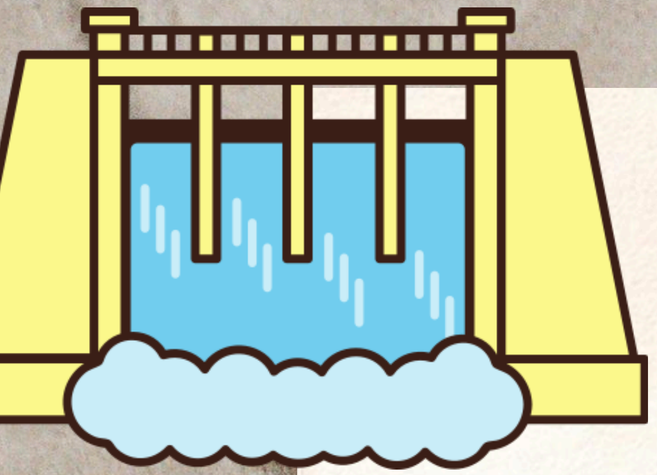


Energy

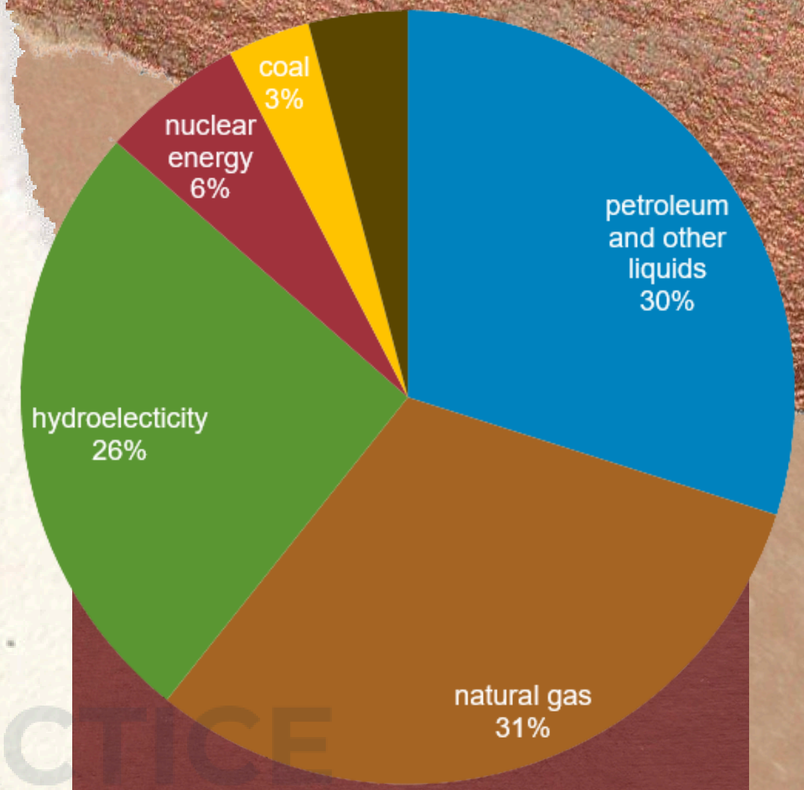
RESOURCES

CIE IGCSE PHYSICS FOR BOARD 0625 AND 0972
(FOR EXAMS 2025+)

7.1 THE ENERGY WE USE

- Most of the energy we use comes from the Sun, but only a small amount is used directly from the Sun.
- The diagram on the right shows the different fuels that contribute to the world's energy supplies.

renewable



TOTAL ENERGY CONSUMPTION IN CANADA

EXAM PAPERS PRACTICE

MAIN BRANCHES OF ENERGY

RENEWABLE ENERGY

Solar, Wind, Hydroelectric, Biomass, Wave, Geothermal

NON RENEWABLE ENERGY

Fossil fuels, Nuclear fuels

MAIN BRANCHES OF ENERGY

RENEWABLE ENERGY

Solar, Wind, Hydroelectric, Biomass, Wave, Geothermal

NON RENEWABLE ENERGY

Fossil fuels, Nuclear fuels

Energy from the Sun

SOLAR PANEL

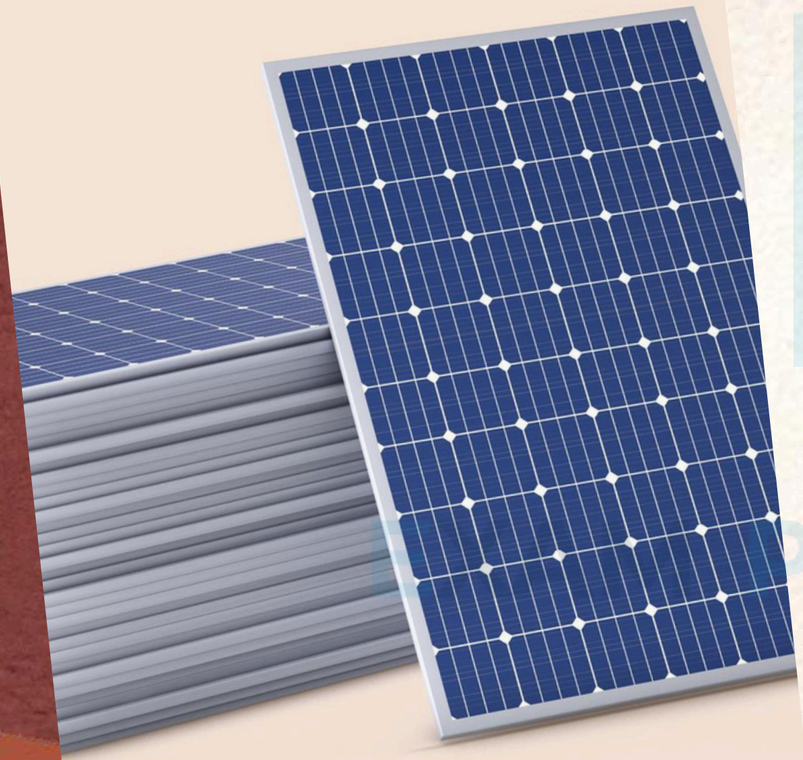
o Sunlight strikes a large solar panel on the roof of a house.

o The solar panel absorbs the energy from the sunlight, heating the water inside the panel.

o This heated water is then used for washing and central heating.

