Questions are for both separate science and combined science students unless indicated in the question

Q1.

(a) The potential difference between the metal dome and earth is 300 000 V.

When the spark jumps there is a charge flow of 0.000 002 C.

Calculate the energy transferred by the spark.

Use the equation:

energy transferred = charge flow × potential difference

_____

_____

_____

Energy transferred = _____ J

(2)

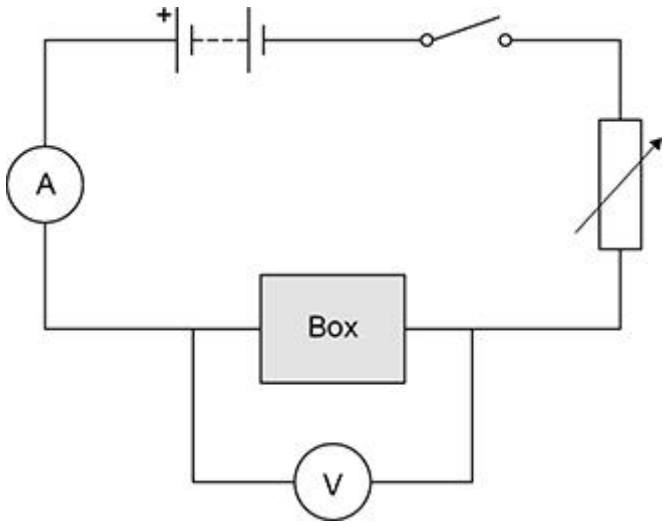
(Total 2 marks)

Q2.

A student had an unknown electrical component inside a sealed box.

Figure 1 shows the circuit the student used to identify the component.

Figure 1



The student varied the potential difference across the component and measured the current in the component.

The table below shows the results when the potential difference across the component was 6.0 V.

Potential difference in volts	**Current in amps**			
	1st reading	2nd reading	3rd reading	**Mean**
6.0	0.26	0.21	0.25	**X**

(a) Calculate value **X** in above table.

_____

_____

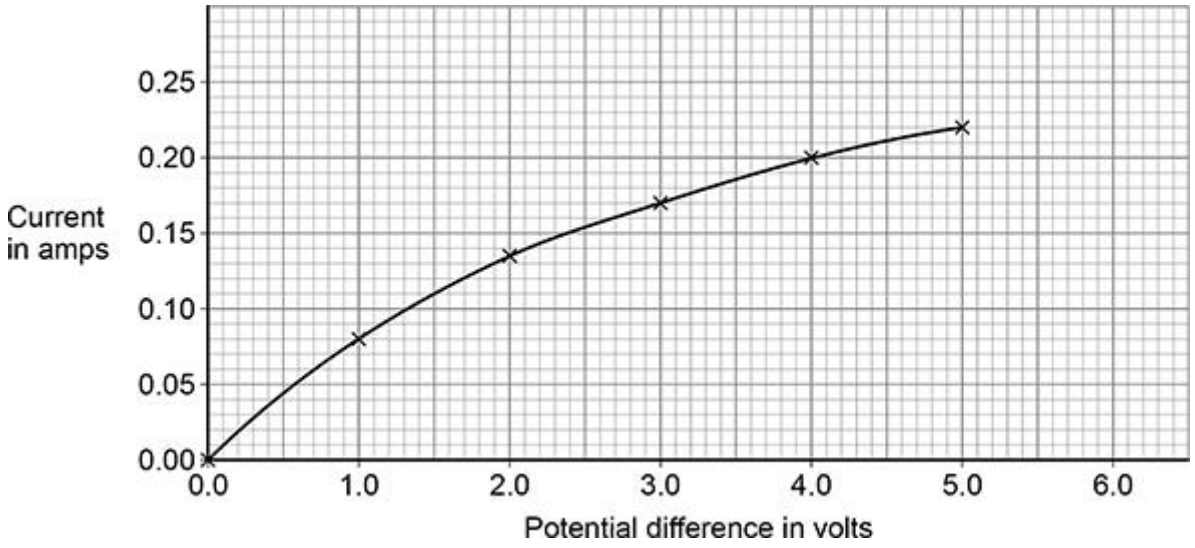
_____

X = _____ A

(2)

Figure 2 shows the results.

