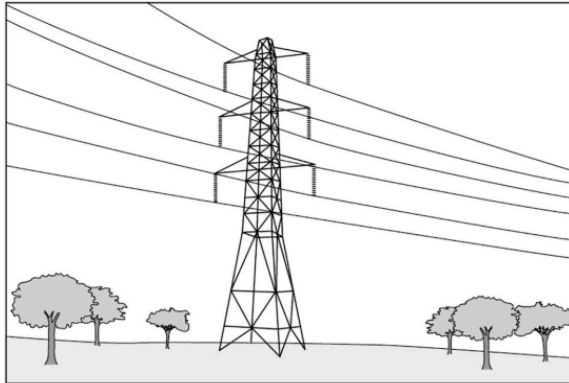


Q1.(2021)

a)

Figure 13 shows some overhead power cables in the National Grid.

Figure 13



Explain the advantage of transmitting electricity at a very high potential difference.

[3 marks]

b)

It is dangerous for a person to fly a kite near an overhead power cable.

Figure 14 shows a person flying a kite.

Figure 14



The person could receive a fatal electric shock if the kite was very close to, but not touching the power cable.

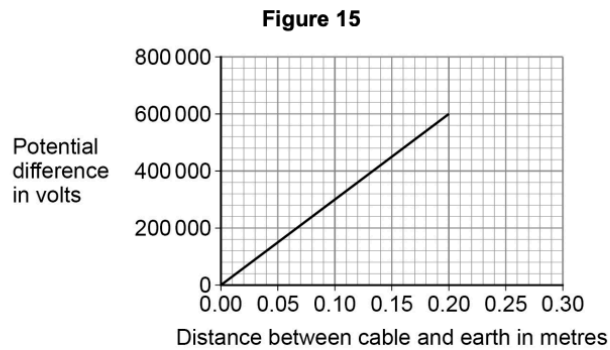
Explain why.

[3 marks]

c)

A scientist investigated how the potential difference needed for air to conduct charge varies with the distance between a cable and earth.

Figure 15 shows the results.



The data in **Figure 15** gives the relationship between potential difference and distance when the air is dry.

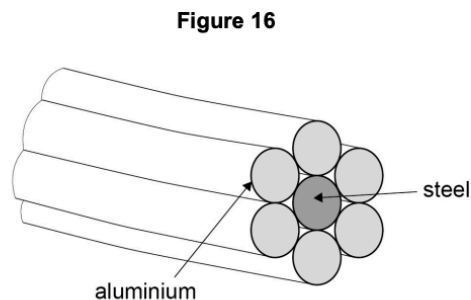
When the humidity of air increases the air becomes a better conductor of electricity.

Draw a line on **Figure 15** to show how the potential difference changes with distance if the humidity of the air increases.

[2 marks]

d)

Figure 16 shows a cross-section through a power cable.



A 1 metre length of a single aluminium wire is a better conductor than a 1 metre length of the steel wire.

The individual wires behave as if they are resistors connected in parallel.

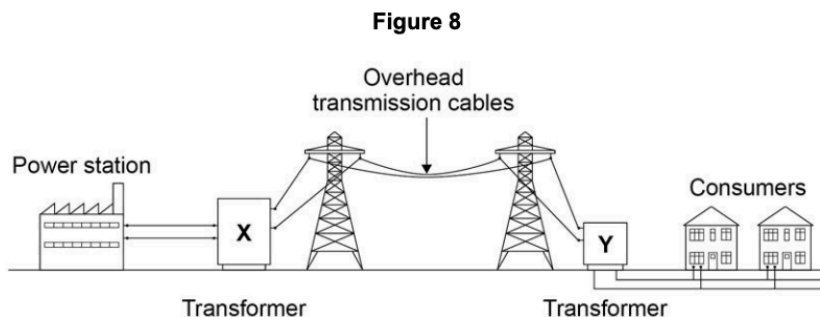
Explain why the current in the steel wire is different to the current in a single aluminium wire.

[2 marks]

Q2.(2022)

a)

Figure 8 shows how electricity is supplied to consumers by the National Grid.



Explain why transformer **X** is used in the National Grid.

[4 marks]

b)

Explain why transformer **Y** is used in the National Grid.

[2 marks]

c)

The town of Hornsdale in Australia has electricity supplied by a huge battery.

On one day the battery transferred 3.24×10^{11} J of energy to the town.

The potential difference of the town's electricity supply is 230 V.

Calculate the charge flow to the town on this day.

Use the Physics Equations Sheet.

Give your answer to **3** significant figures.

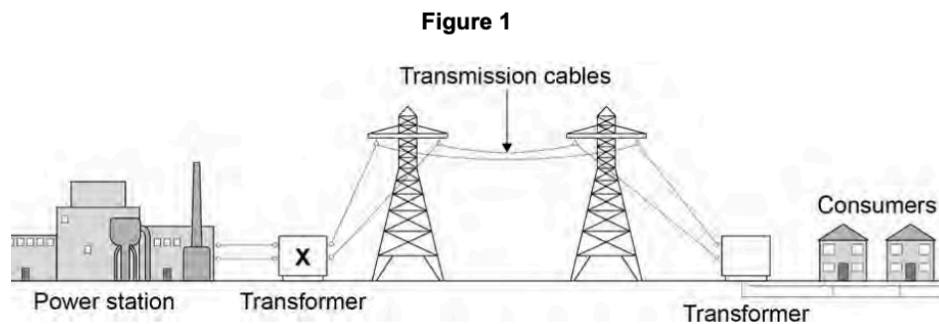
[4 marks]

Charge flow (3 significant figures) = _____ C

Q3.(2023)

a)

Figure 1 shows how the National Grid connects a power station to consumers.



Complete the sentences.

[2 marks]

Transformer **X** causes the potential difference to _____.

Transformer **X** causes the current to _____.

b)

Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

c)

A transmission cable has a power loss of 1.60×10^9 W.

The current in the cable is 2000 A.

Calculate the resistance of the cable.

[3 marks]

Resistance = _____ Ω

d)

Write down the equation which links efficiency, total energy input and useful energy output.

[1 mark]

e)

The total energy input to the National Grid from one power station is 34.2 GJ.

The National Grid has an efficiency of 0.992

Calculate the useful energy output from this power station to consumers in GJ.

[3 marks]

Useful energy output = _____ GJ