Energy from the Sun

SOLAR CELLS



- A photovoltaic cell is an electrical device that converts sunlight directly into electricity by generating a voltage when exposed to light.

Energy from the Sun

ADVANTAGE	DISADVANTAGE
Useful in remote locations	It is unreliable as the intensity of sunlight varies
	A large area of solar panels is necessary to capture enough energy.

WIND POWER

- Wind power is caused by the effects of the Sun.
- The Sun heats certain parts of the atmosphere more than others. The heated air expands and begins to move, creating a convection current.

WIND POWER

- Windmill; used for grinding and pumping
- Wind turbines; generate electricity

ADVANTAGE	DISADVANTAGE
Renewable and does not contribute to global warming	It is unreliable as the speed of wind can vary
	Can be very noisy

HYDROELECTRIC

- Water stored behind a dam is released to turn turbines, which spin generators to produce electricity.
- In some hydroelectric power stations, the turbines can be reversed to pump water back up to the reservoir, storing energy as gravitational potential energy. This water can then be released to generate electricity when demand increases.

ADVANTAGE	DISADVANTAGE
Safe, clean, and reliable way of producing electricity	Wildlife habitats might get replaced by these power stations
Short start up time	

BIOMASS FUEL

- For many people worldwide, wood serves as the primary fuel source for heating homes and cooking.
- Wood, derived from trees and shrubs, stores energy captured from sunlight through photosynthesis.
- Biofuel also encompasses animal dung and biogas produced from decomposing plant matter.

ADVANTAGE	DISADVANTAGE
Renewable and does not contribute to global warming	Burning biofuels indoor can lead to respiratory and other health problems

WAVES POWER

- Waves are formed by friction between wind and water.

ADVANTAGE	DISADVANTAGE
Renewable	It is unreliable as the height of waves can vary

GEOTHERMAL ENERGY

- The Earth's interior is hot, presenting a potentially valuable energy source if accessible.
- Geothermal energy is utilized in locations where hot rocks are close to the Earth's surface.
- To harness this energy, water is injected into the rocks where it boils. The high-pressure steam produced returns to the surface to generate electricity.

EXAM PAPERS PRACTICE

MAIN BRANCHES OF ENERGY

RENEWABLE ENERGY

Solar, Wind, Hydroelectric, Biomass, Wave, Geothermal

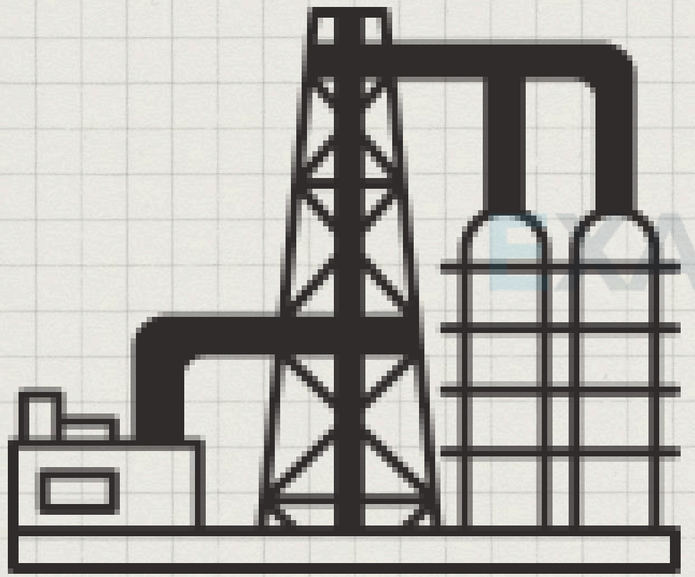
NON RENEWABLE ENERGY

Fossil fuels, Nuclear fuels

Fossil fuels

They are hydrocarbon, when burned, combined with oxygen in the air to produce energy (+ carbon dioxide and water)

OIL



COAL

GAS

Fossil fuels

- When a tree dies and falls onto swampy ground,
- It does not fully decompose due to insufficient oxygen.
- As sediment accumulates over these ancient trees, the pressure increases.
- Over millions of years of compression, these trees transform into underground coal reserves.

