighten) after the engineer ________ (adjust) the settings.
22. The computer ________ (boot up) after the technician ________ (install) the new software.

♝ 4.13 Complete the story by filling in the blanks with the correct form of the verb in brackets. Use only Past Perfect and Past Simple.

1. The electrician ________ (disconnect) the power before he ________ (touch) the wires.
2. She ________ (test) the voltage after the circuit ________ (fail).
3. We ________ (not notice) the blown fuse until the lights ________ (go) out.
4. They ________ (finish) wiring the panel before the inspector ________ (arrive).
5. The battery ________ (leak) because someone ________ (damage) the casing.
6. After the team ________ (calculate) the load, they ________ (install) the transformer.
7. He ________ (not realize) the socket was live until he ________ (get) a shock.
8. Once the generator ________ (start), the emergency lights ________ (come) on.
9. The technician ________ (repair) the motor that ________ (stop) the previous day.
10. When the storm ________ (hit), the power line ________ (already / collapse).
11. She ________ (not proceed) with the test until the system ________ (cool) down.
12. They ________ (reset) the circuit breaker after the overload ________ (occur).
13. I ________ (never / see) a capacitor fail before it ________ (explode) in the lab.
14. He ________ (complete) the installation before the voltage ________ (spike).
15. The display ________ (not work) because we ________ (forget) to connect the power.
16. We ________ (already / identify) the fault when the supervisor ________ (arrive).
17. The fuse ________ (blow) after we ________ (switch) on the heater.
18. She ________ (shut down) the power supply before she ________ (open) the unit.
19. They ________ (order) new cables because the old ones ________ (fray).
20. After the technician ________ (check) the circuit, he ________ (replace) the relay.
21. The machine ________ (stop) working because it ________ (not receive) enough current.
22. I ________ (disconnect) the device after I ________ (notice) a burning smell.
23. The lights ________ (flicker) after the electrician ________ (repair) the faulty connection.
24. We ________ (not start) the experiment until the voltage ________ (stabilize).
25. She ________ (realize) the wire was loose after she ________ (measure) the resistance.
26. The battery charger ________ (overheat) because someone ________ (leave) it on all night.
27. After the power ________ (return), the technicians ________ (check) all systems for damage.

ANSWER KEY

1.1

1. Voltage (V) – Napetost (V)
2. Current (I) – Tok (I)
3. Resistance (R) – Upornost (R)
4. Ohm's Law – Ohmov zakon
5. Conductors – Prevodniki
6. Insulators – Izolatorji
7. Circuit – Krog
8. Electrons – Elektroni
9. Power (P) – Moč (P)
10. Watt (W) – Vat (W)
11. Amperes (A) – Amperi (A)
12. Ohms (Ω) – Ohmi (Ω)
13. Series Circuit – Serijski krog
14. Parallel Circuit – Vzporedni krog
15. Electromotive Force (EMF) – Elektromotorna sila (EMS)
16.

1.2

1 - H
2 - G
3 - C
4 - M
5 - K
6 - L
7 - A
8 - D
9 - N
10 - B
11 - G
12 - F
13 - I
14 - J
15 – O

1.3

Electricity is a form of energy that flows through a closed path called a (1) Circuit. The movement of (2) Electrons through this path creates an electric (3) Current (I), measured in (4) Amperes (A). The force that pushes the current through the circuit is called (5) Electromotive Force (EMF), and it's measured in volts (6) Voltage (V).

Materials that allow electricity to flow easily are called (7) Conductors, while those that block the flow are known as (8) Insulators. The opposition that slows down the current is called (9) Resistance (R), and it's measured in (10) Ohms (Ω).

(11) Ohm's Law helps us understand the relationship between voltage, current, and resistance: $V = I \times R$. The rate at which electrical energy is used or transferred is known as (12) Power (P), measured in (13) Watt (W).

In a (14) Series Circuit, all components are connected one after the other, while in a (15) Parallel Circuit, they are connected alongside each other, offering multiple paths for current to flow.

