



Theatre of Science Renewable Energy 1: Fossil Fuels



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You will need: A candle, means of lighting the candle, **ADULT SUPERVISION** (we're dangling paper over a flame!), baking tray, cotton, scissors, A4 paper.

By the end of today I'd like you to be able to: Name the three fossil fuels and tell me some basic principals of energy.

You might also be able to: Describe how fossil fuels form, and/or how power stations use them to produce electricity.

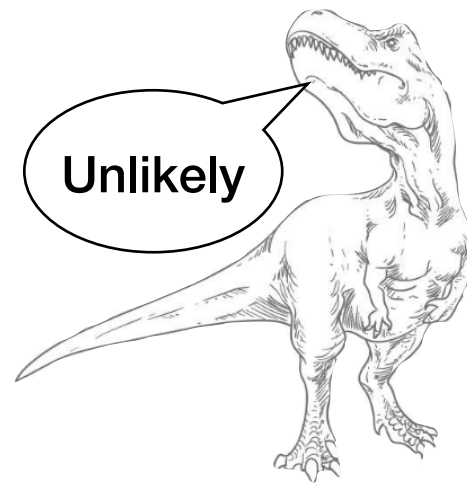
If you're confident or do extra research you could also: Explain some of the energy stores related to power stations (don't worry if this bit's confusing, it's a big topic for a short lesson!)

Today's GCSE questions are from the Edexcel and Cambridge iGCSE specs

Fossil Fuels Facts: For real?

Burning them releases carbon dioxide which is heating up our Earth. But can you spot the facts about fossil fuels? Some questions have more than one answer!

- 1) Coal is older than:
- a. Humans
 - b. Dinosaurs
 - c. Earth

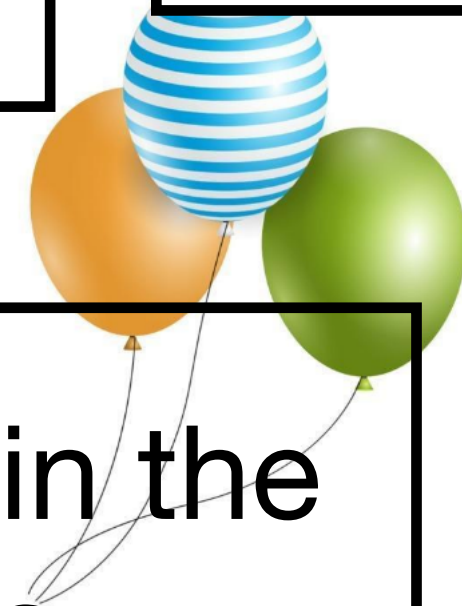


- 2) Oil will run out in:
- a. 5 years
 - b. 50 years
 - c. 500 years

- 3) Drilling for oil & gas may cause:
- Earthquakes
 - Snow storms
 - Dogs to turn into cats



- 4) When gas is found in the ground it is sometimes:
- a. Burned for no reason
 - b. Used to fill huge balloons
 - c. Released into the air



Gas is easy to store because it's light

Countries can own oil and gas under the sea.

True or False?

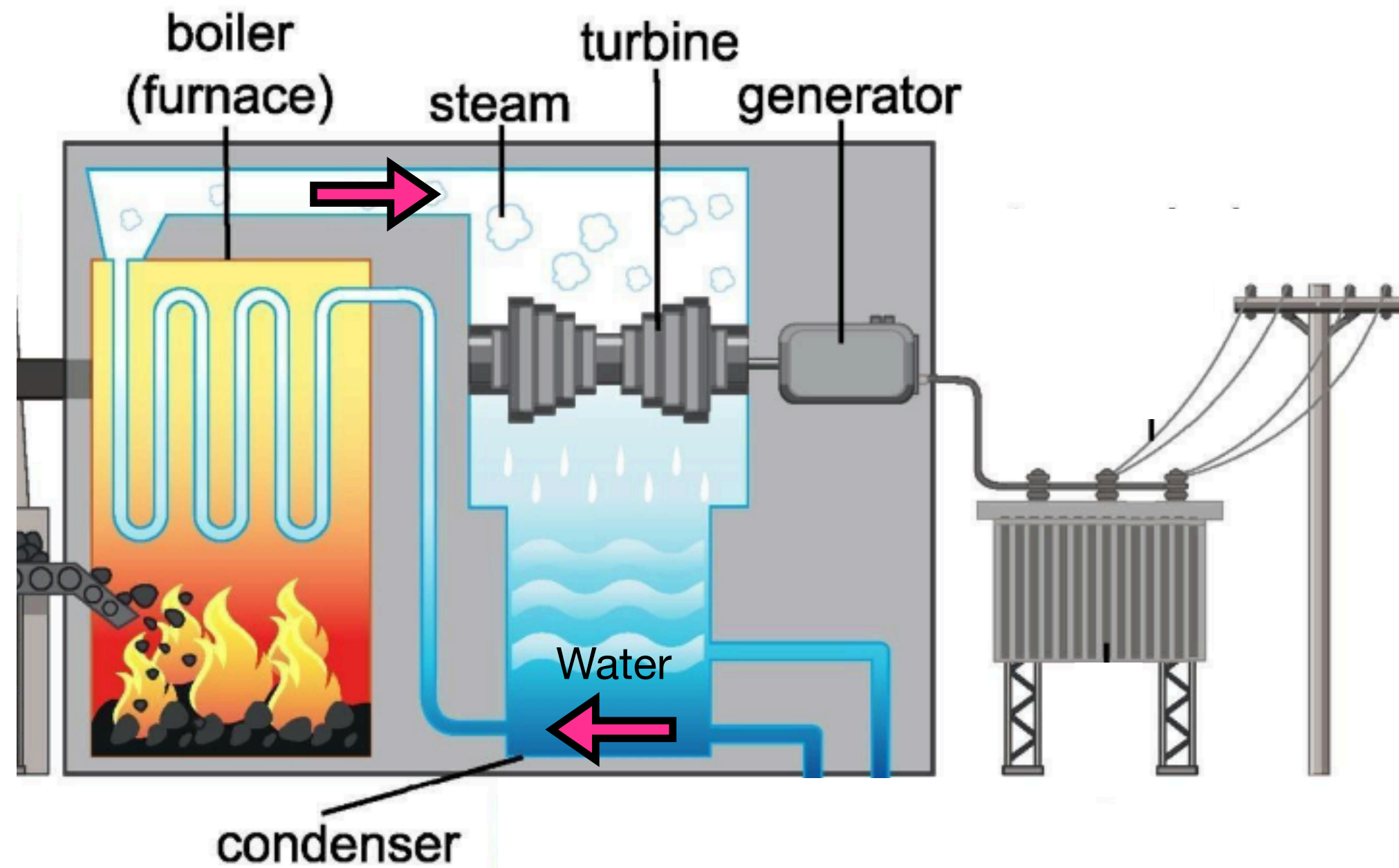
The world is reducing its fossil fuel use.

There's a hole in Earth called "The Gate of Hell" that's always on fire.



GCSE questions!

