

1

Energy resources can be renewable or non-renewable.

(a) Coal is a non-renewable energy resource.

Name **two** other non-renewable energy resources.

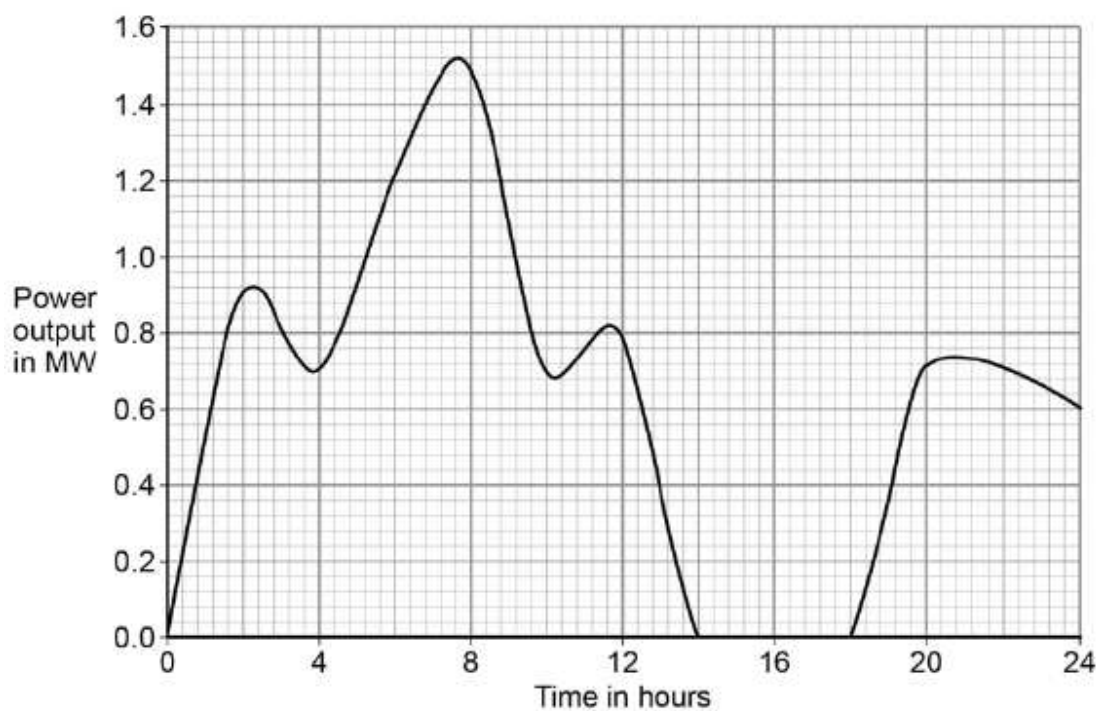
1

2

(2)

(b) Wind turbines are used to generate electricity.

The graph below shows how the power output of a wind turbine changes over one day.



A wind turbine does not generate electricity constantly.

For how many hours did the wind turbine generate no electricity?

.....

Time = ... hours

(1)

- (c) Electrical power is transferred from power stations to the National Grid.

What is the National Grid?

Tick **one** box.

a system of cables and pylons

☐

a system of cables and transformers

☐

a system of cables, transformers and power stations

☐

(1)

- (d) An island has a large number of wind turbines and a coal-fired power station.

The island needs to use the electricity generated by the coal-fired power station at certain times.

Choose **one** reason why.

Tick **one** box.

Wind is a renewable energy resource.

☐

Wind turbine power output is constant.

☐

The power output of wind turbines is unpredictable.

☐

The fuel cost for wind turbines is very high.

☐

(1)

- (e) A wind turbine has an average power output of 0.60 MW.

A coal-fired power station has a continuous power output of 1500 MW.

Calculate how many wind turbines would be needed to generate the same power output as one coal-fired power station.

.....

.....

Number of wind turbines = ...

(2)

- (f) It is important that scientists develop new energy resources.

Choose **one** reason why.

Tick **one** box.

All energy resources are running out.

All energy resources are used to generate electricity.

