Grade 7

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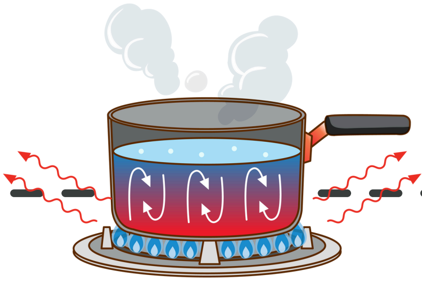
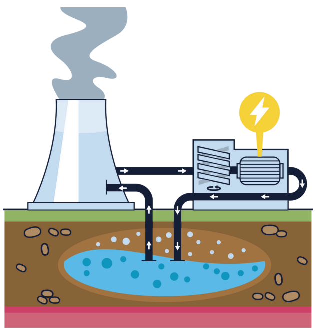


term 3

topics

- heat as a transfer of energy
- sources or energy
- National Grid
- potential and kinetic energy
- save electricity
- key words
- worksheet



quick overview

Sources of energy

Energy = ability to do work. Sources store or produce energy. Two big groups: renewable (won't run out: wind, solar, geothermal, hydropower, biomass) and non-renewable (will run out: fossil fuels—coal, oil, natural gas—and nuclear via uranium fission).

Potential vs kinetic

Potential = stored energy (stretched bands, springs, fuels, food). Measured in joules (J).
Kinetic = energy of moving objects; faster = more kinetic energy. Mechanical energy = potential + kinetic (e.g., a waterfall at the edge has high potential; falling water has kinetic).

Law of Conservation of Energy

Energy cannot be created or destroyed—only transferred/converted (mechanically, electrically, or by heating). Example: TV converts electrical → light + sound; car converts chemical (fuel) → kinetic + heat.

Heating as energy transfer

Heat flows hot → cold by:
Conduction (solids in contact; metals = good conductors; wood/plastic = insulators),
Convection (movement in liquids/gases; makes convection currents),
Radiation (EM waves; needs no medium; dark surfaces absorb more, shiny/light reflect/emit).

Energy transfer to surroundings

Devices have input energy and useful output; some is wasted (often heat/sound/light). E.g., cars may waste ~65% as heat; coal power stations ~50%. Sankey diagrams show this.

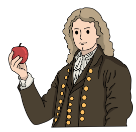
National electricity supply (the grid)

Various sources (coal, oil, gas, nuclear, solar, wind, geothermal, water) create heat → steam → turbine → generator → electricity → grid → pylons/cables to users. Small dynamos make tiny amounts from motion.

Conserving electricity (home)

Electricity is costly; SA's system is strained (load-shedding). Save by switching off lights, dressing warm instead of heaters, boiling only needed water, matching pot to plate, and using efficient bulbs/appliances.

⚖️ Law of Conservation of Energy



- Energy cannot be created or destroyed.
- It can only change from one form to another or be transferred between objects.

(a) The total amount of energy in a system stays the same, even if it changes form.
(b) Energy is transferred whenever systems interact (e.g., when you switch on a kettle).
(c) Energy transfer = energy changing from one form to another.
(d) Energy transfer can happen:

- **Mechanically**: e.g., a car engine moves wheels (chemical → kinetic).
- **Electrically:** e.g., a light bulb (electrical → light + heat).
- **By heating**: heat flows from hot → cold objects.

🌟 Real-Life Examples

Light bulb: Electrical → Light + Heat.
Car: Chemical (fuel) → Kinetic (motion) + Sound + Heat.
Human body: Chemical (food) → Kinetic (movement) + Heat.
Solar panels: Light (from Sun) → Electrical energy.

✅ Key Rule to Remember:

Energy never disappears. If it looks "lost," it has usually changed into a form that is less useful, like wasted heat or sound.

Heating as a Transfer of Energy

- Heat always flows from hot (less dense)→ cold (more dense)
- No heat transfer occurs if objects are at the same temperature.

Heat can move in three ways:

1. Conduction (solids, particle collisions)
2. Convection (liquids & gases, particle movement)
3. Radiation (waves, no medium needed)

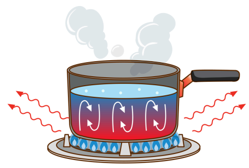
1 Conduction

Definition: Transfer of heat through direct contact between particles in a solid.

How it works: Particles in a hot region vibrate faster and bump into their neighbors, passing energy along.

Examples:

- A metal spoon getting hot when left in boiling water.
- Pots and pans made from metals (good conductors).



Good vs poor conductors: these have an effect on the conduction rate

Metals (copper, steel, aluminium) = excellent conductors.

Wood, plastic, Styrofoam = poor conductors → used as insulators (handles of pots, cooler boxes).

2 Convection

Definition: Heat transfer in liquids and gases due to movement of particles.

How it works:

Heated fluid expands, becomes less dense, and rises.

Cooler, denser fluid sinks.

