Global challenges – 2021/20 GCSE Gateway Physics Combined Science A

1. Nov/2021/Paper_J250/06/No.6
   Why are step-up transformers used in the national grid?

   A   To generate alternating currents.

   B   To increase the current from power stations.

   C   To increase the voltage from power stations.

   D   To reduce pollution from power stations.

   Your answer ☐   [1]

2. Nov/2020/Paper_J250/06/No.7
   Hydroelectric power stations use water to transfer energy.

   Which answer shows the energy transfer in a hydroelectric power station?

   A   kinetic store $\rightarrow$ gravitational store

   B   gravitational store $\rightarrow$ kinetic store

   C   kinetic store $\rightarrow$ chemical store

   D   gravitational store $\rightarrow$ chemical store

   Your answer ☐   [1]

3. Nov/2020/Paper_J250/06/No.14

This question is about domestic electricity.

(a) Draw lines to connect each **term** with the correct **description**.

Term	Description
National grid	Increases voltage.
Step-up transformer	Decreases voltage.
Alternating voltage	Network of wires connecting power stations to users.
Step-down transformer	Changes direction 50 times a second.

[3]

(b) **Fig. 14.1** is a diagram of the wiring in a metal kettle.

The diagram in **Fig. 14.1** is incomplete.

Use these words to **label** the 3 wires on the diagram.

You may use each word once, more than once, or not at all.

Earth   **Live**   **Neutral**   **[2]**

.... wire

.... wire

.... wire

Heating element

Metal case
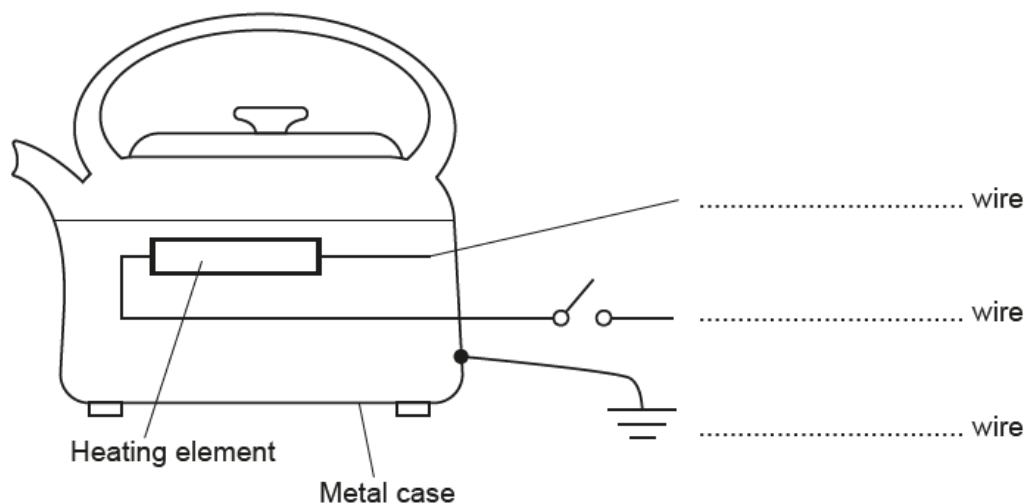
Fig. 14.1

(c) The table shows power losses for different voltages in a power line.

Voltage (kV)	Power loss (kW)
200	720
300	320
400	180
500	115
600	80

(i) Using the data in the table, plot a graph of power loss against voltage and draw a line of best fit.
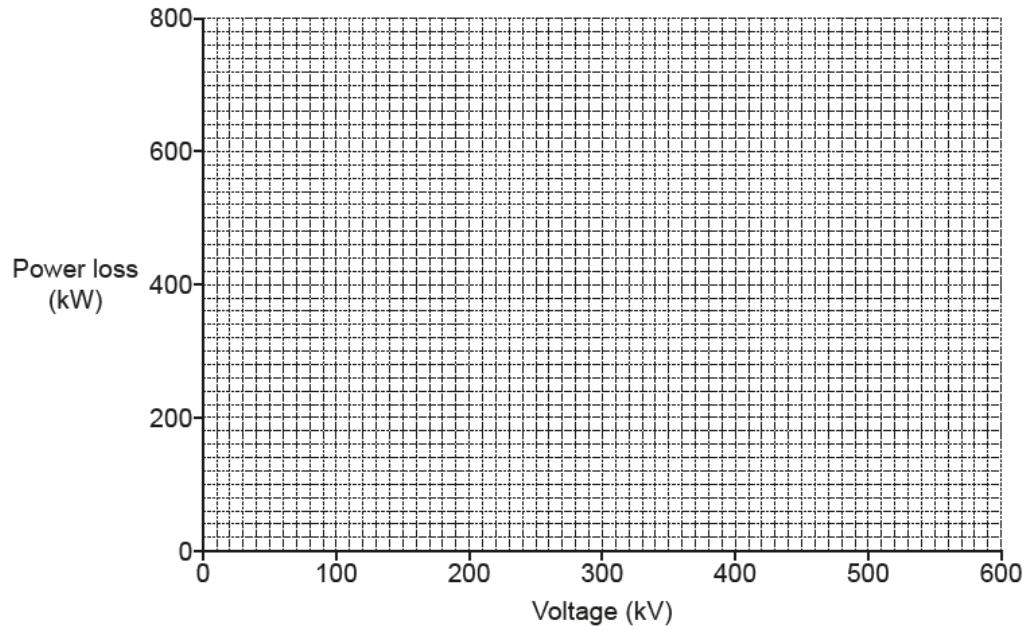
[2]