This power station burns fossil fuel



1) Which part transfers energy from a *chemical* store to a *thermal* store? (1)

- a) Furnace
- b) Turbine
- c) Generator
- d) Condenser

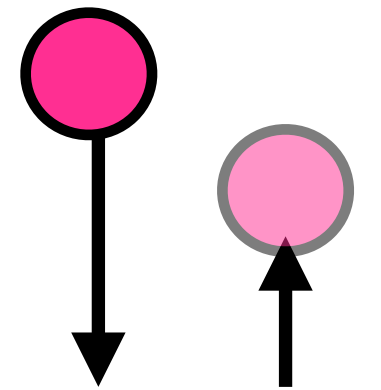
2) Which part transfers energy electrically from a kinetic energy store? (1)

- a) Boiler/Furnace
- b) Turbine
- c) Generator
- d) Condenser

3) Name one fossil fuel (1) _____

4) A ball bounces off a floor, but doesn't bounce back to where it started. What happened to the ball's lost energy?

- a) It was destroyed as it hit the ground
- b) It was destroyed as it travelled through the air
- c) The chemical energy of the ball has increased.
- d) The heat (*thermal*) energy of the ball and its surroundings have increased.



Summary questions!

1. Name the three fossil fuels. _____
2. Complete the sentence: Energy cannot be _____ or _____



Theatre of Science Renewable Energy 2: Wind!



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You will need: A candle, means of lighting the candle, jar that will fit over the candle (no lid needed), small plate, jug / glass water, food colouring (optional!).

By the end of today I'd like you to be able to: State two advantages and one advantage to generating electricity with wind, as opposed to fossil fuels.

You might also be able to: Describe what is meant by the word 'renewable'.

If you're confident or do extra research you could also: Explain how the Sun is the ultimate source of wind on Earth.

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Below are THREE disadvantages and FOUR advantages of using wind to produce electricity.

There's also ONE classic 'bad' GCSE answer, ONE nonsense answer and ONE might-be-true answer. Can you spot them?!

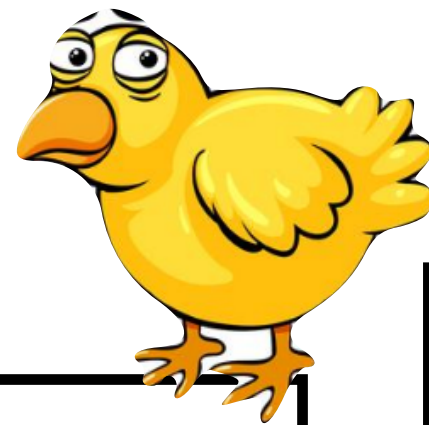
Doesn't contribute to global warming

You can't have it on demand: only when the wind's blowing

Wind can be replenished very quickly

It can be reused again and again

Turbines lead to the death of birds



Wind farms provide a safe place for sea creatures



Depends on the weather

Doesn't give off pollution / carbon dioxide

Wind turbines make more nutritious flour

Conserves fossil fuels



Finished? For one or more of your disadvantages, put your engineering hat on and suggest a **solution!** I'll discuss them in a minute.

GCSE questions!

1) Which source of energy is renewable?

- a. Coal b. Oil
- c. Gas d. Wind

Here's a method of generating electrical power:



2) What energy source does this method use? (1)

3) Give two advantages of using this method for generating electricity, compared to using coal.

4) Give one disadvantage of this method, compared to coal.

Summary questions!

- 1) Draw a diagram and label it to show how the Sun makes wind!
- 2) Give two advantages and one disadvantage of using wind to generate electricity, compared to fossil fuels.



Theatre of Science Renewable Energy 3: Renewable Energy Continued!



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You will need: A small bowl of water, a piece of paper.

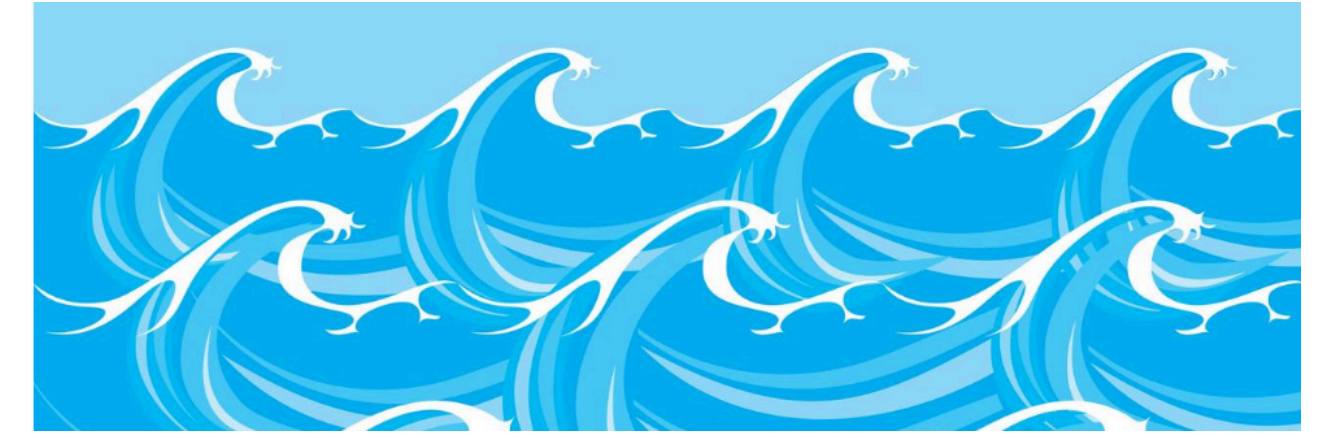
By the end of today I'd like you to be able to: State at least four renewable energy sources and describe their main advantages and disadvantages

You might also be able to: Explain the energy transfers taking place for each method

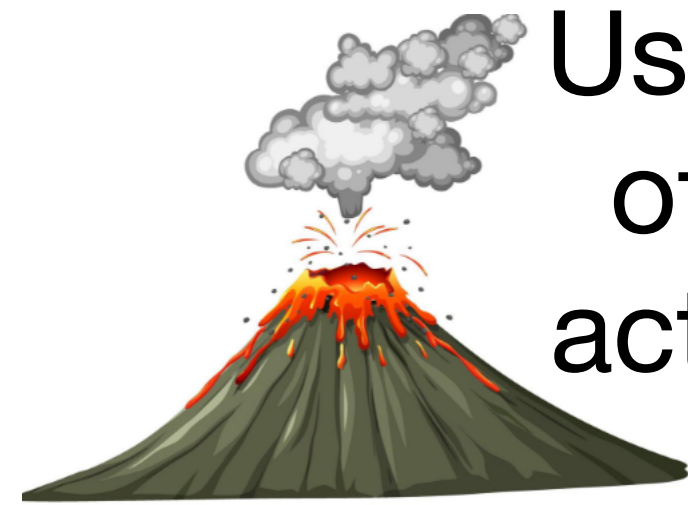
If you're confident or do extra research you could also: Explain your opinion on each method giving reasons relating to pollution, the environment, and reliability.