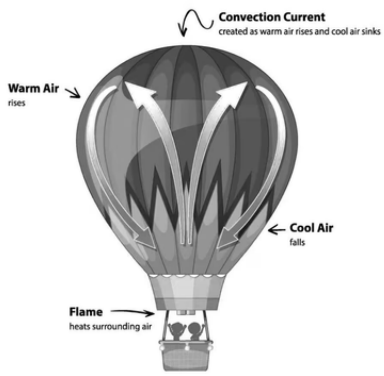
This continuous cycle = convection current.

Examples:

Boiling water: bubbles and water swirl around.

Sea breeze: warm air over land rises during the day, cool air from t

Hot air balloons rise because heated air inside is less dense.



3 Radiation

Definition: Transfer of energy as electromagnetic waves (infrared radiation), no medium and contact needed.

How it works: Heat travels in waves from a source and can move through space or air.

Examples:

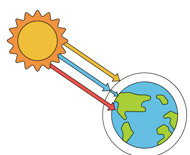
Feeling the sun's warmth on your skin.

Heat from a fire when you're not touching it.

Surface effects:

Dark, matte surfaces absorb radiation → heat up faster.

Light, shiny surfaces reflect radiation → stay cooler.



That's why car dashboards get hot in summer, but foil blankets keep warmth in during emergencies.

Heat Transfer	State of Matter	How Particles Behave	Medium Needed?	Speed / Efficiency	Examples in Daily Life	Limitations
Conduction 🔥	Mostly **solids** (best in metals)	Particles vibrate in place and pass energy to neighbors through collisions. Free electrons in metals speed up the process.	Needs matter in contact (direct touch).	Fastest in metals, slower in wood/plastic, almost none in air.	- Metal spoon in hot tea gets hot 🌡️ - Frying egg in a pan 🍳 - Ironing clothes 👕	- Limited to solids in contact. - Slow in insulators (plastic, wood). - Can burn skin if not managed.
Convection 🌊	**Liquids & gases**	Warm fluid expands, less dense → rises. Cooler fluid contracts, denser → sinks. Continuous **convection currents** form.	Requires liquid or gas medium.	Faster than conduction in fluids; moves heat over larger areas.	- Boiling water swirls in a pot 🍲 - Sea breeze & wind currents 🌬️ - Hot air balloon rising 🎈 - Radiators warming a room 🏠	- Doesn't work in solids. - Uneven heating can cause turbulence.
Radiation ☀️	Works in **any state** (even in vacuum).	No particles needed. Energy moves as **infrared electromagnetic waves**.	No medium required; travels through space.	Can be very fast (speed of light); effectiveness depends on surface colour and texture.	- Sun heating Earth ☀️🌍 - Heat from campfire 🔥 - Warmth from a light bulb 💡 - Microwave oven (radiation cooking) 🍲	- Surfaces matter: dark absorbs more, shiny reflects. - Can cause overheating or burns if uncontrolled.

🔑 Key Heat Transfer Terms

<u>**Heat**</u>

- Energy that always flows from hot → cold.

Example: a hot cup of tea loses heat to the cooler air.

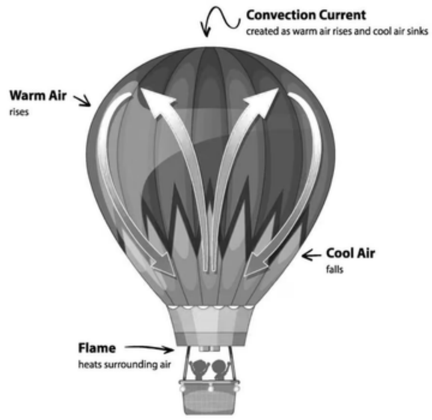
- **Heat transfer :** The process of heat moving from one place to another.
- **Three methods :** conduction, convection, radiation.

- <u>**Conduction**</u>

Transfer of heat in solids.
Happens when vibrating particles collide and pass energy along.
Example: metal spoon in hot soup heats up.

- <u>**Convection**</u>

Transfer of heat in liquids and gases.
Heat carried by the actual movement of particles.
Example: boiling water circulates; warm air rises, cool air sinks.



- <u>**Radiation**</u>

Transfer of heat through waves (infrared).
Needs no contact and no medium (can travel through space).
Example: heat from the Sun, warmth from a fire.

<u>Convection current</u>

- A cycle where warm, less dense fluid rises and cooler, denser fluid sinks.

Example: sea breezes, boiling water currents.

<u>Heat conductor</u>

- A material that allows heat to move through it quickly and easily.

Examples: metals (copper, aluminium, steel).

<u>Heat insulator</u>

- A material that blocks or slows heat transfer.

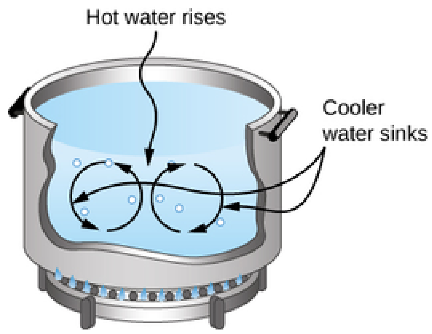
Examples: wood, plastic, Styrofoam, wool.
Used for safety (pot handles, cooler boxes).