ANSWER KEY

1.4

1. repairs (Present Simple)
2. is working (Present Continuous)
3. is wearing (Present Continuous)
4. is checking (Present Continuous)
5. tests (Present Simple)
6. replaces (Present Simple)
7. is helping (Present Continuous)
8. are inspecting (Present Continuous)
9. knows (Present Simple)
10. are following (Present Continuous)
11. shows (Present Simple)
12. is analyzing (Present Continuous)
13. is looking (Present Continuous)
14. solves (Present Simple)
15. explains (Present Simple)

1.5

1. is studying (Present Continuous)
2. attends (Present Simple)
3. is installing (Present Continuous)
4. is following (Present Continuous)
5. are observing (Present Continuous)
6. checks (Present Simple)
7. explains (Present Simple)
8. enjoys (Present Simple)
9. understands (Present Simple)
10. applies (Present Simple)
11. is connecting (Present Continuous)
12. is showing (Present Continuous)
13. will finish (Future Simple – Note: This is a future action, different from the required present tenses)
14. takes (Present Simple)
15. is learning (Present Continuous)

1.6

1. works (Present Simple)
2. is repairing (Present Continuous)
3. is malfunctioning (Present Continuous)
4. knows (Present Simple)
5. is examining (Present Continuous)
6. measures (Present Simple)
7. is taking (Present Continuous)
8. test (Present Simple)
9. are installing (Present Continuous)
10. are ensuring (Present Continuous)
11. works (Present Simple)
12. is supervising (Present Continuous)
13. requires (Present Simple)
14. will function (Future Simple) – Note: "will" is used for a future action in the context, but the rest of the sentence is in the required present tenses
15. takes (Present Simple)

2.1

1. Energy - E
2. Force - N
3. Work - L
4. Power - M
5. Kinetic Energy - B
6. Potential Energy - O
7. Newton - D
8. Joule - H
9. Watt - A
10. Mechanical Energy - J
11. Thermal Energy - G
12. Electrical Energy - I
13. Gravitational Force - K
14. Friction - F
15. Conservation of Energy – C

ANSWER KEY

2.2

1.Energy - Energija
2.Force - Sila
3.Work - Delo
4.Power - Moč
5.Kinetic Energy - Kinetična energija
6.Potential Energy - Potencialna energija
7.Transfer – Prenos
8.Electricity-elektrika
9.Mechanical Energy - Mehanska energija
10.Thermal Energy - Toplotna energija
11.Electrical Energy - Električna energija
12.Gravitational Force - Gravitacijska sila
13.Friction - Trenje
14.Conservation of Energy - Ohranjanje energije

2.4

1.B
2.C
3.A
4.C
5.B
6.B
7.C
8.A

2.3

Unit of Measurement	Symbol	What It Measures	Explanation
Volt	V	Electric potential or voltage	The difference in electric potential between two points.
Ampere	A	Electric current	The flow of electric charge per second.
Ohm	Ω	Electrical resistance	The opposition to the flow of electric current.
Watt	W	Power	The rate at which energy is used or produced.
Joule	J	Energy or work	The amount of work done when a force moves an object over a distance.
Coulomb	C	Electric charge	The quantity of electric charge.
Farad	F	Capacitance	The ability of a system to store electric charge.
Hertz	Hz	Frequency	The number of cycles per second in an alternating current.

ANSWER KEY

2.5
1.High-efficiency photovoltaic cells and larger, more efficient wind turbines.
2.AI-powered systems optimize workflows, predict maintenance needs, and improve decision-making processes.
3.Hypersonic systems can travel at speeds greater than Mach 5 and are particularly evident in the military and aerospace sectors.
4.Gallium nitride (GaN) and silicon carbide (SiC).
5.Modern robots perform complex tasks with precision and consistency, reducing the need for human intervention in hazardous environments.
6.Autonomous drones and robotic systems perform reconnaissance, surveillance, and combat tasks, reducing the risk to human soldiers.
7.Ultra-wide-bandgap materials like diamond and gallium oxide are expected to enhance power conversion technologies with exceptional thermal conductivity and electrical properties.
8.AI and advanced semiconductor materials are enabling smarter and more sustainable energy solutions, driving the next generation of power electronics.