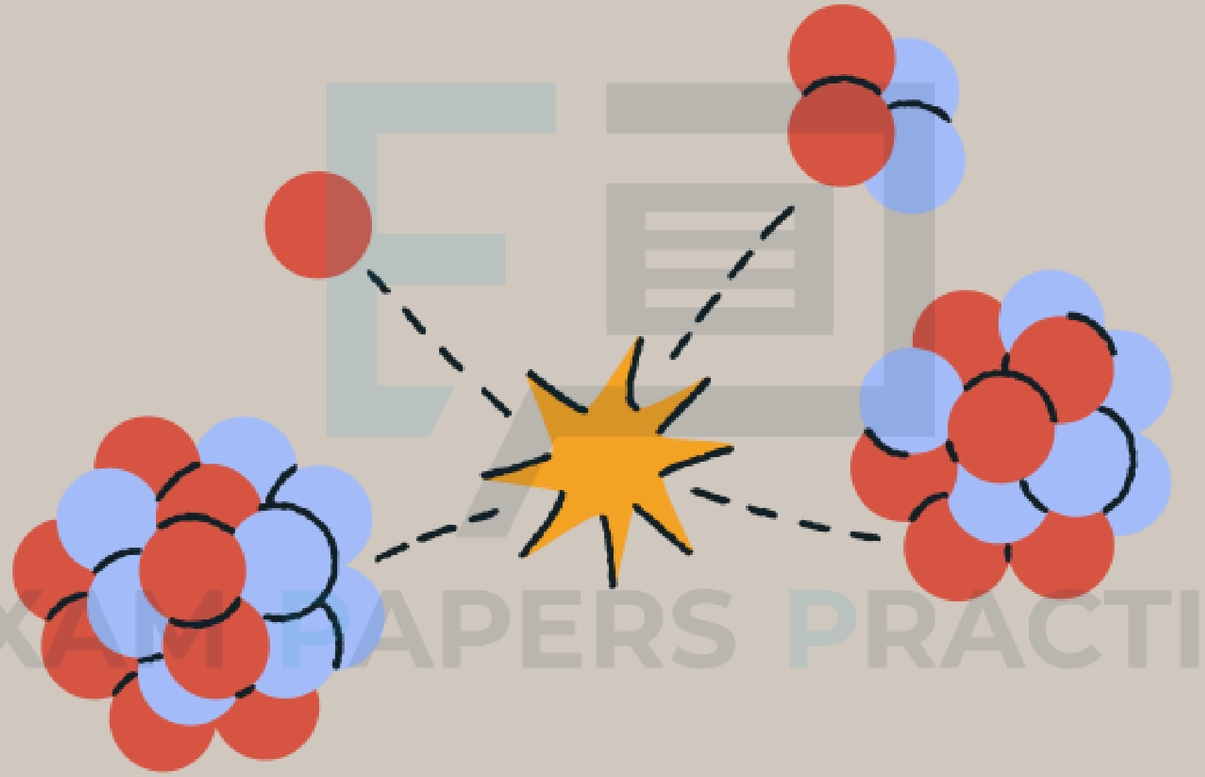
Disadvantage of fossil fuels

Burning fossil fuels releases carbon dioxide into the atmosphere, contributing to global warming.

Burning coal and oil generates sulfur dioxide, which can result in the formation of acid rain.

Nuclear fuels

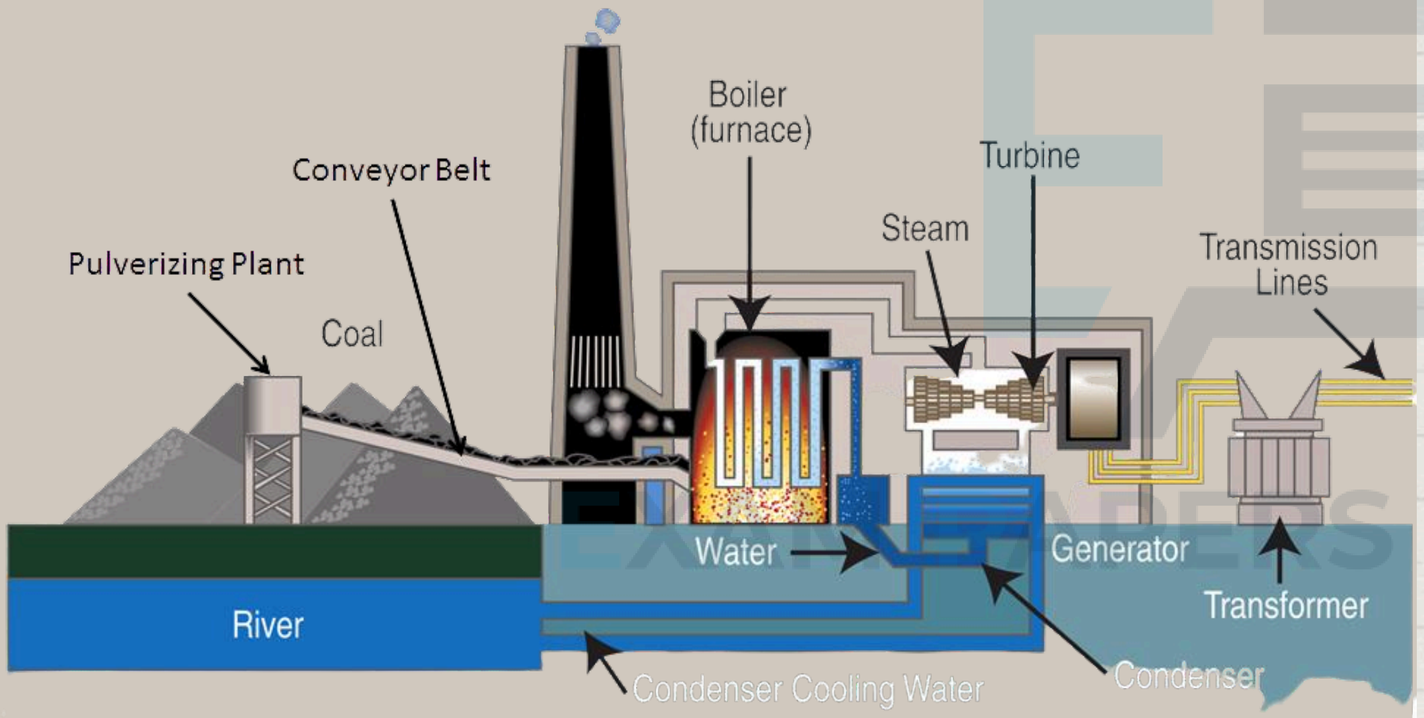
Uranium serves as the fuel for nuclear power stations due to its highly concentrated energy store.