🌊 Convection Currents Explained

Definition:
When a liquid or gas is heated unevenly, warmer parts expand and become less dense → they rise, while cooler, denser parts sink. This movement sets up a circular flow called a convection current.
Key point: The cycle continues until the whole liquid or gas reaches the same temperature, then convection stops

🍲 <u>Convection in a Pot of Water</u>

- Heating starts → The fluid at the bottom gets heated first.
- Particles expand → Hot fluid becomes lighter / less dense.
- Hot fluid rises → It moves upward through the cooler fluid.
- Cool fluid sinks → Cooler, denser fluid moves down to take its place.
- Cycle repeats → This creates a continuous circular current until the temperature becomes equal everywhere.



🌞 Step-by-Step Heat Transfer in the Atmosphere

1. **Radiation**

- The Sun's rays travel through space as electromagnetic waves.
- They reach Earth's surface and heat the ground directly.

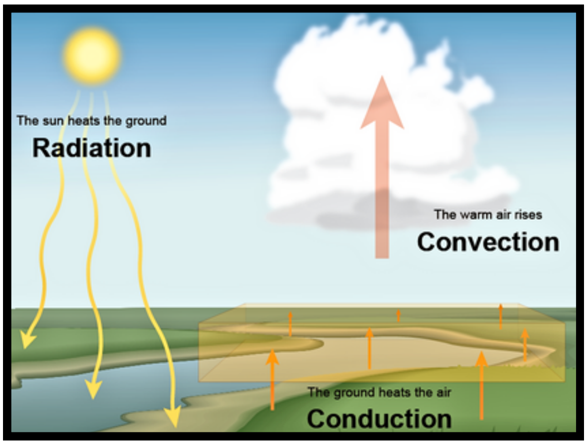
Key point: No medium needed — radiation works even in the vacuum of space.

2. **Conduction**

Once the ground is hot, it transfers heat to the air molecules in direct contact with it.
This happens by particle collisions — exactly like a hot pot heating the handle of a spoon.
Key point: Conduction only works at the boundary where the ground touches the air.

3. **Convection**

The air that touches the ground warms up, expands, and becomes less dense.
This warm air rises upward, while cooler, denser air sinks down to replace it.
The cycle creates convection currents that move heat through the atmosphere.



🔋 Sources of Energy

What is a source of energy?
A source of energy is where stored energy comes from.
This stored energy (called potential energy) is released when it burns or is used.

Example: coal or wood burning releases heat and light energy.

- ☀️ The Sun as the Main Source

The Sun is made of hydrogen gas.
Inside the Sun, hydrogen changes into helium in a nuclear reaction.
This produces heat and light energy that reaches Earth.

- 🌱 Plants use sunlight to grow → all energy on Earth can be traced back to the Sun.

energy sources

🔄 Renewable Resources of Energy

Definition: Resources that can be replaced naturally in a short time and will not run out if used wisely.
Examples:
🌞 Solar energy
🌬️ Wind energy
💧 Hydropower (rivers, dams)
🌱 Biomass (wood, plant waste)
🌋 Geothermal energy

🛢️ Non-Renewable Resources

Definition: Resources that are limited in supply and cannot be replaced quickly once they are used up. They take millions of years to form.
Examples:
⛏️ Coal
🛢️ Oil (petroleum)
🔥 Natural gas
☢️ Uranium (nuclear fuel)

⚡ **<u>Key Difference</u>**

Renewable = Can be replaced naturally, cleaner for the environment, but is unreliable (weather dependant)
Non-renewable = Finite, will run out one day, often causes pollution.(but is reliable and available)

🔋 Renewable Energy Sources

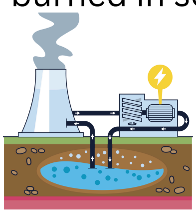
(Replenished naturally, do not run out, and cause little or no pollution.)

1. 🌬️ Wind Energy
Air currents are created because different parts of the atmosphere have different temperatures.
Wind turbines capture this movement and turn it into electricity.

2. 💧 Water Energy (Hydropower)
Water stored in a dam flows through a channel.
The moving water spins a turbine, which powers a generator to produce electricity.
This is called a hydroelectric power plant.

3. ☀️ Solar Energy
Sunlight on a solar panel produces electrical energy.
Energy can be stored in a battery.
Solar panels can also heat water in pipes, used for household hot water.

4. 🌱 **Biofuel**
Plants store energy from the sun.
Examples:
Sugarcane → squeezed for sugar → fermented into alcohol → used as fuel in cars (Brazil is a leader).
Wood → burned in sealed containers → used for heat & electricity efficiently.




🔋 Non-Renewable Energy Sources

⛽ Uses of Fossil Fuels

1. Coal
- Electricity generation ⚡ → Burned in power stations to produce steam that drives turbines.
- Industrial heating 🔥 → Used in cement, steel, and brick-making industries.
- Domestic use 🏠 → In some areas, still used for cooking and heating.
- By-products → Coal tar, ammonia, and other chemicals used in plastics, dyes, and medicines.