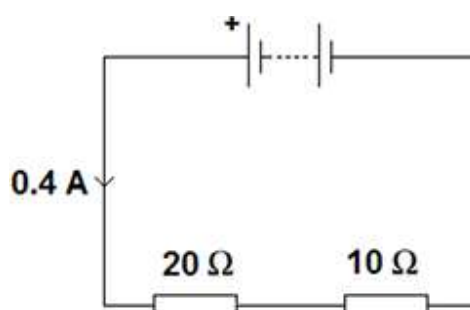
Most energy resources have negative environmental effects.

☐☐☐

(1)
(Total 8 marks)

2

An electrical circuit is shown in the figure below.



- (a) The current in the circuit is direct current.

What is meant by direct current?

Tick **one** box.

Current that continuously changes direction.

Current that travels directly to the component.

Current that is always in the same direction.

☐☐☐

(1)

- (b) The equation which links current, potential difference and resistance is:

$$\text{potential difference} = \text{current} \times \text{resistance}$$

Calculate the potential difference across the battery in the circuit in the figure above.

.....
.....

$$\text{Potential difference} = \dots\dots\dots \text{ V}$$

(3)

- (c) The equation which links current, potential difference and power is:

$$\text{power} = \text{current} \times \text{potential difference}$$

Calculate the power output of the battery in the figure above.

Give your answer to one significant figure.

.....

$$\text{Power} = \dots\dots\dots \text{ W}$$

(2)

(Total 6 marks)

3

An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in the figure below.



© Michael Priest

- (a) The electrician should **not** change the shower unless he switches off the mains electricity supply.

Explain why.

.....

.....

.....

.....

(2)

- (b) The new shower has a power output of 10 690 W when it is connected to the 230 V mains electricity supply.

The equation which links current, potential difference and power is:

$$\text{current} = \frac{\text{power}}{\text{potential difference}}$$

Calculate the current passing through the new shower.

Give your answer to two significant figures.

.....

.....

.....

Current = ... A

(4)

- (c) The new shower has a higher power rating than the old shower.

How does the power of the new shower affect the cost of using the shower?

Give a reason for your answer.

.....

.....

.....

.....

(2)

(Total 8 marks)

4

An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in **Figure 1**.

Figure 1



© Michael Priest

- (a) If the electrician touches the live wire he will receive an electric shock.

Explain why.

.....

.....

.....

.....

.....

.....

.....

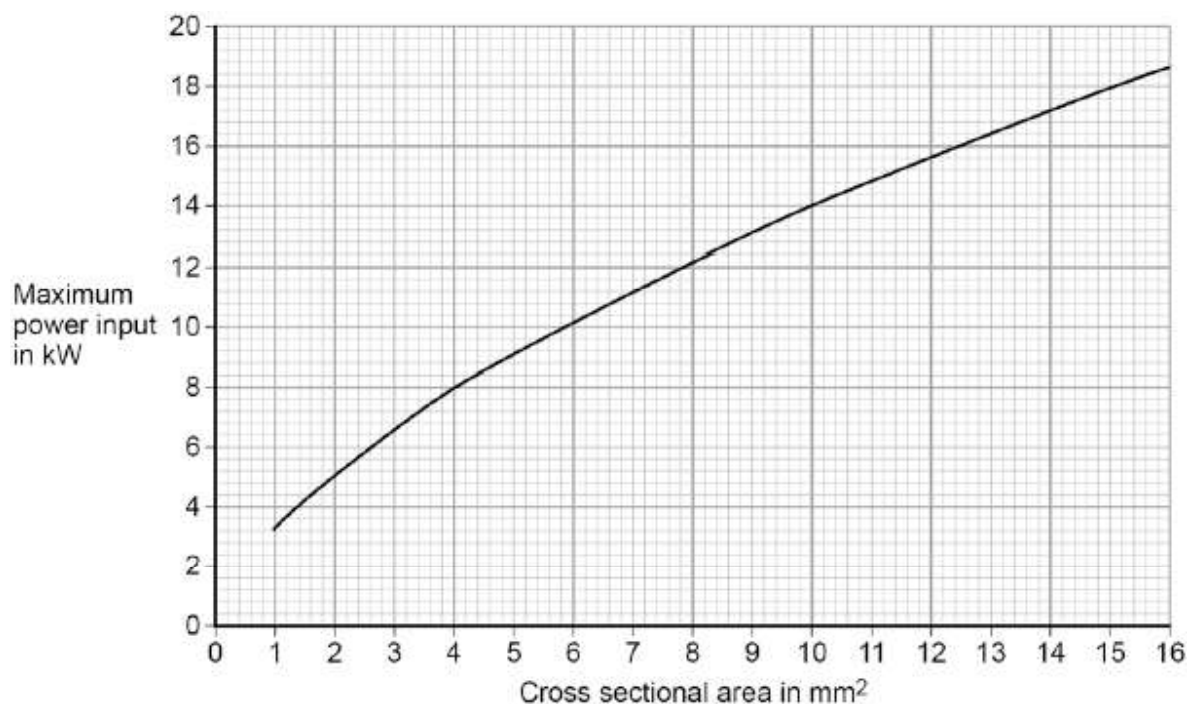
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(4)