Figure 2



(b) Calculate the power of the component when the potential difference across the component is 3.0 V.

Use **Figure 2** and the equation:

power = potential difference × current

_____

_____

_____

_____

_____

Power = _____ W

(3)

(Total 5 marks)

Q3.

Use the Physics Equations Sheet to answer parts (a).

(a) Write down the equation which links energy (*E*), power (*P*) and time (*t*).

_____

(1)

(b) A nuclear power station has a power output of 500 MW.

Calculate the energy output in 3600 s.

Give your answer in J.

_____

_____

_____

_____

_____

Energy output = _____ J

(3)

(Total 4 marks)

Q4.

Use the Physics Equations Sheet to answer parts (a) and (b).

(a) Write down the equation which links energy (*E*), power (*P*) and time (*t*).

_____

(1)

(b) The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

_____

_____

_____

_____

_____

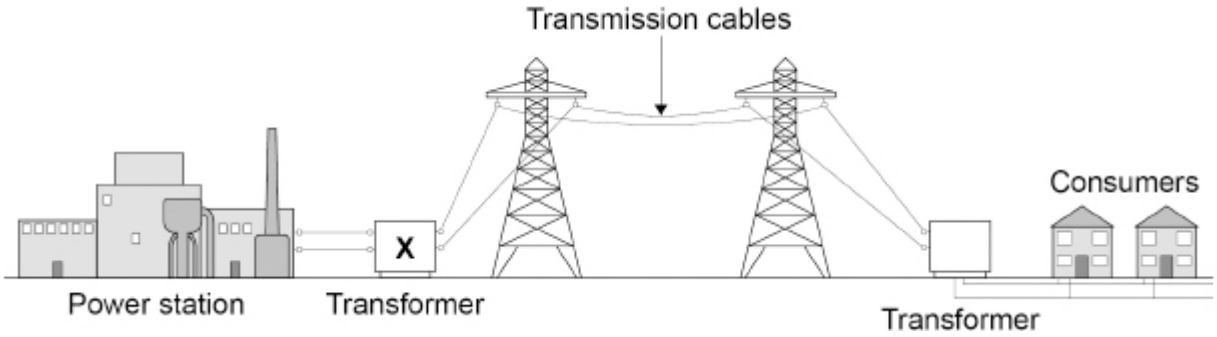
Energy transferred = _____ J

(3)

(Total 4 marks)

Q5.

The figure below shows how the National Grid connects a power station to consumers. **(Physics only)**



(a) Complete the sentences.

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

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

(2)

Use the Physics Equations Sheet to answer parts (b) and (c).

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

Tick (✓) **one** box.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

(1)

(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.

Resistance = _____ Ω

(3)

Use the Physics Equations Sheet to answer parts (d) and (e).

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

(1)

(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.

Useful energy output = _____ GJ

(3)

(Total 10 marks)

Q6.

Use the Physics Equations Sheet to answer parts (a) and (b).

(a) Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*).

_____

(1)

(b) The heating elements have a maximum power output of 1200 W.

The energy transferred to the heating elements to reach normal operating temperature is 3600 J.

Calculate the time taken for the heating elements to reach normal operating temperature at maximum power output.

_____

_____

_____

_____

_____

_____

Time = _____s

(3)

(Total 4 marks)

Q7.

An engineering company has invented pavement tiles that generate electricity as people walk on them.

The figure below shows someone walking on the pavement tiles.

Use the Physics Equations Sheet to answer parts (a) and (b).

(a) What equation links current (I), potential difference (V) and power (P)?

Tick (✓) **one** box.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

(1)

(b) When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.

_____

_____

_____

_____

_____

Current = _____ A

(3)

Use the Physics Equations Sheet to answer parts (c) and (d).

(c) What equation links efficiency, total power input and useful power output?

Tick (✓) **one** box.

$\text{Efficiency} = \frac{\text{useful power output}}{\text{total power input}}$ ☐

$\text{Efficiency} = \frac{\text{total power input}}{\text{useful power output}}$ ☐

Efficiency = useful power output × total power input ☐

(1)

(d) The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

_____

_____

_____

_____

_____

Useful power output = _____ W

(3)

(Total 8 marks)