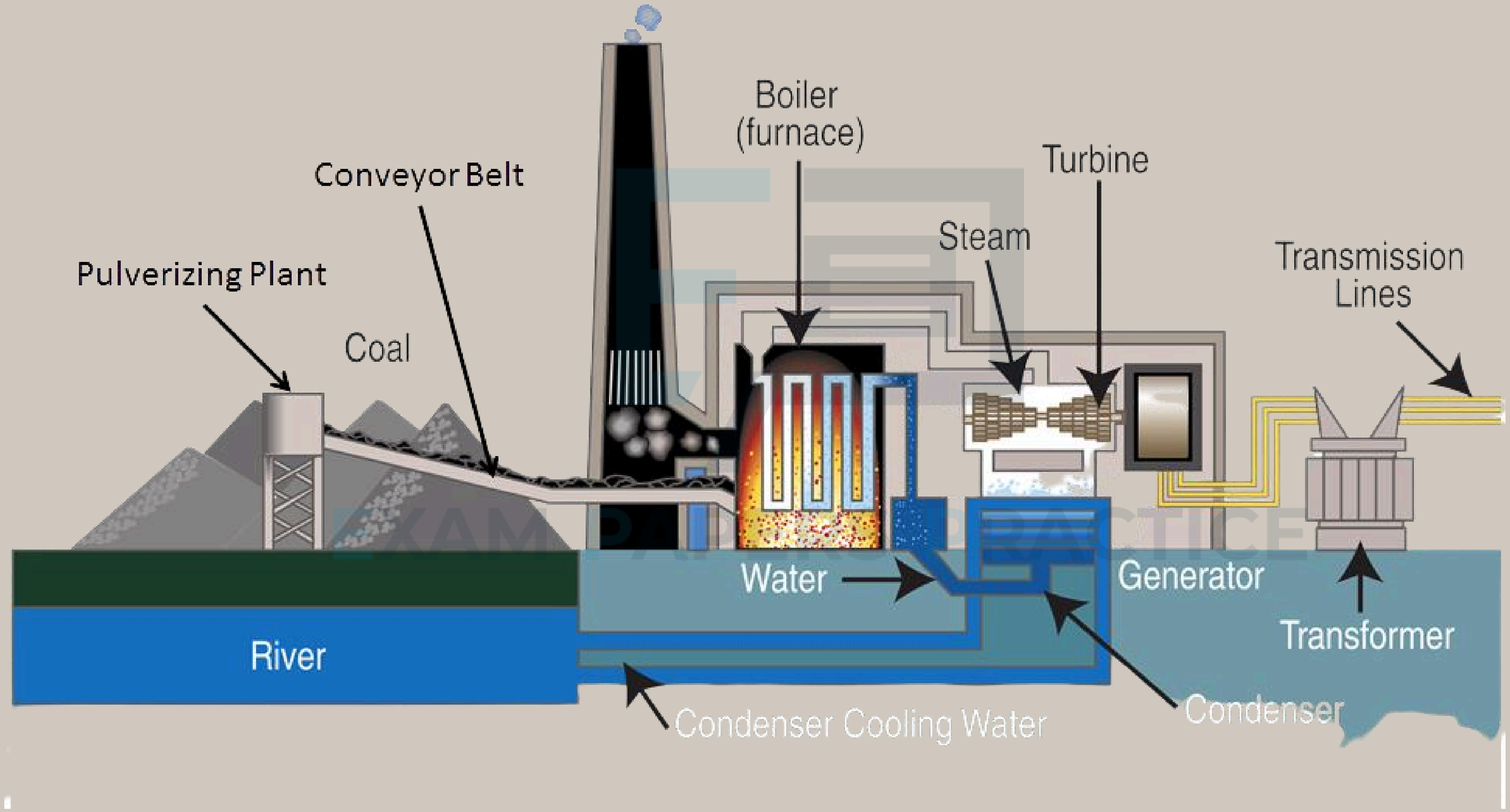
Nuclear fission is the process in which the nucleus of an atom splits into smaller nuclei, releasing a significant amount of energy.