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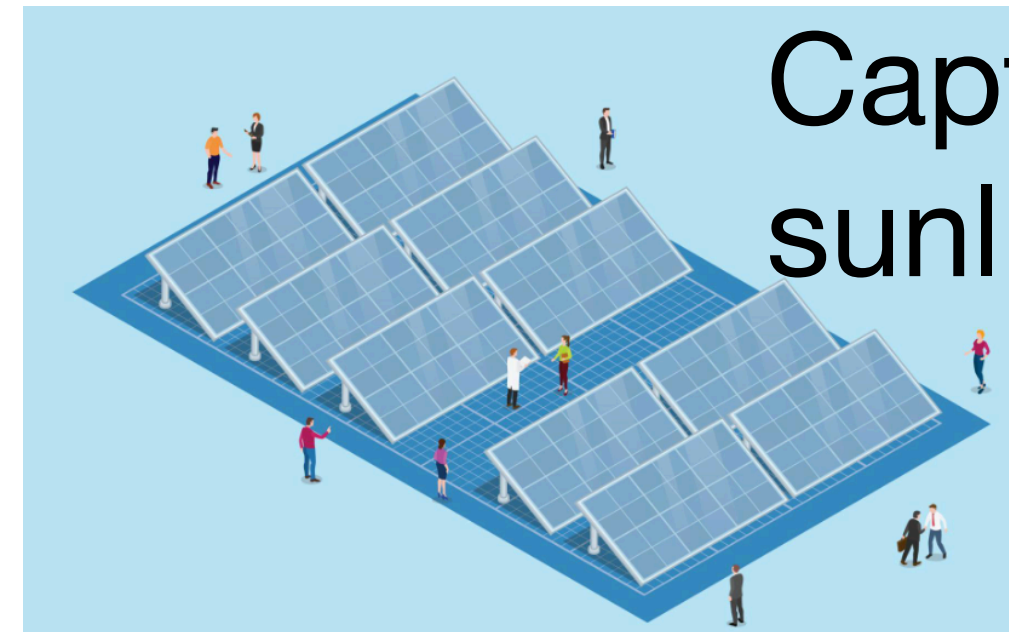
Which of these renewable ways of generating electricity have I made up?



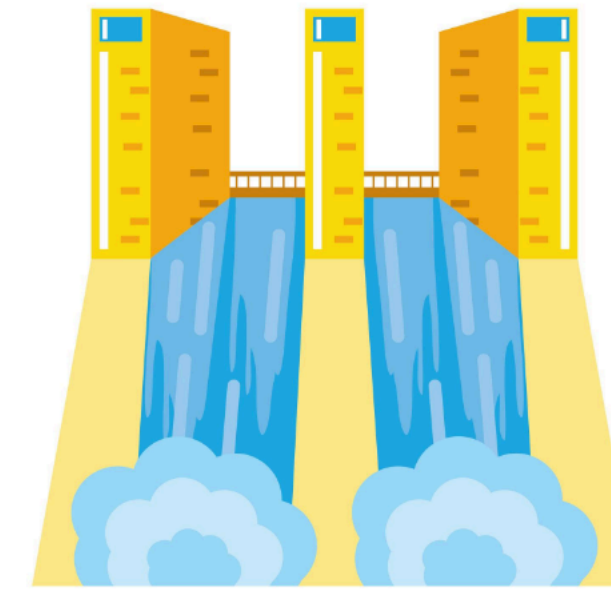
Using the energy of waves



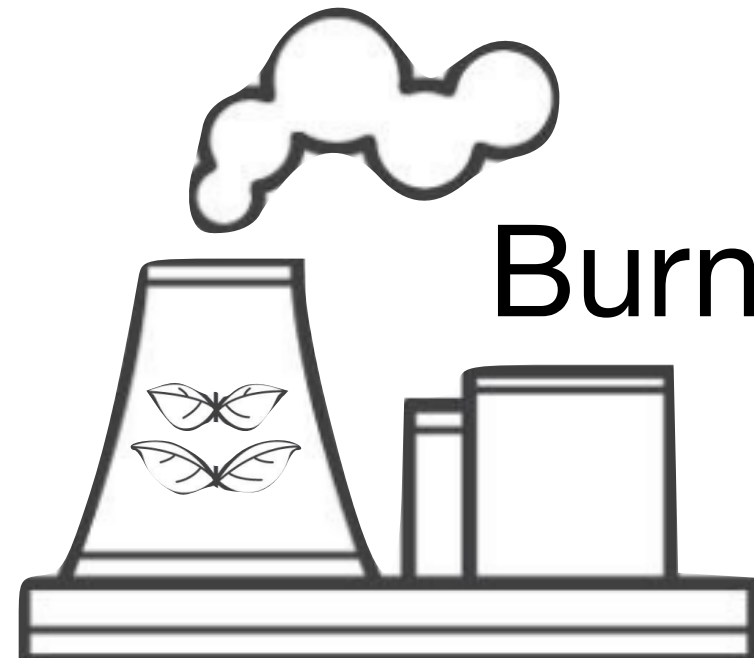
Using the energy of smoke from active volcanoes



Capturing sunlight

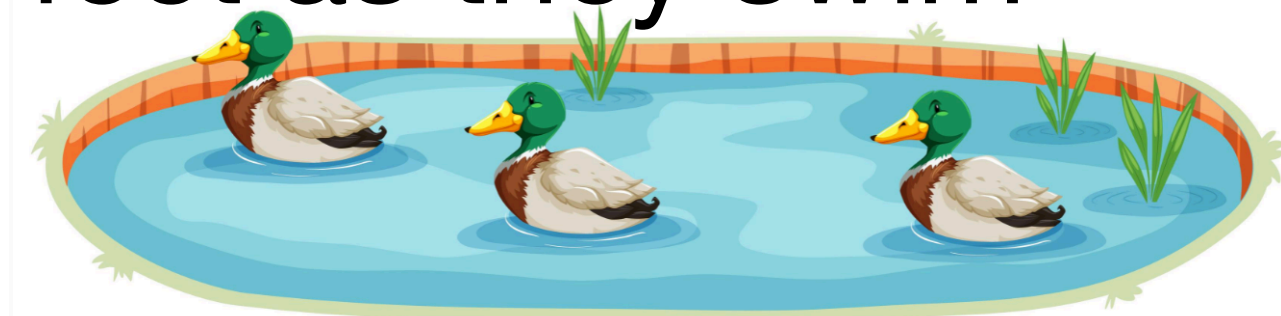


Using energy of water being released from a dam



Burning wood instead of coal

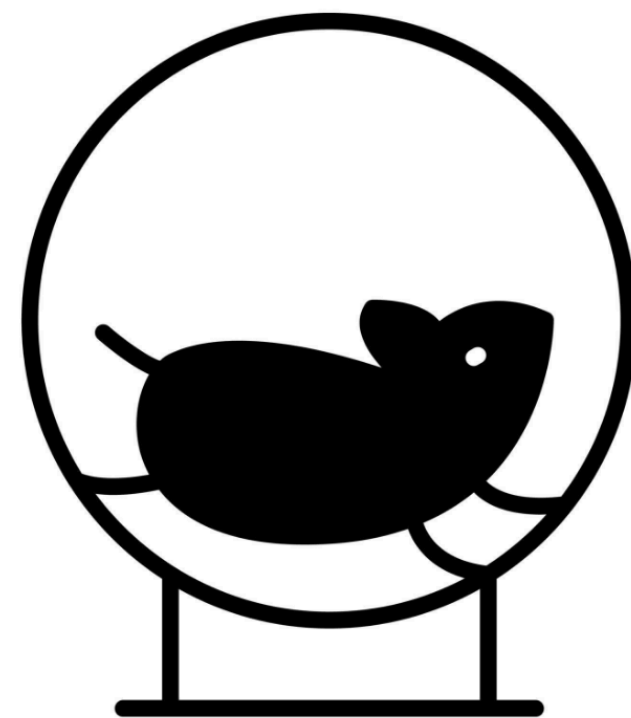
Using energy of duck's feet as they swim