2. Oil (Petroleum & Crude Oil)
- Transport fuels 🚗✈️🚢 → Petrol, diesel, jet fuel, ship fuel.
- Electricity generation ⚡ → Burned in oil-fired power stations (though less common than coal/gas).
- Lubricants 🛢️ → Motor oils, greases.
- Plastics & chemicals 🧪 → Used to make plastics, synthetic fibres, fertilizers, detergents, paints, and pharmaceuticals.
- Heating & cooking 🔥 → Kerosene (paraffin) used in stoves, lamps, and heaters.

3. Natural Gas
- Electricity generation ⚡ → Burned in gas power stations.
- Heating & cooking 🔥 → Used in homes (gas stoves, geysers, heaters).
- Industrial uses 🏭 → In making glass, cement, steel, and as a feedstock for chemicals.
- Transport fuel 🚗 → Compressed Natural Gas (CNG) used in vehicles as a cleaner alternative to petrol/diesel.
- Fertilizers 🌾 → Ammonia from natural gas used to produce nitrogen fertilizers.

🛢️ How Fossil Fuels Formed

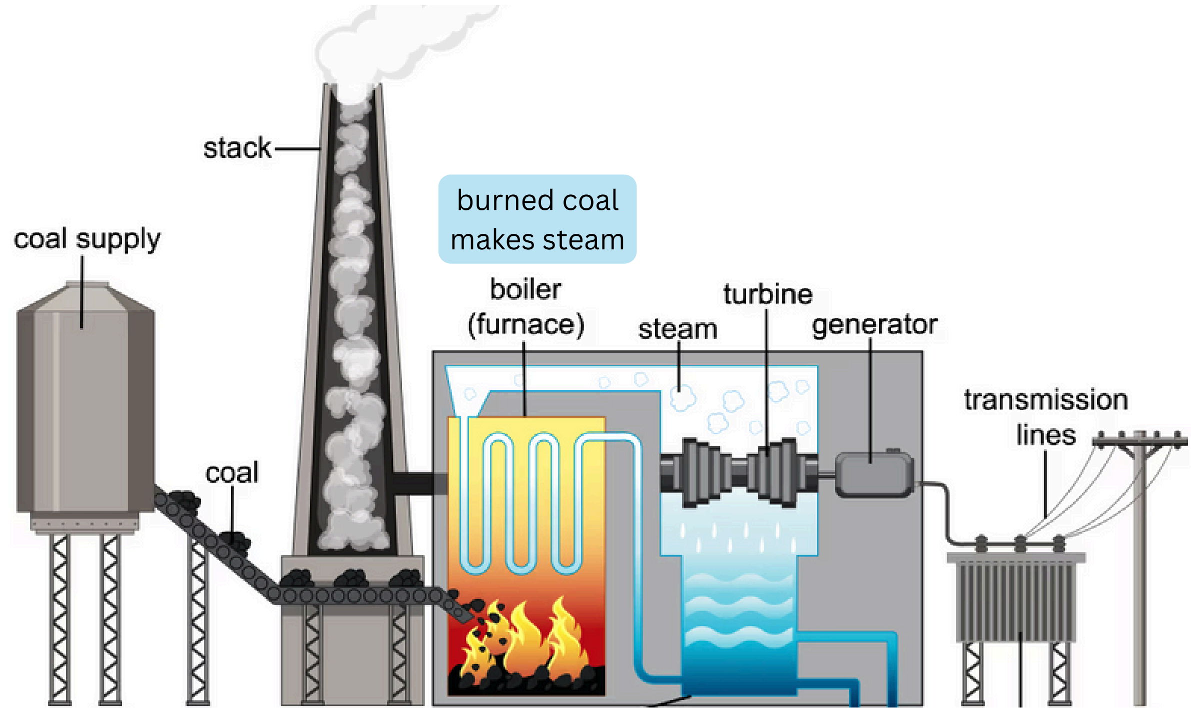
Millions of years ago 🌍
Earth was covered in swampy forests.
Dead plants and animals sank into the swamps with potensial energy from sun.
Buried by sand and rock ⏳
Over thousands of years, swamps were covered with fine sand that hardened into rock.
Oceans covered land 🌊
Land sank and oceans spread over the areas.
Landmasses rose again ⛰️
After millions of years, the land re-emerged as hills, mountains, and islands.
Remains trapped underground with their stored energy (potensial energy) 🪨
Layers of rock trapped decayed vegetation and animal remains deep below the surface.
Heat and pressure 🔥⚡
Over millions of years, heat + enormous pressure transformed rotted vegetation into crude oil.
Formation of gas and coal ⛏️
Natural gas was trapped with oil.
Other vegetation hardened into coal.

Fossil fuels (coal, oil, and natural gas) are the result of:
dead plants & animals → buried by layers of rock → compressed by heat & pressure → turned into energy-rich fuels over millions of years.