2.6
1.decided
2.was studying
3.called
4.were talking
5.went
6.realized
7.had forgotten
8.was fixing
9.heard
10.turned
11.was sparking
12.was working
13.arrived
14.completed

2.7
1.decided
2.was assembling
3.noticed
4.were discussing
5.exploded
6.realized
7.had used
8.was replacing
9.heard
10.turned
11.was overheating
12.was cooling
13.arrived
14.finished

ANSWER KEY

2.8
1.started
2.were designing
3.discovered
4.were discussing
5.suggested
6.were implementing
7.began
8.were working
9.were testing
10.noticed
11.corrected
12.continued
13.were monitoring
14.stabilized
15.celebrated

2.9
1.installs
2.was running, produced
3.check
4.went
5.was repairing, flickered
6.are testing
7.is measuring
8.were inspecting, overheated
9.explains
10.upgraded
11.blew
12.was connecting, was restored
13.discovered
14.was testing, tripped
15.records

2.10
1.started
2.install
3.were working
4.was running
5.produced
6.went
7.was repairing
8.flickered
9.are testing
10.is measuring
11.were inspecting
12.overheated
13.explains
14.upgraded
15.blew
16.was connecting
17.was restored
18.discovered
19.was testing
20.tripped
21.records

2.11
1.undertook
2.assemble
3.were calibrating
4.fluctuated
5.triggered
6.failed
7.was diagnosing
8.dimmed
9.are monitoring
10.is adjusting
11.were inspecting
12.burst

ANSWER KEY

13.demonstrates
14.integrated
15.short-circuited
16.was configuring
17.stabilized
18.identified
19.was verifying
20.activated
21.logs

2.12
1.began
2.conducted
3.was flying
4.discovered
5.invented
6.was working
7.are exploring
8.developed
9.was experimenting
10.faced
11.use
12.became
13.were building
14.began
15.improve

2.13
1.started
2.generate
3.were operating
4.monitored
5.opened
6.were installing
7.rose
8.are researching
9.emerged
10.were developing
11.became
12.produce
13.completed
14.were testing
15.ensured

2.14
1.undertook
2.designed
3.were testing
4.malfunctioned
5.caused
6.failed
7.was analyzing
8.crashed
9.are working
10.discovered
11.were attempting
12.arose
13.decided
14.are planning
15.were discussing
16.realized

3.1
Students' own answers

ANSWER KEY

3.2
Transalation: student's own answer
1.Fossil Fuels: Natural fuels like coal, oil, and gas used for energy.
2.Renewable Energy: Sustainable energy from sources like wind, solar, and hydro.
3.Wind Turbines: Devices that convert wind into electricity.
4.Solar Photovoltaics (PV): Panels that turn sunlight into electricity.
5.Hydropower: Electricity from flowing or falling water.
6.Geothermal Power: Energy from Earth's internal heat.
7.Nuclear Fission: Splitting atomic nuclei to release energy.
8.Energy Storage: Systems to store energy for later use.

3.3
1.penstock
2.turbine
3.turbine
4.kinetic
5.electrical
6.generator
7.head
8.flow rate
9.storage
10.run-of-river
11.micro-hydropower
12.greenhouse gas
13.ecosystems
14.efficiency

3.4
1.J
2.A
3.B
4.C
5.D
6.E
7.F
8.G
9.H
10.I

3.5
1.are definitely going to install
2.will probably test
3.is soon going to stabilize
4.is definitely going to analyze
5.will definitely reduce
6.will definitely check
7.is clearly going to shut down
8.are definitely going to upgrade
9.is soon going to fail
10.will soon start
11.will definitely improve
12.is definitely going to inspect
13.is clearly going to short-circuit
14.will definitely develop
15.will probably increase

3.6
1.are going to install
2.will start
3.will reduce
4.will test
5.will generate
6.are going to upgrade
7.will complete

ANSWER KEY

3.7
1. are going to start
2. are going to install
3. will improve
4. will test
5. am going to help
6. are going to run
7. will overheat
8. will submit

3.8
1. are going to start
2. are going to install
3. will improve
4. will test
5. am going to help
6. are going to run
7. will overheat
8. will submit
9. are going to set up
10. will review
11. will appreciate
12. are not going to shut down
13. is going to present
14. will need
15. is going to start