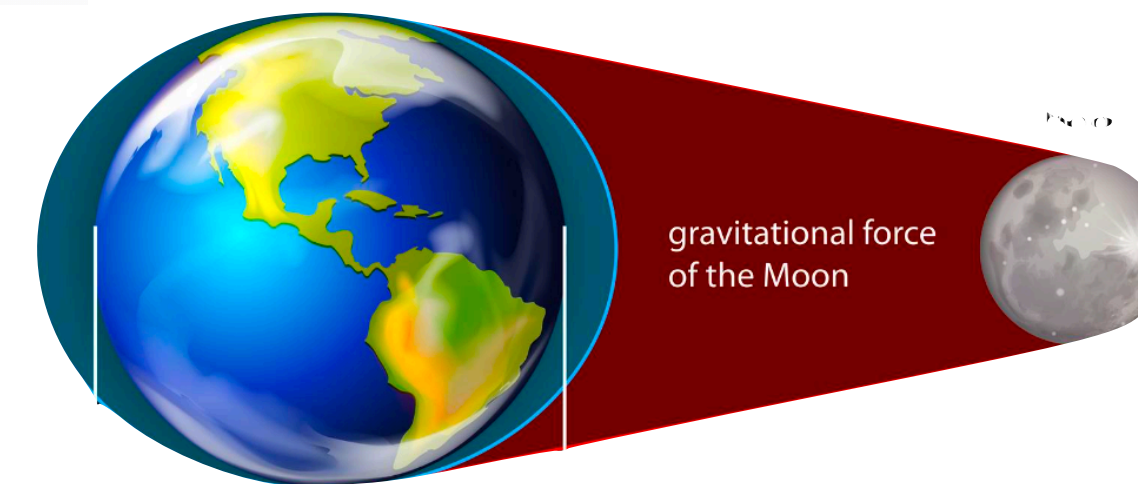
Drilling a hole and using Earth's heat



Using the energy of hamsters in wheels



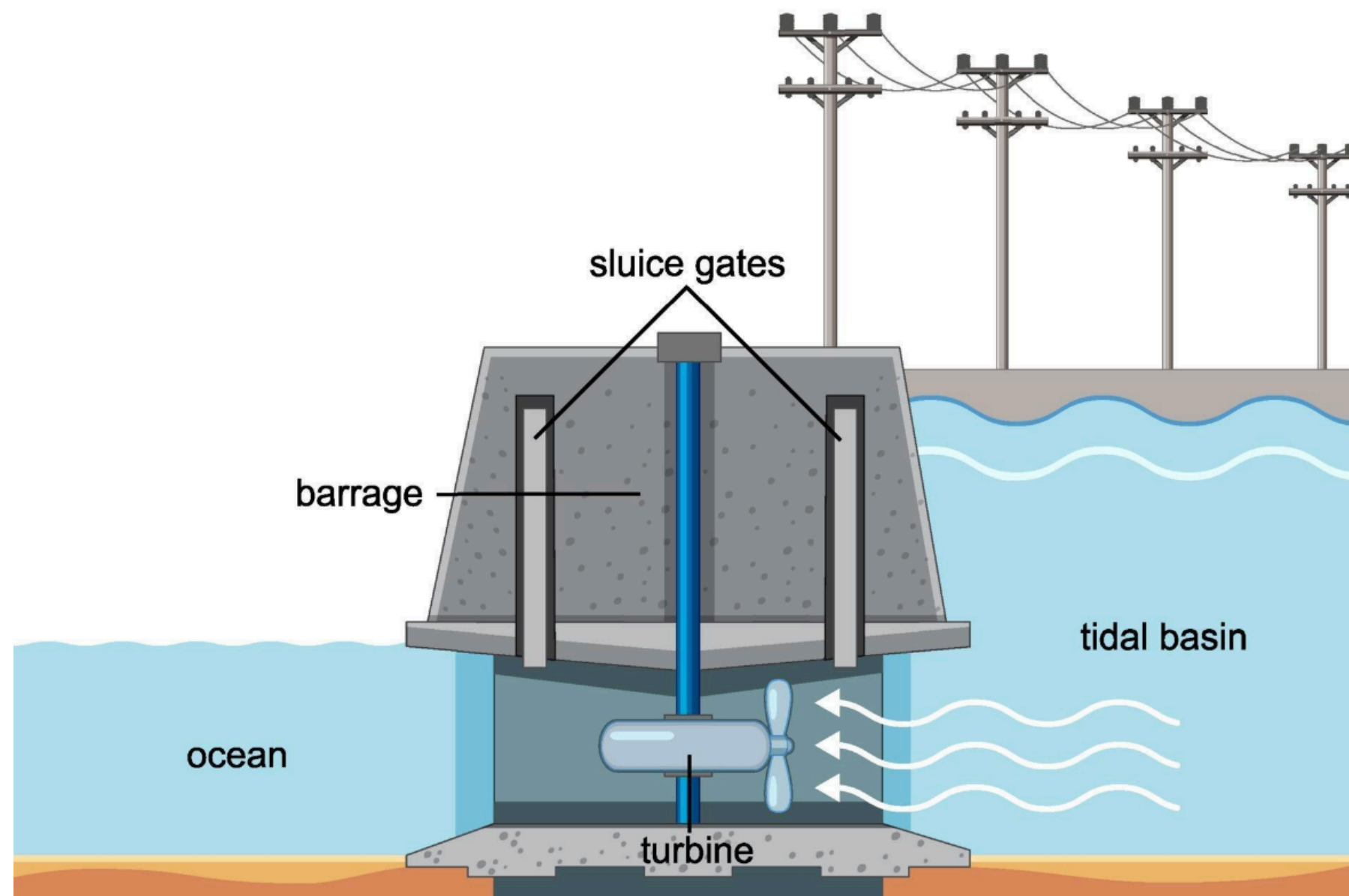
Burning gas that comes off rubbish dumps



Using the energy of the tides going in and out

Done? Say where the energy first came from in each true case! How is it being transferred?