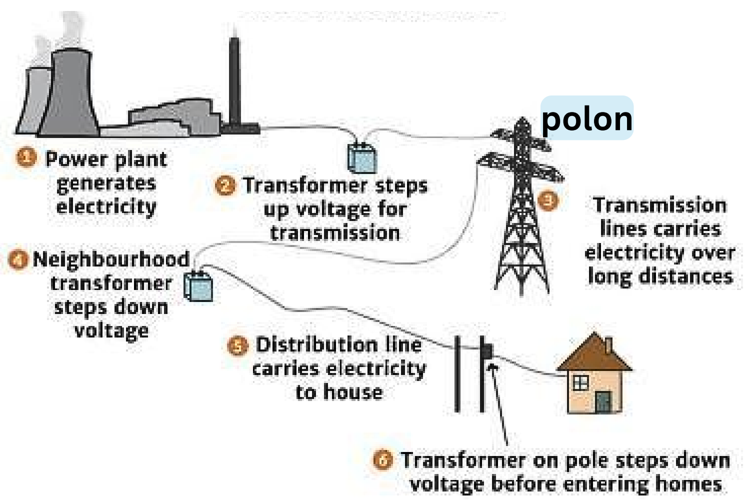
National Grid

Stage of Generation at power plant	Process	Energy Transfer
1. energy source	Energy from sources like coal, oil, gas, nuclear fuels, water, wind	Chemical / nuclear / kinetic → Heat / Kinetic energy
2. turbines	Energy transferred to turbines	Heat energy to kinetic energy
3. generator	Turbines transfer energy to generators	Kinetic energy → Mechanical energy
4. electricity	Generators convert energy	Mechanical energy → Electrical energy
5. tansmission lines	Electricity transferred through wires	Electrical energy carried to homes, schools, appliances, lights

1. generation



2. distribution



Electricity Transmission & Distribution

Power Station → generates electricity.

Step-up Transformer → increases voltage for efficient transmission.

Transmission Lines → carry electricity over long distances.

Step-down Transformer (Neighbourhood) → reduces voltage for safe distribution.

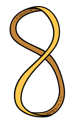
Distribution Lines → carry electricity to houses and buildings.

Pole Transformer (before homes) → further reduces voltage before entering households.

Types of Potential Energy

1. **Elastic Potential Energy**

- Stored when something is stretched, squeezed, or wound up.



Released only when the object returns to its original shape.
Example: rubber band, spring, bow and arrow.

2. **Positional (Gravitational) Potential Energy**

- Energy due to an object's position.

An object lifted above the ground has stored energy because of gravity.
Example: rock on a hill, book on a shelf, water behind a dam.

3. **Chemical Potential Energy**

- Stored in substances and released during a chemical reaction.

Example: burning wood, food, batteries, fossil fuels.
When released → produces heat, light, or other energy.

Potential Energy in Food

- All food = chemical potential energy.
- Plants get energy from the sun → animals eat plants → humans eat plants/animals.
- Food energy is measured in kilojoules (kJ).
- 1000 joules = 1 kilojoule (kJ).
- Average adult needs about 8000 kJ/day.

Energy system	**Form of potential energy**	**Energy input**	**Where is the energy going?**	**Form of kinetic energy (output)**
Burning coal	Chemical	Coal	Heat → released into air	Movement of particles in coal & surrounding air
An electric fan	Electrical (from chemical in batteries or power station fuel)	Electricity	Motor (mechanical system)	Movement of fan blades (mechanical kinetic energy)
A person blowing a vuvuzela	Chemical (in food stored in body)	Person (biological energy)	Vuvuzela (air vibrations)	Sound energy (movement of air particles)

⚡ Kinetic Energy: Movement Energy

Definition: The energy of a moving object.
Moving objects can make stationary objects move.
Example: A rolling ball can knock over pins.

🔄 Potential and Kinetic Energy in Systems

- **A system** = a set of parts working together. If one part changes, the rest is affected.

Example: Chemical potential energy in your body (from food) → used to roll a ball → ball gains kinetic energy.

🔧 Systems where Potential & Kinetic Energy are Involved

1. Mechanical Systems ⚙️

Energy in cars, machines, springs, stretched elastic.

- Converts stored (potential) energy into motion (kinetic).

2. Heating Systems 🔥

Input energy = heat (candle, stove, burner).

- Converts heat into useful energy.

3. Electrical Systems ⚡

Input = electricity (cell, battery, power grid).

- Converts to light, sound, movement, etc.

4. Biological Systems 🌱

Input energy comes from plants/animals we eat.

- Stored chemical potential energy → converted to movement (kinetic).

Energy system	Example	Type of energy used	Extra notes
Mechanical	Riding a bicycle 🚴	Kinetic energy	Legs use chemical energy from food to produce motion.
Electrical	Radio 📻	Sound energy	Electrical energy → sound + sometimes light.
Biological	Eating a sandwich 🥪	Chemical potential energy	Stored in food, released in body for movement or heat.
Thermal/Heat	Hot bath 🛁	Heat energy	Heat flows from hot water to cooler body/air.