- (b) Different electrical wires need to have a cross-sectional area that is suitable for the power output.

Figure 2 shows the recommended maximum power input to wires of different cross-sectional areas.

Figure 2



The new electric shower has a power input of 13.8 kW.

Determine the minimum **diameter** of wire that should be used for the new shower.

The diameter, d , can be calculated using the equation:

$$d = \sqrt{\frac{4A}{\pi}}$$

A is the cross-sectional area of the wire.

.....

Minimum diameter = ... mm

(2)

- (c) The charge that flows through the new shower in 300 seconds is 18 000 C.
The new electric shower has a power of 13.8 kW.

Calculate the resistance of the heating element in the new shower.

Write down any equations you use.

.....

.....

.....

.....

.....

.....

.....

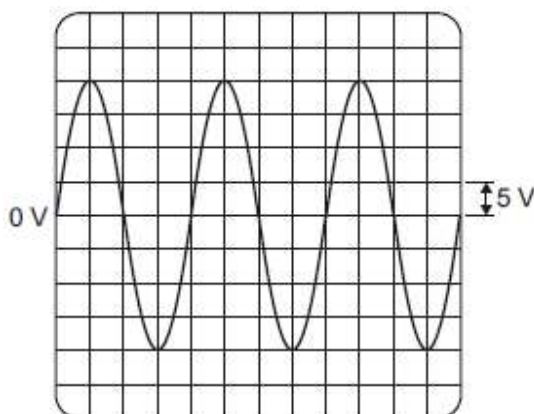
Resistance = ... Ω

(5)
(Total 11 marks)

5

- (a) **Figure 1** shows the oscilloscope trace an alternating current (a.c.) electricity supply produces.

Figure 1



One vertical division on the oscilloscope screen represents 5 volts.

Calculate the peak potential difference of the electricity supply.

.....

Peak potential difference = ... V

(1)

- (b) Use the correct answer from the box to complete the sentence.

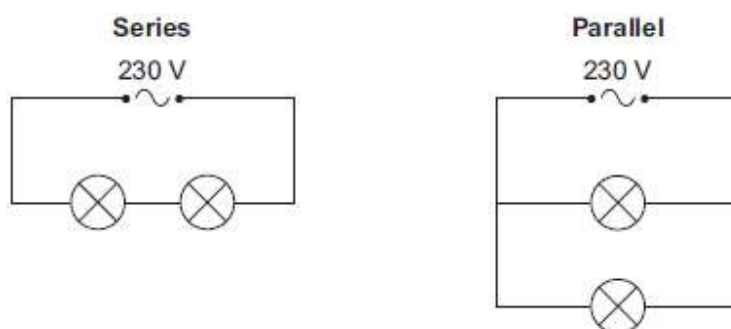
40	50	60
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In the UK, the frequency of the a.c. mains electricity supply is hertz.

(1)

- (c) **Figure 2** shows how two lamps may be connected in series or in parallel to the 230 volt mains electricity supply.

Figure 2



- (i) Calculate the potential difference across each lamp when the lamps are connected in **series**.

The lamps are identical.

.....