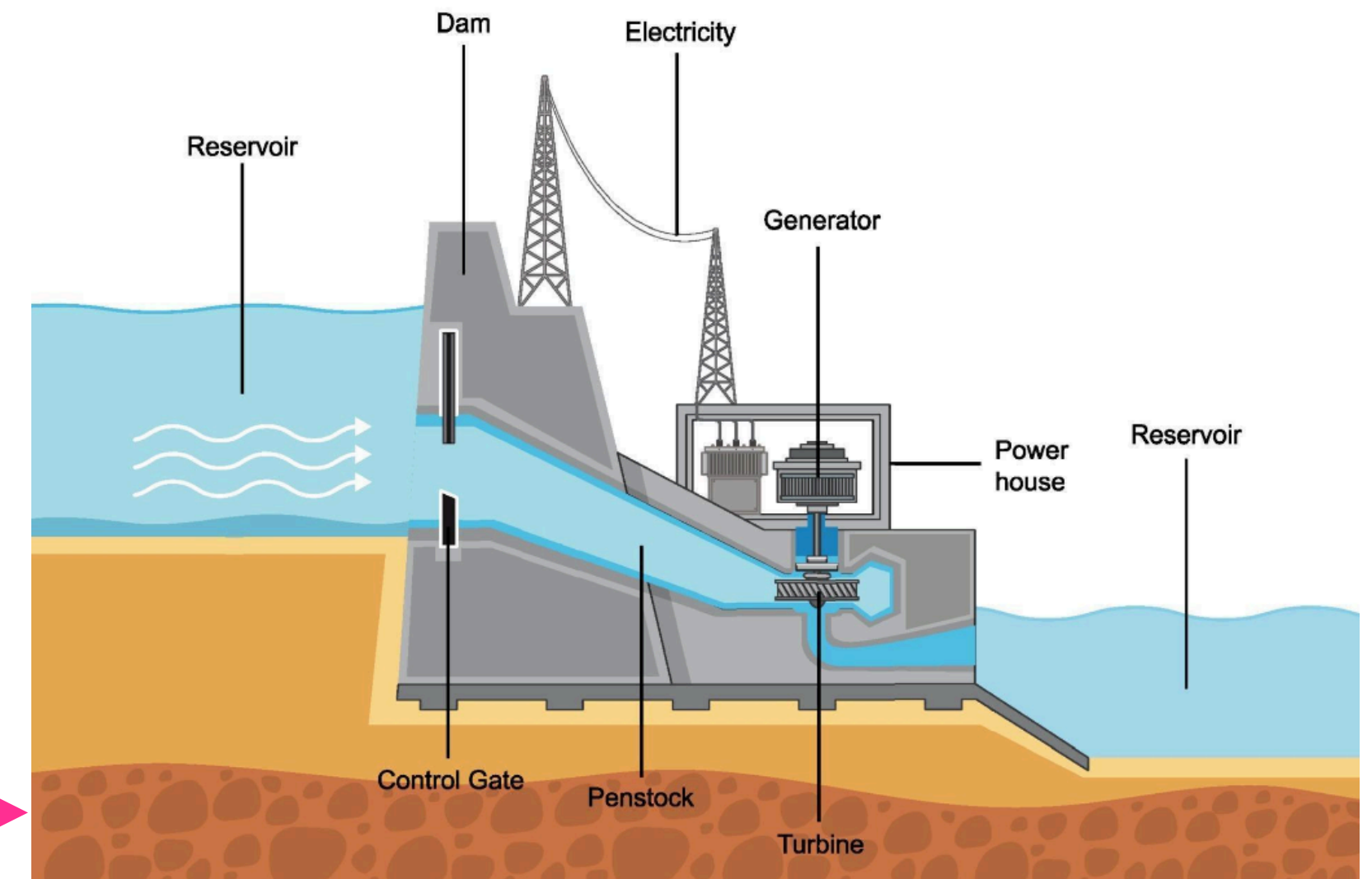
Tidal Power Station



Tidal power
(the tide flowing through a turbine)

Hydro-power (water from a dam flowing through a turbine)

Hydro-powered Electrical Power Plant



What do they have in common?

They don't release pollution while running

Their energy comes from the Sun

They harm migrating animals

What's different about them?

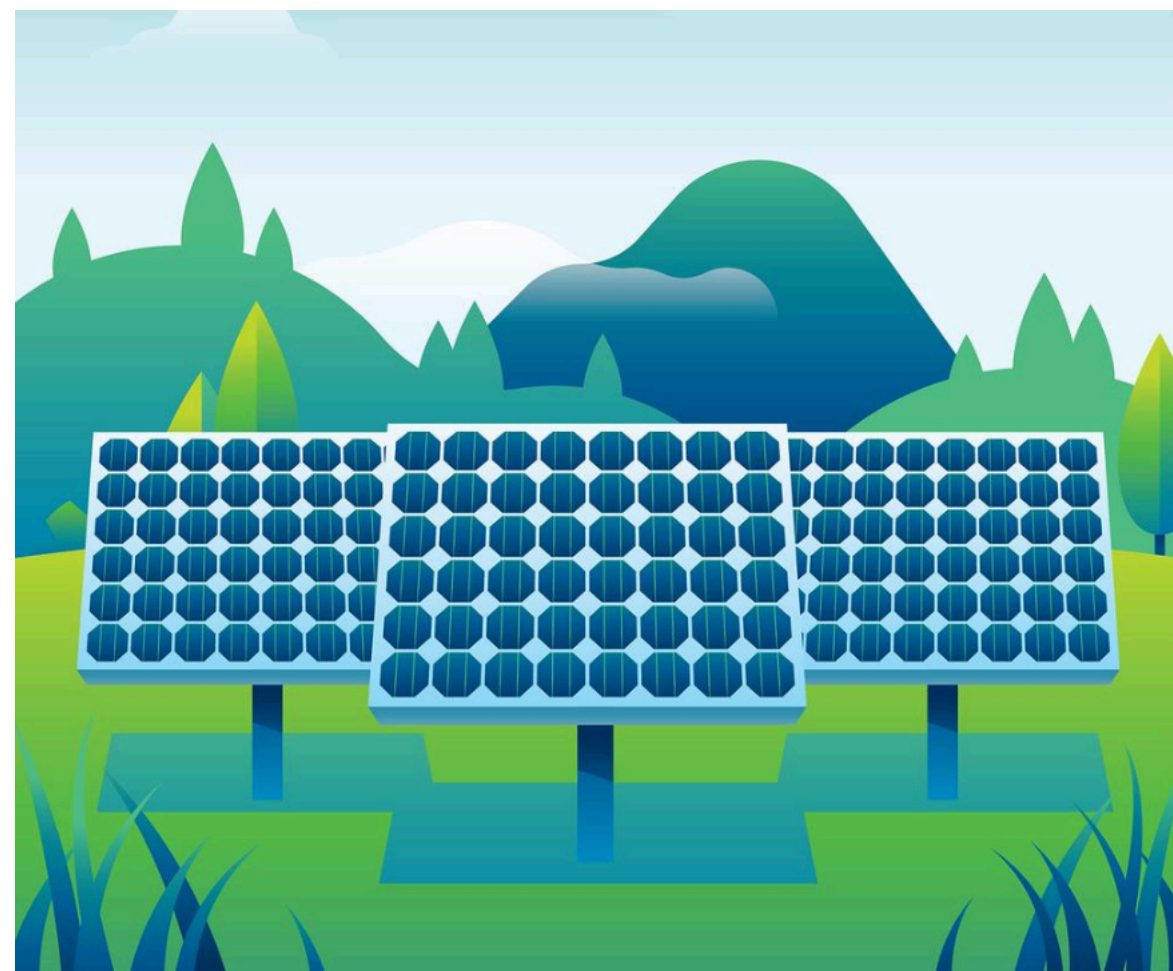
Can provide enough electricity whenever we need it.