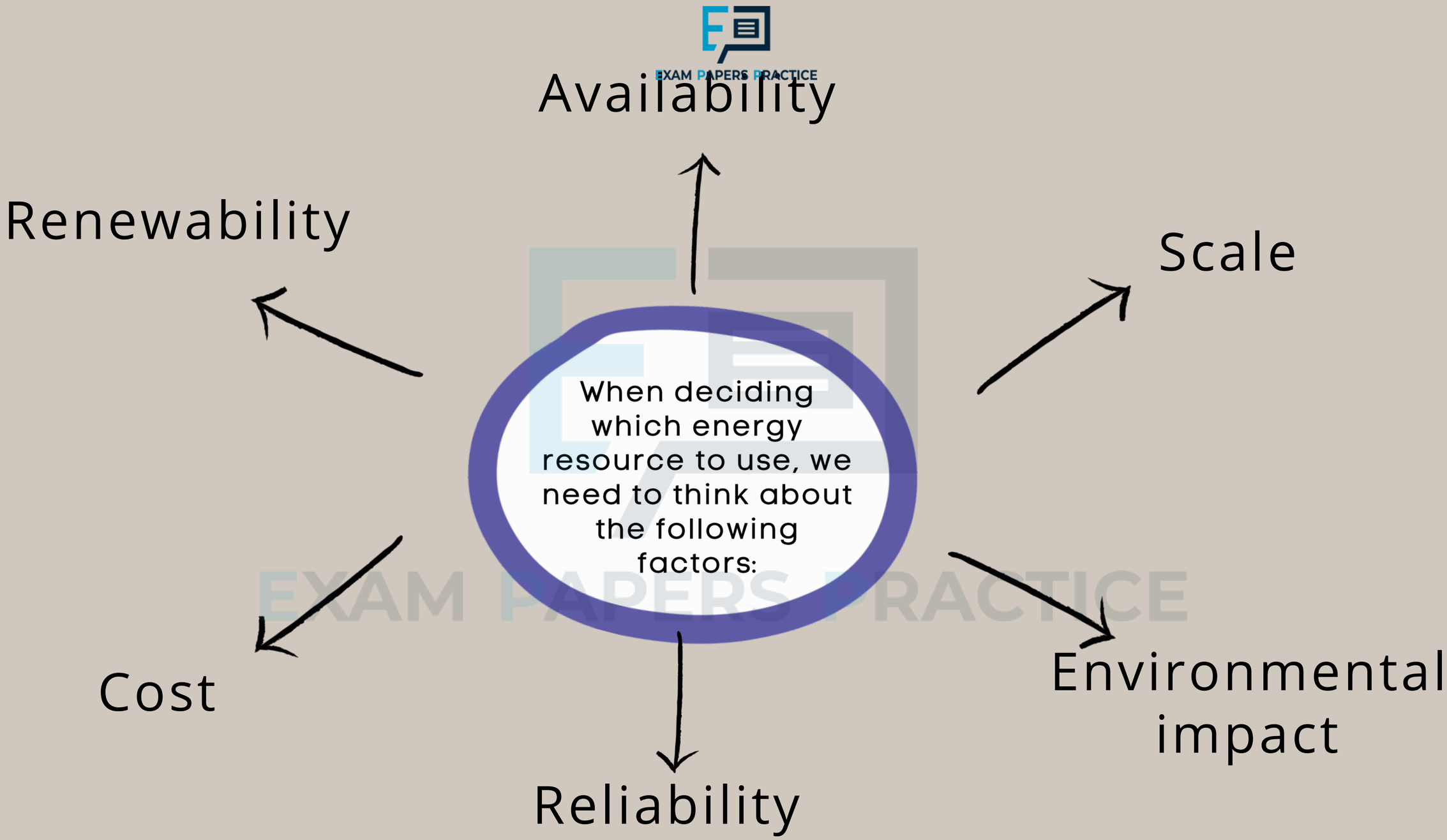
ADVANTAGE	DISADVANTAGE
Nuclear fuel is relatively cheap, concentrated resource	Nuclear power has been found to be costly primarily due to the high initial expenses associated with constructing the power stations.

Using energy resources to generate electricity



1. Thermalenergygeneratedfrom burning fossil fuels or through nuclear fission is utilized to heat water in a boiler, producing steam.
2. Thesteamdrivesthebladesofa turbine, converting thermal energy into kinetic energy.
3. Theturbine,connectedviaan axle to a generator, induces voltage in conducting wires as they move through a magnetic field.


Boiler
(furnace)
Turbine
Conveyor Belt
Steam
Transmission
Lines
Pulverizing Plant
Coal
Water
Generator
Transformer
River
Condenser Cooling Water
Condenser



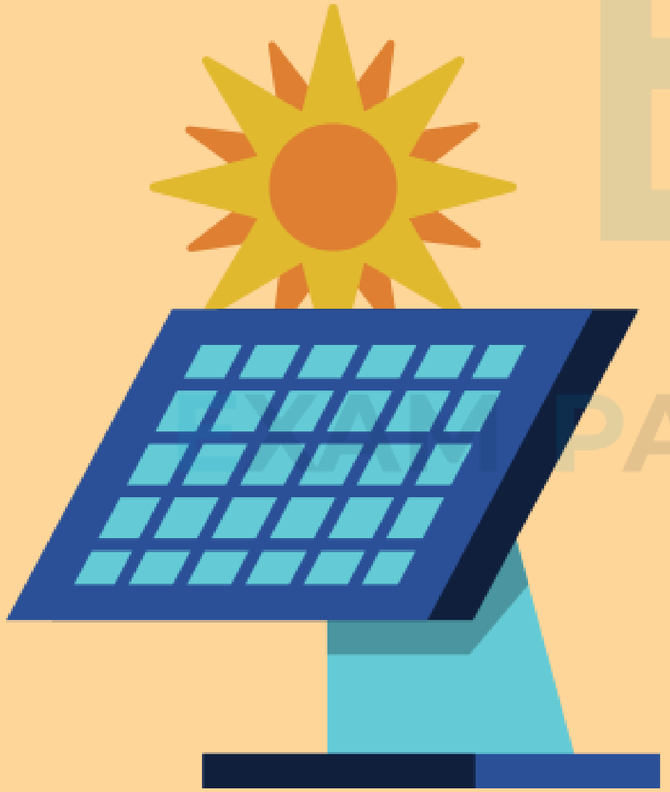
7.2 ENERGY FROM THE SUN

Most of the energy we use can be [redacted]

Fossil fuels are ancient stores of solar energy.

Example 1

Most of the energy we use can be [redacted]



Solar panels can absorb radiation from the Sun, converting it into hot water or electricity through arrays of solar cells (photocells) often seen on rooftops in some countries.