⚡ Using Electricity Wisely

✅ Electricity Do's : how to save

- **Use energy-saving bulbs** 💡 – They use less electricity than normal bulbs and last longer.
- **Switch off lights & appliances** 🔌 – Prevents wasting power when not in use.
- Wear warm clothing instead of heating 🧥 – Saves electricity by reducing the need for heaters.
- **Close doors and windows** 🚪 – Prevents heat loss or cold drafts, so less heating is needed.
- **Shower instead of bath** 🚿 – Uses less hot water, saving both water and electricity for heating.
- **Turn off the geyser when not in use** 🔥 – Geysers use a lot of power; switching off saves energy.
- **Boil only the water you need in the kettle** ☕ – Boiling extra water wastes electricity.
- **Use the correct stove plate size** 🍳 – A small pot on a big plate wastes energy.
- **Choose the right fridge size** 🧊 – A fridge that's too big wastes power; too small may overwork.
- **Air-dry clothes instead of tumble drier** 🌞 – Saves lots of electricity.
- **Use blankets for warmth instead of heaters** 🛏️ – Reduces unnecessary heating costs.
- **Cover the geyser with a geyser blanket** 🪆 – Stops heat loss so the geyser uses less power to reheat water.
- **Insulate the ceiling** 🏠 – Prevents heat from escaping in winter or entering in summer, lowering energy bills.

❌ Electricity Don'ts

- Don't leave cellphone chargers plugged in 📱 – They keep drawing a small amount of power even when not charging.
- Don't put warm food in the fridge 🍲 → 🧊 – The fridge uses extra electricity to cool it down again.

✨ Key Idea: Every small saving adds up. If households reduce wasted energy, we save money, protect our electricity supply, and reduce load-shedding and pollution.

🔋 Useful and Wasted Energy in a System

💡 What is a Machine?

A machine = anything that helps to accomplish a task.
All machines/appliances/tools/vehicles:
Input energy → needed to make them work
Output energy → useful + wasted

⚙️ Example: Electric Drill

Purpose	Input Energy	Useful Output Energy	Wasted Energy
Drill a hole	Electrical energy (mains or battery)	Kinetic energy (drill bit rotates)	Heat (motor & drill bit get hot), Sound (noise)

📊 Efficiency of a System

Efficiency = % of input energy that is useful.
No machine is 100% efficient.
Wasted energy is usually heat or sound.
Examples:
Devices where sound = wasted energy → hair dryer, lawn mower, drill.
Devices where heat = wasted energy → light bulb, candle, engine.

🔑 How to Calculate Useful Energy

Formula:

$$\text{Efficiency} = \frac{\text{Useful Energy Output}}{\text{Total Energy Input}} \times 100$$

- **Useful energy** = the energy you actually want (e.g. light from a bulb, movement of a fan).
- **Wasted energy** = the energy that is lost (usually heat, sometimes sound).

Example 1: Light Bulb 💡

- Input energy = **100 J electrical**
- Useful output = **20 J light**
- Wasted = **80 J heat**

Efficiency:

$$\frac{20}{100} \times 100 = 20\%$$

So, the **useful energy** is **20 J of light**.

Example 2: Electric Kettle 🔥

- Input = **2000 J electrical**
- Useful = **1600 J heating water**
- Wasted = **400 J sound & heat loss**

Efficiency:

$$\frac{1600}{2000} \times 100 = 80\%$$

Keywords and Definitions – Energy

General Energy Concepts

Energy – The ability to do work or cause change.
Heat – A form of energy that moves from hot objects to cold objects.
Heat transfer – The movement of heat energy from one place to another.
Potential energy – Stored energy that has the potential to do work.
Kinetic energy – The energy of movement.

Heat Transfer

Conduction – Transfer of heat through solids by particle collisions.
Convection – Transfer of heat in liquids or gases by movement of particles.
Radiation – Transfer of heat by electromagnetic waves, without direct contact.
Convection current – Circular movement of fluids (liquids/gases) caused by hot, less dense fluid rising and cooler, denser fluid sinking.
Heat conductor – A material that allows heat to move through it easily (e.g., metals).
Heat insulator – A material that does not allow heat to move through easily (e.g., wood, plastic).

Energy Systems & Efficiency

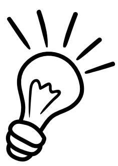
System – A group of parts that work together as a whole.
Useful energy – The energy that is transferred in a system to perform the desired task.
Wasted energy – Energy that is lost to the surroundings in an unwanted form (e.g., sound, heat).
Efficiency – A measure of how much input energy is converted to useful output energy (expressed as a percentage).
Joule (J) – The unit of measurement for energy.