(ii) Describe the relationship between power loss and voltage.

You **may** use values from the graph or table in your answer.

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.... [2]

(iii) Explain why the national grid is an efficient way to transfer energy.

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.... [1]

4

4.

This question is about the way electricity is used in the home.

(a) The national grid transfers electrical power from power stations.

The table shows information for different types of power line.

	Power line 1	Power line 2	Power line 3
Voltage (V)	400 000	200 000	100 000
Current (A)	125	250	
Power loss (W)	46 875	187 500	750 000

(i) The resistance of each power line is $3\,\Omega$.

Calculate the current in **power line 3**.

Use the equation: power = current² × resistance

Current = ... A **[3]**

(ii) Explain how power loss is reduced in the national grid.

Use the values for **power line 1** and **power line 2** to help you.

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.... **[3]**

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(b) In **Fig. 14.1**, an electrician wires an electrical socket next to a sink.
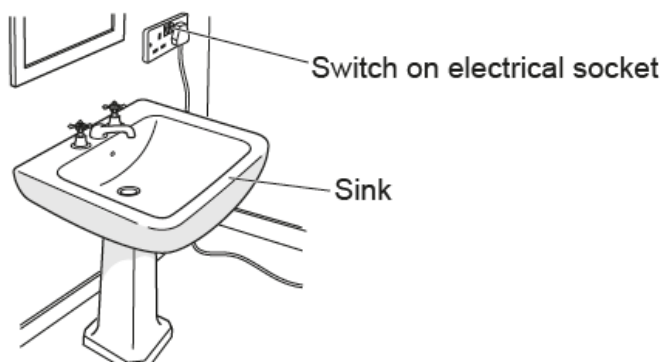

Fig. 14.1

The switch on the socket is open. Explain why this situation is dangerous if water enters the socket.

Write about the live wire and earth wire in your answer.

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.... **[3]**

5.

A turbine contains a rotating blade.

Fig. 15.1 is a diagram of a wind turbine and **Fig. 15.2** is a diagram of a water (tidal) turbine.
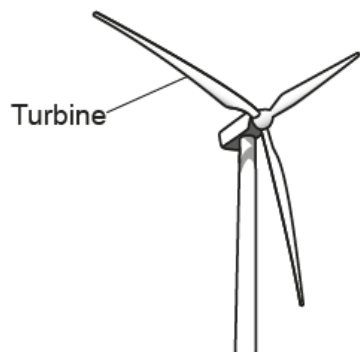
Fig. 15.1
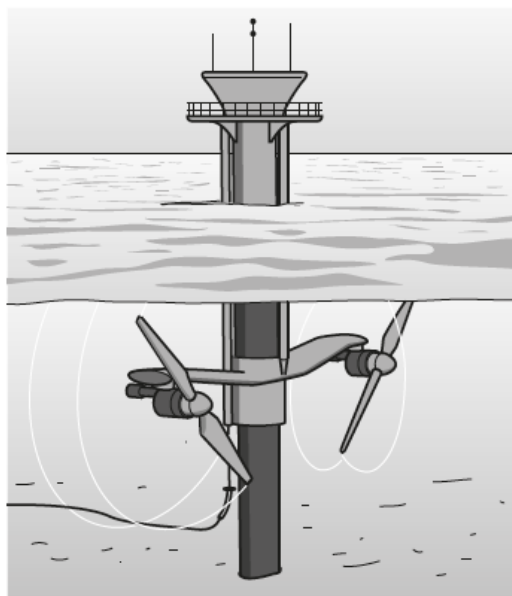
Fig. 15.2

A volume of air (wind) or water (tidal) flows through the turbine every second.

Some of the **kinetic energy** of the air or water is transferred.

This table gives information about wind and tidal turbines:

	Wind energy	Tidal energy
Density of air or water (kg/m^3)	1.2	1020.0
Typical air or water speed (m/s)	5	5
Volume of air or water through turbine in 1 second (m^3)	38 000	8
Efficiency	0.60	0.75

Compare the advantages and disadvantages of using each type of turbine.

Use kinetic energy calculations to support your answer.

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.... **[6]**