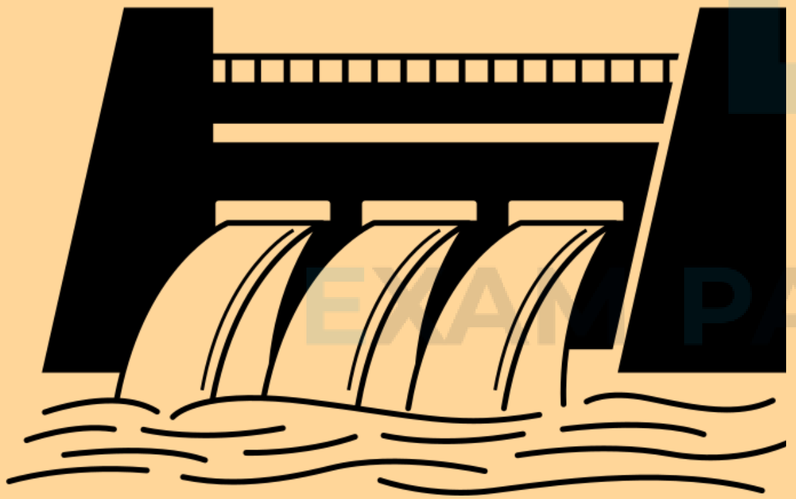
Example 2

Most of the energy we use can be [redacted]

Wind is generated by the Sun heating the air. As warm air rises and cool air replaces it, this movement can be harnessed using wind turbines to generate electricity.

Example 3

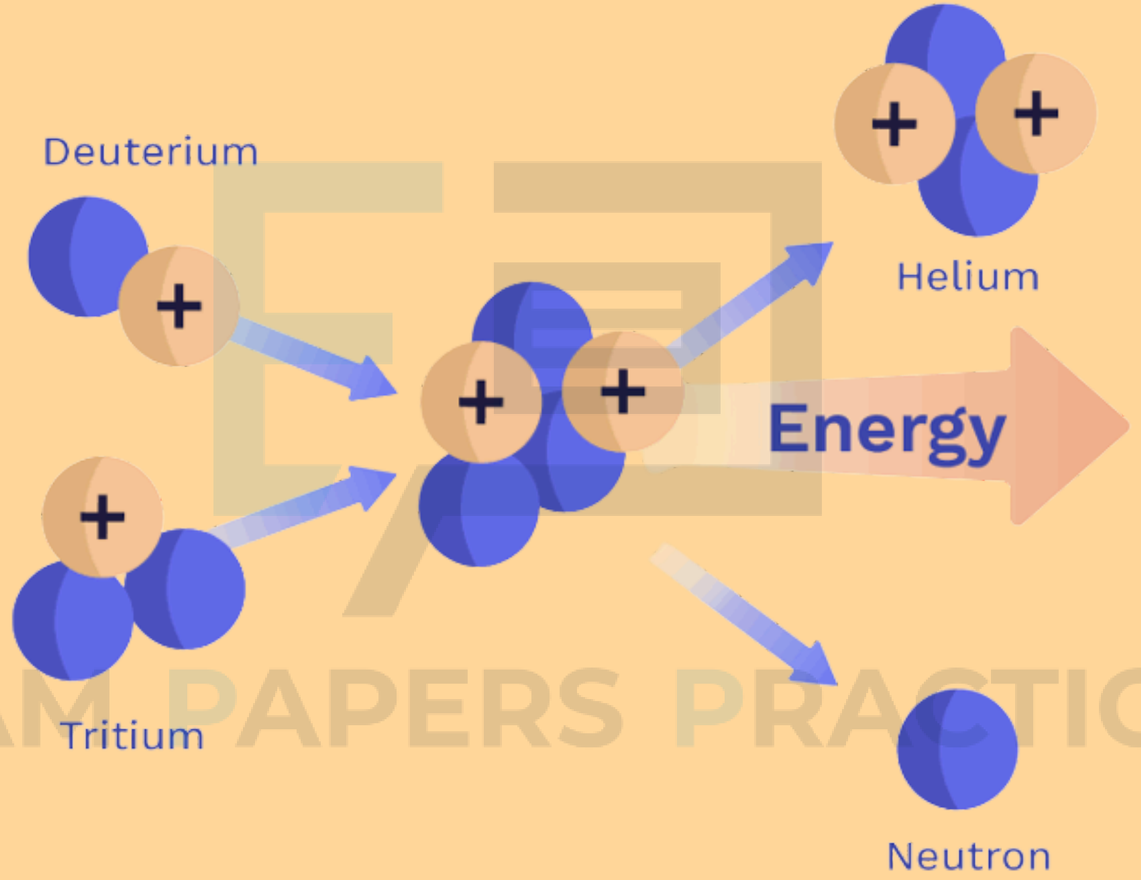
Most of the energy we use can be [redacted]