Sources of Energy

Renewable energy – Energy sources that can be replaced naturally and will not run out (e.g., solar, wind, water, biofuel).
Non-renewable energy – Energy sources that cannot be replaced once used up (e.g., coal, oil, natural gas).
Fossil fuels – Non-renewable fuels formed from dead plants and animals over millions of years (coal, oil, gas).
Biofuel – Fuel made from plant or animal material (e.g., sugarcane ethanol, cow dung).
Solar energy – Energy from the sun converted to heat or electricity.
Wind energy – Energy generated when moving air turns turbines.
Water energy – Energy from moving water used to generate electricity (hydropower).

Electricity Supply & National Grid

National Grid – A system of power stations, cables, and transformers that supplies electricity to the whole country.
Power station – A facility where energy sources are converted into electrical energy.
Turbine – A wheel that is turned by moving steam, water, or wind.
Generator – A machine that converts kinetic energy into electrical energy.
Transformer – A device that increases (step-up) or decreases (step-down) voltage for transmission and distribution.



Transmission lines – High-voltage cables that carry electricity over long distances.
Utility pole – A smaller pole carrying lower-voltage distribution lines into homes.
Transmission tower / Pylon – A tall structure carrying high-voltage transmission lines across long distances.

quick Q and A

1. **Which is not renewable?**
A) Wind B) Solar C) Natural gas D) Hydropower

2. **The unit for energy is:**
A) N B) J C) W D) V

3. **A stretched rubber band stores mainly:**
A) Kinetic B) Chemical C) Elastic potential D) Thermal

4. Kinetic energy depends most directly on an object's:
A) Colour B) Speed C) Shape D) Density

5. **Energy in a TV changes from electrical to mainly:**
A) Sound & light B) Heat only C) Chemical D) Nuclear

6. **Heat transfer in solids in contact is called:**
A) Radiation B) Convection C) Conduction D) Evaporation

7. **In convection, warmer fluid is ___ and moves ___.**
A) Denser; down B) Less dense; up C) Less dense; down D) Denser; up

8. **Dark, matte surfaces tend to:**
A) Reflect most radiation B) Absorb more radiation C) Emit less radiation
D) Conduct less heat

9. **In the grid, turbines are turned by:**
A) Batteries B) Steam/wind/water flow C) Magnets directly
D) Solar panels only

10. **In an appliance, "useful output" means:**
A) Any heat produced B) Any sound produced
C) The energy for the intended purpose D) The total input energy

Answer memo: 1) C 2) B 3) C 4) B 5) A 6) C 7) B 8) B 9) B 10) C

Section A: Multiple Choice

1. Which method of heat transfer does NOT need particles or a medium?
A. Conduction
B. Convection
C. Radiation
D. Evaporation

2. In convection currents, hot air or water:
A. Becomes denser and sinks
B. Becomes less dense and rises
C. Stays at the bottom
D. Disappears

3. The main energy source for electricity in South Africa is:
A. Oil
B. Coal
C. Nuclear
D. Wind

4. Which of the following is a renewable energy source?
A. Coal
B. Oil
C. Solar
D. Gas

5. The unit of energy is:
A. Newton
B. Watt
C. Joule
D. Volt

6. Which of these systems mostly wastes energy as sound?
A. Light bulb
B. Drill
C. Candle
D. Stove

7. Elastic potential energy is stored in:
A. A lifted rock
B. A moving car
C. A stretched rubber band
D. A burning candle

8. Fossil fuels are formed from:
A. Fresh plants
B. Dead plants and animals over millions of years
C. Running water
D. Wind

9. Which device increases the voltage of electricity so it can travel far distances?
A. Step-down transformer
B. Step-up transformer
C. Generator
D. Turbine

10. Which energy change happens in a generator?
A. Heat → Light
B. Kinetic → Electrical
C. Chemical → Kinetic
D. Electrical → Heat

Section B: Short Questions

1. Explain the difference between renewable and non-renewable energy. Give two examples of each.
2. Describe step by step how fossil fuels such as coal and oil are formed.
3. Use a diagram to explain how a convection current works in boiling water.
4. Name and describe the three methods of heat transfer with one real-life example of each.
5. Write down two advantages and two disadvantages of using fossil fuels.
6. Explain the difference between useful energy and wasted energy in a machine. Use the example of an electric drill.

Section C: Long Questions

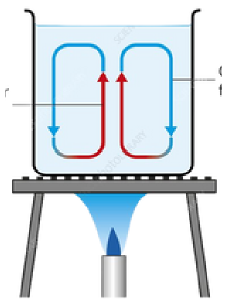
1. Discuss four types of renewable energy (wind, water, solar, biofuel). Explain how each works and give one advantage and one disadvantage of each.
2. Explain with a labelled diagram how electricity is generated from coal in a power station.
3. Draw a neat flow diagram of the order of energy supply from a power station to a household. Include turbine, generator, transformers, power lines, and consumer.
4. Compare potential and kinetic energy by:
5. Giving a definition of each,
6. 2 examples each,
7. Explaining how one can change into the other.
8. A light bulb is supplied with 200 J of electrical energy but only gives 50 J of light energy.

(a) Calculate the wasted energy.

(b) Calculate the efficiency of the bulb. (Show your working)

(c) Why is no machine 100% efficient?