3.9
1. arrives
2. are going to install
3. upgrades
4. is checking
5. are going to replace
6. will generate
7. are going to use
8. are working
9. will invest
10. produce
11. is conducting
12. come
13. is going to launch
14. will provide
15. are inspecting

3.10
1. is organizing
2. starts
3. is gathering
4. will analyze
5. will provide
6. records
7. will present
8. will debate
9. will design
10. will compile
11. contains
12. will submit
13. will examine
14. will incorporate

will acknowledge

ANSWER KEY

3.11
1. hosts
2. will give
3. are participating
4. are preparing
5. are setting up
6. will install
7. will be
8. are demonstrating
9. will answer
10. will announce
11. are going to offer
12. will take place
13. will teach
14. begins
15. lasts
16. is launching
17. will distribute
18. include

3.12
1. leave
2. comes
3. notice
4. starts
5. receive
6. use
7. finish
8. rises

3.13
1. will install, arrives
2. will check, leaves
3. comes, will restart
4. will fix, inspects
5. rises, will start
6. will call, continues
7. will upgrade, receive
8. blows, will generate
9. will launch, finish
10. will save, use
11. will conduct, arrive
12. will replace, starts
13. charges, will be
14. will announce, complete
15. will switch, come
16. will upgrade, receive
17. starts, will provide
18. will install, leaves
19. passes, will check
20. will analyze, collect
21. arrives, will inspect
22. will replace, burn
23. will offer, launch
24. fails, will activate
25. will test, install
26. will monitor, are
27. will fix, leaves
28. are, will reduce

ANSWER KEY

3.14
1. will repair, arrives
2. will upgrade, is
3. will send, passes
4. come, will switch
5. will test, finish
6. will save, use
7. will check, leaves
8. is, will work
9. will launch, complete
10. will monitor, are
11. will analyze, collect
12. arrives, will inspect
13. will replace, fails
14. will announce, review
15. will upgrade, receive

3.15
1.will host
2.will give
3.will participate
4.are preparing
5.are setting up
6.will install
7.will be
8.will demonstrate
9.will answer

3.16
1.Ancient civilizations such as the Greeks and Romans.
2.Cragside, a country house in Northumberland, England.
3.Benoit Fourneyron in 1827.
4.The Pelton wheel, invented by Lester Allan Pelton.
5.The Francis turbine.
6.It was the first commercial installation using alternating current technology.
7.Hoover Dam and Grand Coulee Dam.
8.Impoundment, diversion, and pumped storage.
9.By using dams to store water in reservoirs and releasing it through turbines.
10.They store energy by pumping water to a higher elevation during low demand periods and releasing it to generate electricity during peak demand.
11.Variable speed turbines and fish-friendly technologies.
12.Upgrading outdated components and implementing advanced control systems.

3.17
1.Photovoltaic (PV)
2.Semiconductor
3.Monocrystalline
4.Polycrystalline
5.Inverter
6.Greenhouse gas emissions
7.Intermittent
8.Subsidies
9.Infrastructure
10.Sustainable

ANSWER KEY

3.18
1.C
2.B
3.A
4.B
5.B

3.19
1.Environmental Impact
2.Types of Tidal Power Systems
3.Historical Development
4.Advantages of Tidal Power
5.Challenges and Future Prospects
6.How Tidal Power Works

4.1
1.Capacitor
2.Inverter
3.Smart Grid
4.Supercapacitor
5.Energy Density
6.Load Shifting
7.Electrochemical Storage
8.Distributed Generation
9.Microgrid
10.Power Outage

4.2
1.D
2.E
3.F
4.H
5.G
6.I
7.C
8.A
9.J
10.B

4.3
1.B
2.C
3.D
4.B
5.A
6.C
7.B
8.B

4.4
1.Types of batteries: Lithium-ion, LFP, Li-NMC; high energy density, long cycle life.
2.Range improvement: 150-400+ miles; affected by driving habits, weather, terrain.
3.Charging types: Level 1 (5 miles/hour), Level 2 (25 miles/hour), DC Fast Charging (100-300+ miles/30 minutes).
4.Environmental benefits: Zero tailpipe emissions, lower lifecycle emissions, battery recycling.
5.Economic and social benefits: Job creation, government incentives, energy security, quieter driving experience.