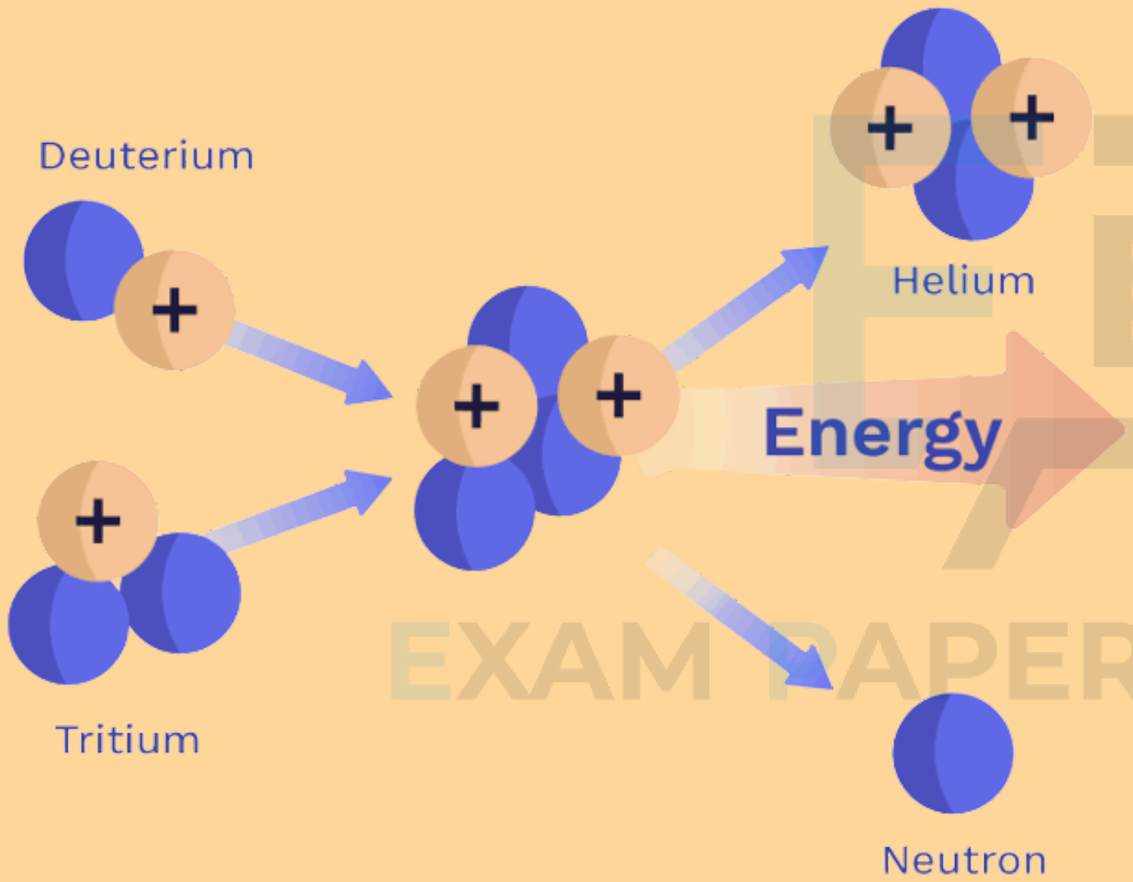
Most hydroelectric power originates from the Sun. Solar radiation causes water to evaporate from oceans and land surfaces. This evaporated water eventually forms clouds at higher altitudes. Rainfall on elevated terrain can then be captured behind dams, which is part of the water cycle. Without solar energy, there would be no water cycle and no hydroelectric power.

Example 4

Energy is released in the Sun by the process of nuclear fusion.