✏️ Section D



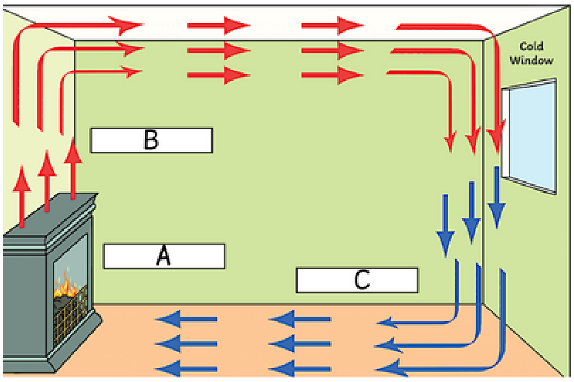
1. Study the diagram below showing water being heated in a container.

(a) Explain step by step how a convection current is formed in the water when it is heated from below. (6)

(b) Why does the hot water rise while the cold water sinks? (2)

(c) Give two real-life examples where convection currents occur. (2)

2. Study the diagram below .
(a) What method of heat transfer is being shown in this diagram? (2)
(b) Explain what happens at each of the following points: A, B , C (6)



3. Match the Column (5 × 1 = 5 marks)
Match the items in Column A with the correct description in Column B

COLUMN A	COLUMN B
2.1. Matt surface	A. The instrument that is used to measure temperature.
2.2. Wasted energy	B. Texture or finish that is not shiny or glossy and does not reflect light.
2.3. Thermometer	C. The energy due to motion or energy that an object has when it is moving.
2.4. Joule (J)	D. In an energy system, some energy transferred to surroundings in ways not useful.
2.5. Kinetic energy	E. The unit of measurement for energy.

4**. Choose the Correct Term**
Choose the correct term from the list below for each of the following descriptions. Write only the term.
W<u>ord Bank: </u>Ethanol, potential energy, cow dung, conduction, insulators

4.1 A good indigenous heat insulator used to insulate walls.
4.2 Energy that is stored in a system.
4.3 Substances that do not allow thermal energy to be conducted through them.
4.4 A substance made from fermented crops, used as a fuel for cars.

5. **Energy Transfers**
A television has an energy output of 500 J.
400 J is in the form of light.
50 J is in the form of sound.
50 J is thermal energy.
Write a description of the energy transfers in each of the following forms of energy.
Also calculate the efficiency of the television in percentage .

Memo: C. Radiation

Memo: B. Becomes less dense and rises

Memo: B. Coal

Memo: C. Solar

Memo: C. Joule

Memo: B. Drill

Memo: C. A stretched rubber band

Memo: B. Dead plants and animals over millions of years

Memo: B. Step-up transformer

Memo: B. Kinetic → Electrical

Section B: Short Questions

- Memo: Renewable = can be replaced naturally (e.g. solar, wind). Non-renewable = finite, takes millions of years to form (e.g. coal, oil).
- Memo: Dead plants/animals → buried by rock/sand → heat + pressure → coal, oil, gas.
- Memo: Heat at bottom → particles spread apart → less dense → rise → cooler water sinks → cycle forms.
- Memo: Conduction (solids, spoon in soup), Convection (liquids/gases, boiling water), Radiation (waves, sun heating Earth).
- Memo: Advantages: cheap, available. Disadvantages: pollution, non-renewable.
- Memo: Useful = kinetic (drill turning), wasted = heat & sound.

Section C: Long Questions (5 × 10 = 50 marks)

- Memo: Wind (turbines → electricity, clean, but depends on wind), Water (hydro dams, reliable, but floods land), Solar (panels heat water/electricity, renewable, but costly), Biofuel (plants → alcohol/fuel, renewable, but uses farmland).
- Memo: Burn coal → boil water → steam turns turbine → turbine drives generator → electricity produced.
- Memo: Coal → heat → steam → turbine → generator → step-up transformer → transmission lines → step-down transformer → consumer.
- Memo: Potential = stored (elastic, gravitational, chemical). Kinetic = movement. Examples: rock on hill (potential) → falling rock (kinetic).
- Memo: (a) 150 J wasted . (b) Efficiency = (50/200)×100 = 25% (c) Some energy always lost as heat/sound

Section D: Convection Currents and Applications

- Memo: (a) Heat bottom → particles move faster → spread apart → less dense → rise → cooler sinks → circulation (6). (b) Hot water less dense rises, cold water denser sinks . (c) Sea breeze, boiling water
- Memo: (a) Convection . (b) A: energy source heated/burned . B: Warm air rises. C: Cold air near window sinks
- Memo: 2.1 B 2.2 D, 2.3 A, 2.4 E, 2.5 C
- Memo: 3.1 Cow dung, 3.2 Potential energy, 3.3 Insulators, 3.4 Ethanol
- Memo: Light: electrical energy = useful light energy Sound: electric energy = useful sound energy , Heat: electric energy = wasted heat/thermal energy
- Memo: Formula = (useful/total)×100 (1). Substitution = (450/500)×100 (1). Efficiency = 90%