4.5 /

4.6
Students' own answers

4.7
Students' own answers

ANSWER KEY

4.8
1.have discovered
2.have been working
3.have installed
4.have been studying
5.have developed
6.have been monitoring
7.have benefited
8.have upgraded
9.have been testing

4.9
1.has designed
2.have been testing
3.have identified
4.have implemented
5.has received
6.has given
7.have supported
8.have contributed
9.has invested
10.have installed
11.has reduced
12.has increased
13.have been monitoring
14.have collected
15.have shown
16.has been planning
17.has been collaborating
18.has demonstrated

4.10
1.has identified
2.have been working
3.have installed
4.has received
5.has organized
6.have supported
7.has upgraded
8.have been monitoring
9.have reduced
10.have collected
11.have shown

4.11
1.had gone out, had not fixed
2.had generated, had
3.had checked, had blown
4.had installed, stabilized
5.had shut down, had run out

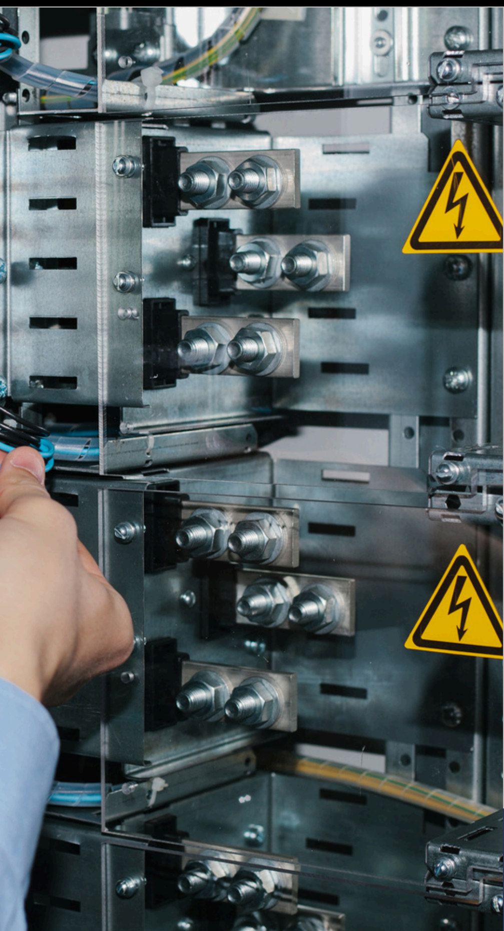
ANSWER KEY

4.12
1.had repaired, went out
2.had finished, came back
3.had turned off, had not connected
4.had started, had
5.had restarted, had replaced
6.had failed, had overheated
7.had tested, had blown
8.had completed, returned
9.had flickered, had fluctuated
10.had charged, worked
11.went out, had tripped
12.had checked, dimmed
13.started, had fixed
14.shut down, had depleted
15.restored, had repaired
16.came on, had resolved
17.had stabilized, operated
18.had inspected, surged
19.failed, had run out
20.cut off, had not replaced
21.brightened, had adjusted
22.booted up, had installed

4.13
1.had repaired, went out
2.had finished, came back
3.had turned off, had not connected
4.had started, had
5.had restarted, had replaced
6.had failed, had overheated
7.had tested, had blown
8.had completed, returned
9.had flickered, had fluctuated
10.had charged, worked
11.went out, had tripped
12.had checked, dimmed
13.started, had fixed
14.shut down, had depleted
15.restored, had repaired
16.came on, had resolved
17.had stabilized, operated
18.had inspected, surged
19.failed, had run out
20.cut off, had not replaced
21.brightened, had adjusted
22.booted up, had installed

ENGLISH VOCABULARY AND GRAMMAR

FOR ELECTRICAL ENGINEERING



English Vocabulary and Grammar for Electrical Engineering is an English for specific purposes coursebook.
It is based on the latest methodological approaches, including:

- **Technical vocabulary related to electrical engineering**
- **Grammar for academic purposes with explanations and examples**
- **Reading comprehension articles based on the latest scientific advances**
- **Grammar exercises with examples related to electrical engineering**
- **Answer key**

dr. Eva Boh