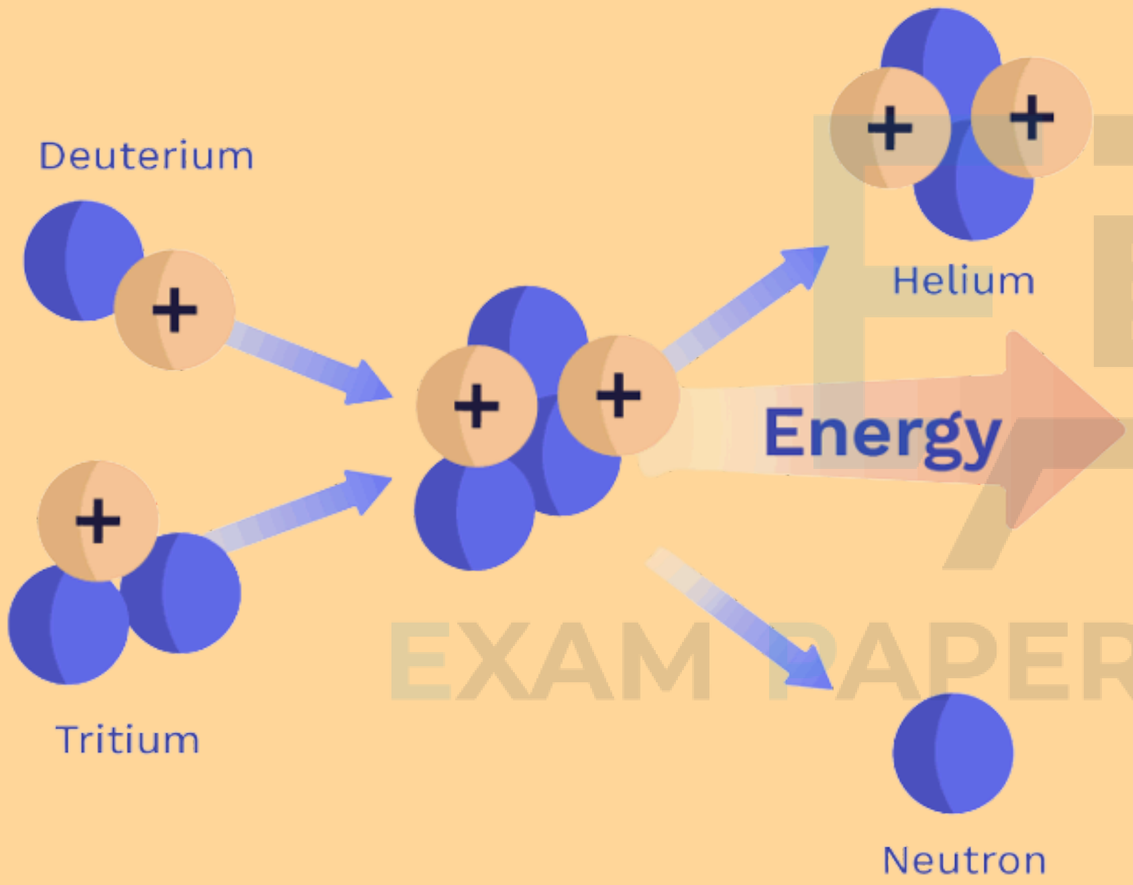


Nuclear fusion is the process where atomic nuclei combine to form heavier nuclei, releasing a significant amount of energy in the process.

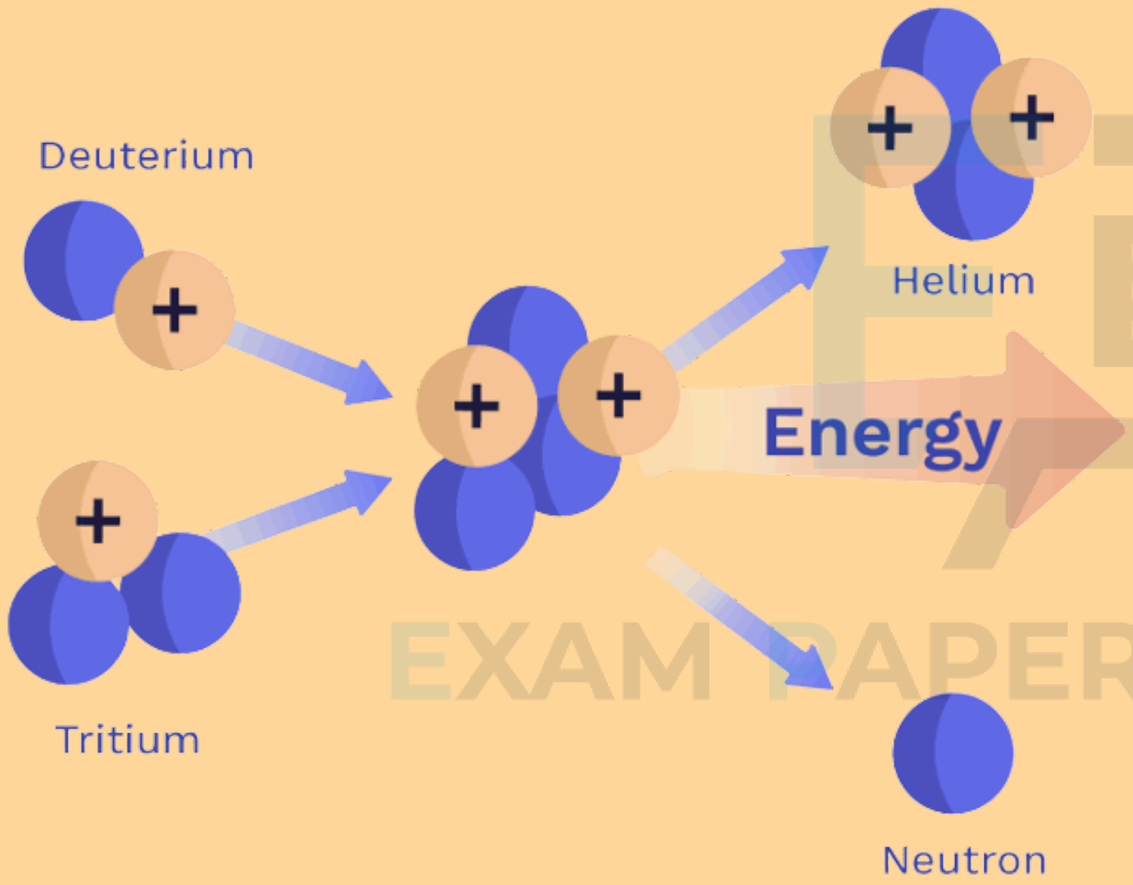


Condition for nuclear fusion to happen:

- High temperature
- High pressure



1. At this temperature, all atoms become ionized.
2. All electrons are stripped from the atoms, resulting in a plasma of positively charged nuclei and negatively charged electrons.
3. Atomic nuclei, all positively charged, repel each other due to like charges. To overcome this electrostatic repulsion and induce fusion, temperatures of around 100 million degrees are necessary.



4. The mass of the resulting nucleus is slightly less than the combined mass of the initial nuclei. The difference in mass is converted into energy.
5. The energy released is substantial because it involves multiplying the mass m by the speed of light c squared.

Which energy resource does not use the Sun as the source of its energy?

A Hydroelectric

B Wind

C Nuclear

D Coal

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A Hydroelectric

B Wind

C Nuclear

D Coal

Listed below are some energy resources.

W	wind powering a turbine
X	water falling through a hydroelectric turbine
Y	alcohol made from crops which have been grown for burning in a biomass generator
Z	uranium for nuclear fission reactors

Which of the resources are renewable?

A W, X and Z

B W and X

C W, X and Y

D W, X, Y and Z

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A W, X and Z

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C W, X and Y

D W, X, Y and Z

Which energy resource involves splitting heavy nuclei?

A Nuclear fission

B Geothermal

C Biomass

D Nuclear fusion

Which energy resource involves splitting heavy nuclei?

A Nuclear fission

B Geothermal

C Biomass

D Nuclear fusion