Expensive to build

Hard to find places to put them

Match the description to the renewable energy source

Solar Cells: Use sunlight to produce electricity



Reliable: energy is always available

Releases some harmful gases trapped inside Earth

Very hard to find places to put it

Cheap to run

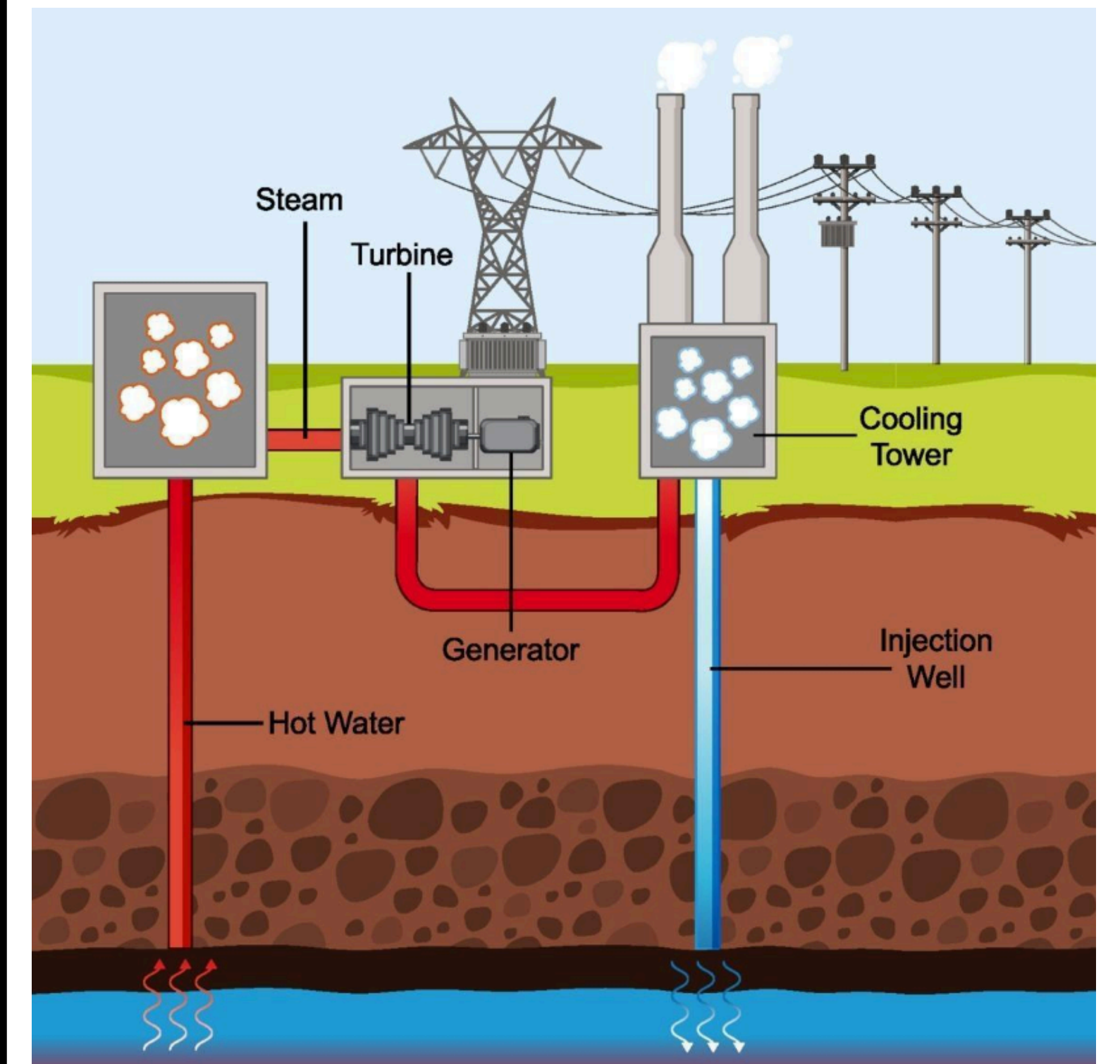
Easy to look after

Takes up farm land

No pollution released while working

Where they are makes a big difference to how well they work

Geothermal: Dig hole and use Earth's heat to make steam, used to generate electricity



GCSE questions!

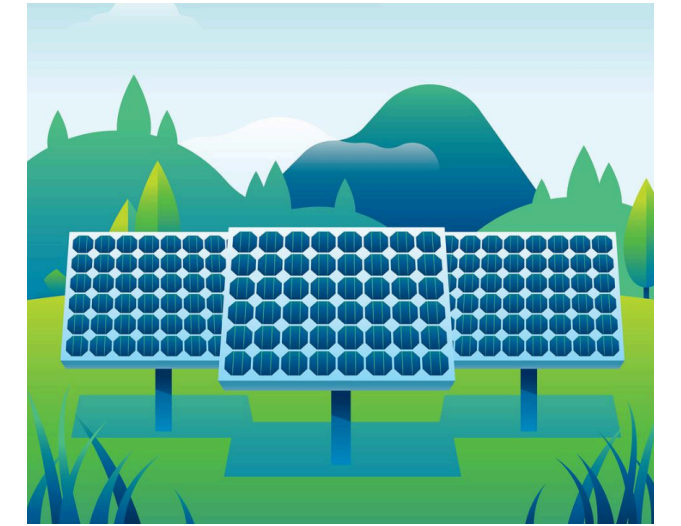
1) Which energy source is used to boil water to generate electricity?

- a. Hydroelectric
- b. Geothermal
- c. Tides
- d. Waves

2) Which energy source does not originate from the Sun?

- a. Hydroelectric
- b. Geothermal
- c. Tides
- d. Waves

3) Give two advantages and two disadvantages of using solar cells to generate electricity.



Summary question!

List as many renewable energy sources as you can. For each one, say whether they...

- *Can provide electricity whenever it's needed
- *Release pollution while they're running
- *Harm wildlife



Theatre of Science Renewable Energy 4: Nuclear Power!

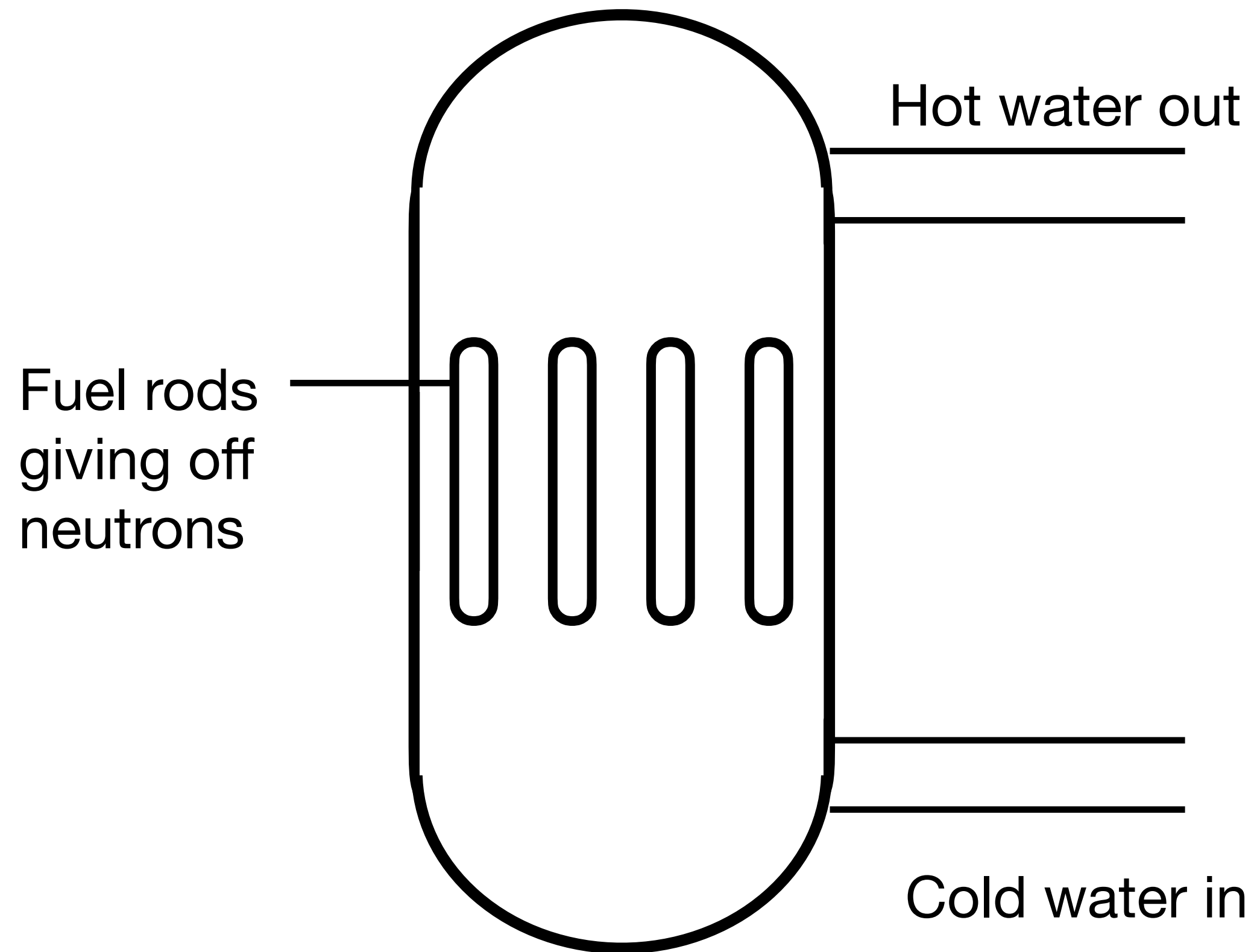
By the end of today I'd like you to be able to: Sketch and label an atom, and state that unstable atoms can be spilt to release heat, which generates electricity.

You might also be able to: Describe the main parts of a nuclear power station and explain their purpose.

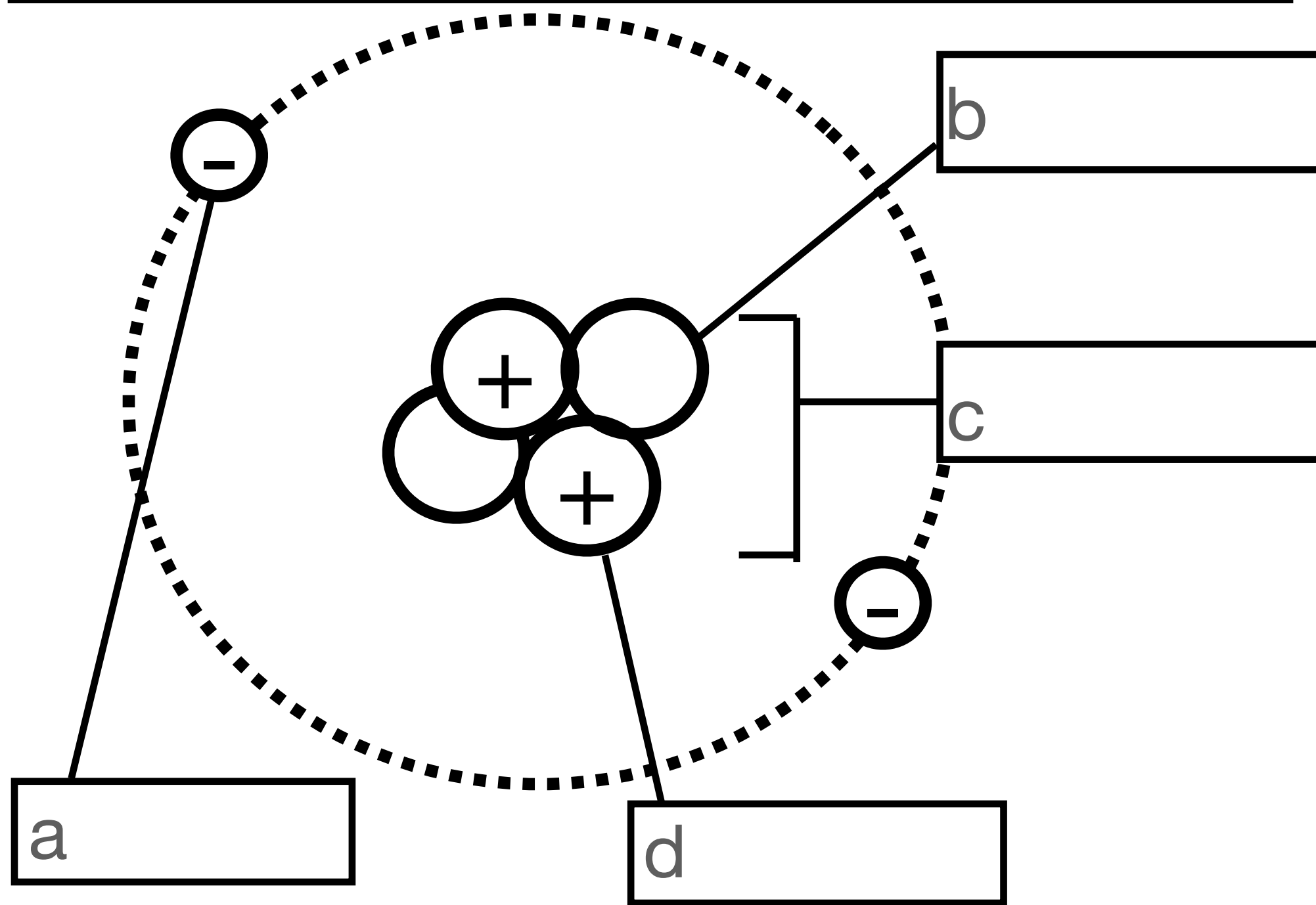
If you're confident you could also: Explain the pros and cons of nuclear energy compared to other energy sources, and explain what your opinion is of using nuclear energy to generate electricity.

You will need: Pen & paper.

This diagram might be useful for notes!



1) Label this diagram of a helium atom:



Proton

Neutron

Nucleus

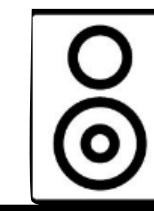
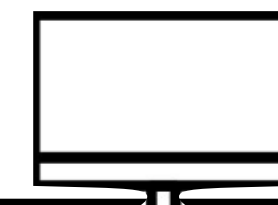
Electron

2) Complete the following:

Some atoms have a nucleus which is un_____. So they release radiation: we say atoms like this are _____. The nucleus of an unstable atom can be _____ by firing _____ at it. This process is called nuclear _____. It releases _____ we use to generate _____.



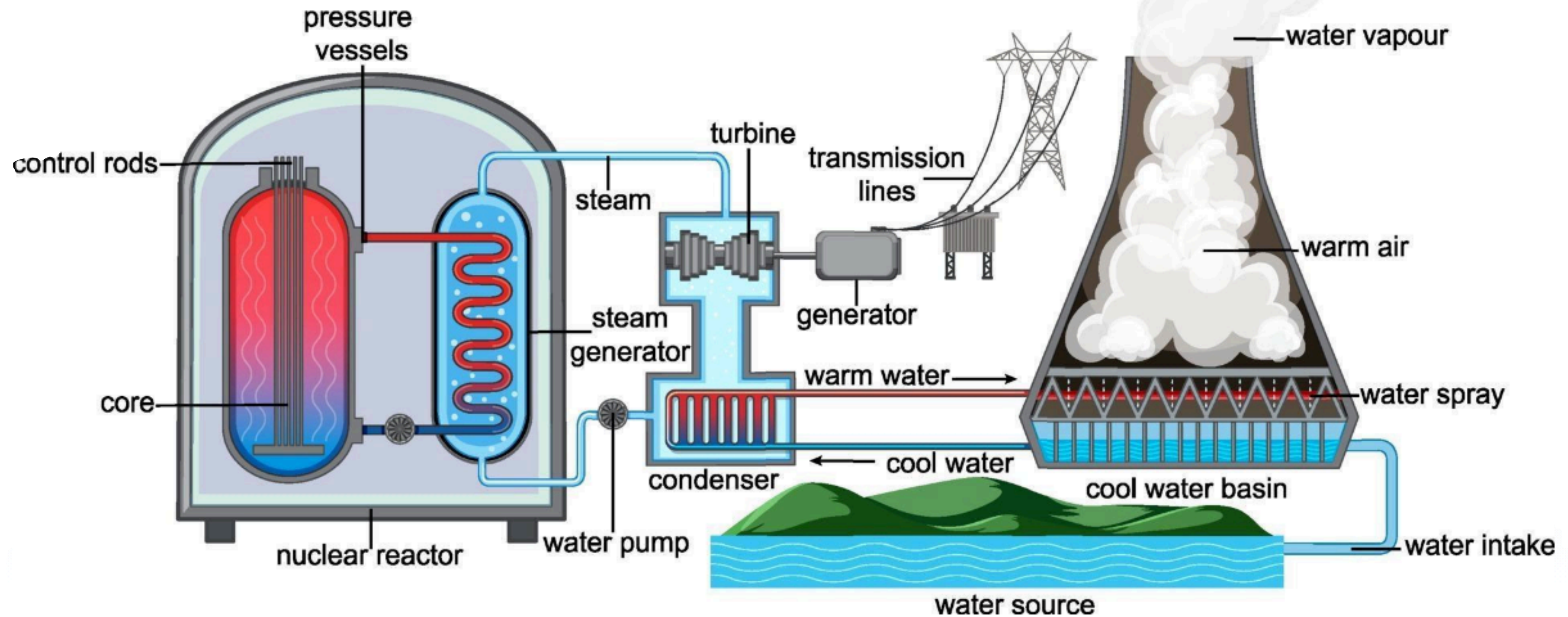
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??

3) Explain, as thoroughly as you can, how heat can be used to generate electricity.

Nuclear Power Station



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GCSE questions!

1) Explain why this sentence is wrong:

“Atoms are arranged in the Periodic table according to the number of **electrons** they have”. (1 mark)

2) Which row in this table describes the **nucleus** of an atom?

	In the nucleus are...	Charge on the nucleus
A	Electrons and neutrons	Negative
B	Protons and electrons	Neutral
C	Protons and neutrons	Neutral
D	Protons and neutrons	Positive

3) What is the role of the control rods in a nuclear power station? (1)

4) State an advantage and a disadvantage of using nuclear fuel to generate electricity.

Summary questions!

1. Sketch and label an atom.

2. Complete the sentence:

“When unstable atoms are split, the _____ given off can be used to generate _____. The waste is radio_____ and must be treated carefully.”



Theatre of Science Renewable Energy 5: Electric Cars!

By the end of today I'd like you to be able to:

Give one or two reasons why electric cars are an important part of the future.

You might also be able to: Describe the worries that might stop people buying an electric car.

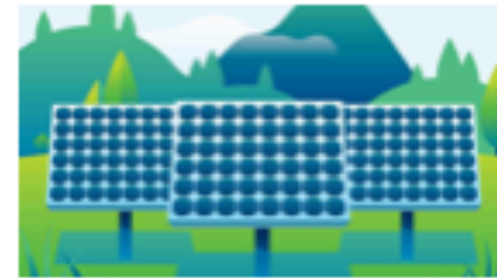
If you're confident you could also: Explain the problems currently facing electric cars and describe some solutions.

You will need: A calculator, two food cans that weigh the same but contain different foods. Eg 400g soup and 400g beans, or 415g spaghetti hoops and 415g chickpeas.

1. Which of these ways of generating electricity...



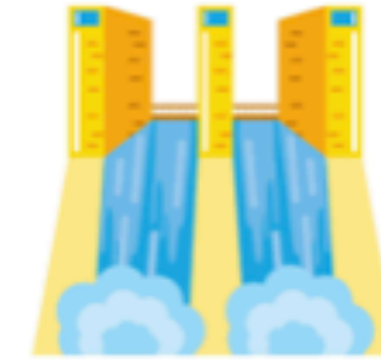
Burning wood chips (biomass)



Solar panels



Burning gas or coal



Damming a river



Splitting an atom! (Nuclear fission)



Wind turbine

Give off carbon dioxide while they're running?

Give electricity whenever we need it?

Is very damaging to marine life?

Makes dangerous waste?

**2. Do you think electric cars put carbon dioxide into the environment?
EXPLAIN YOUR ANSWER!**

2. Match the situation, problem and solution

Situation

Wind and solar panels can't provide energy whenever we need it.

Electric cars are almost silent when they go slowly

Petrol is made from oil

Electric cars need charging often and it can take ages

Electric cars contain a rare, toxic metal called cobalt

Problem

Oil will run out in about 50 years!

It's mined in the Democratic Republic of the Congo where working conditions can be very poor

high chance of pedestrians being hit

this makes the journey longer

we have to use gas at peak times.

Solution

Develop cobalt-free batteries.

Electric cars

They have to make a noise, it's the law!

Electric cars plugged in could provide energy at peak times.

Invent electric roads that charge cars as they drive along!

GCSE questions!

1) This table compares a petrol and electric car

Power Source	Energy density (MJ per kg)	Mass of power source (kg)	Mass of car (kg)	Time it takes to refuel (mins)
Battery	0.95	280	1600	40
Petrol	45	51	1500	3

The electric car has a range of 200 miles with a fully charged battery. The petrol car has a range of 1100 miles on a full tank of petrol.

The cars travel at the same speed but take different times to complete a 300 mile journey. Explain why (2)

2) Energy density is the amount of energy stored per kg of energy source. Use the numbers in the table to explain why the petrol car has a greater range than the electric car. Use calculations. (3)

3) Electric cars are cheaper to run than petrol cars, but can't go as far before they need recharging. Name one other advantage, and one other disadvantage. (2)

Summary questions!

1. Describe two worries people might have that would stop them buying an electric car.
2. How are electric cars greener? Explain your answer.