Potential difference when in series = ... V

(1)

- (ii) What is the potential difference across each lamp when the lamps are connected in **parallel**?

Tick (✓) **one** box.

115 V

☐

230 V

☐

460 V

☐

(1)

- (iii) Give **one** advantage of connecting the lamps in parallel instead of in series.

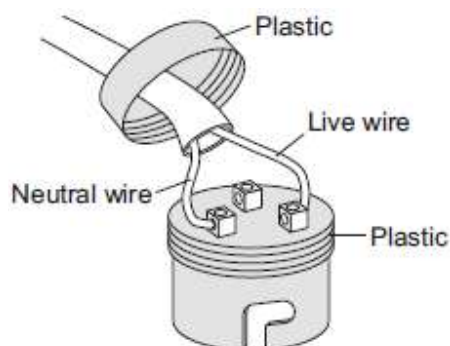
.....

.....

(1)

- (d) **Figure 3** shows the light fitting used to connect a filament light bulb to the mains electricity supply.

Figure 3



The light fitting does **not** have an earth wire connected.

Explain why the light fitting is safe to use.

.....

.....

.....

.....

(2)

- (e) A fuse can be used to protect an electrical circuit.

Name a different device that can also be used to protect an electrical circuit.

.....

(1)

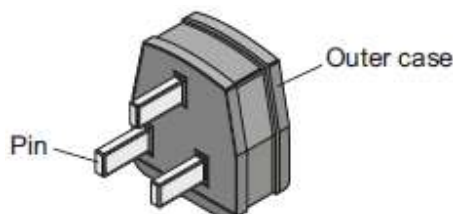
(Total 8 marks)

6

- (a) A washing machine is connected to the mains electricity supply using a cable and three-pin plug.

Figure 1 shows a three-pin plug.

Figure 1



Name the materials used in the structure of a plug. Give the reason why each material is used.

Pin

.....

Outer case

.....

(1)

- (b) The three-pin plug contains a fuse. The fuse is connected to one of the wires inside the cable.

- (i) Which **one** of the wires inside the cable is the fuse connected to?

.....

(1)

- (ii) The fuse is a thin wire inside a closed glass tube. The wire acts as a resistor.

What effect does a current through a wire have on the wire?

.....

(1)

- (iii) The power of the washing machine varies between 0.7 kW and 2 kW depending on which part of the wash cycle is operating.

Calculate the maximum current drawn from the mains electricity supply by the washing machine.

The mains electricity supply is at a potential difference of 230 V.

.....

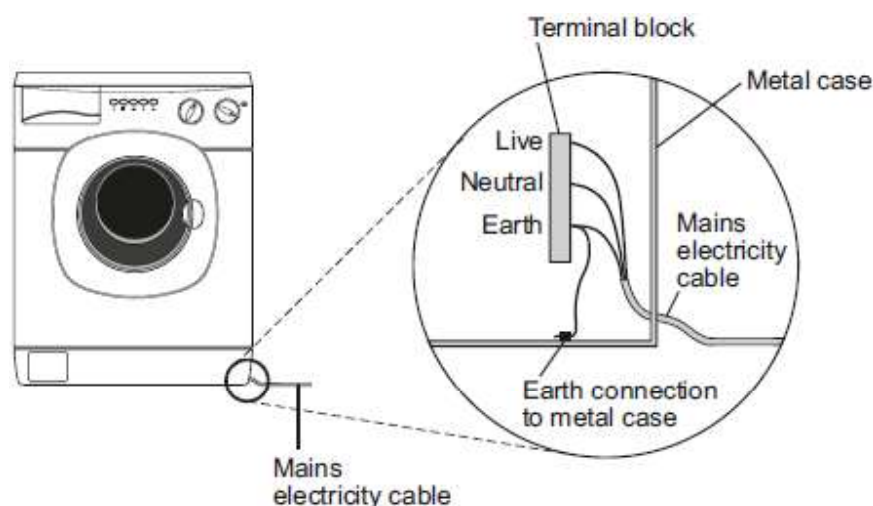
Current = ... A

(2)

- (c) **Figure 2** shows how the mains electricity cable is connected to the washing machine.

The earth wire is connected to the metal case of the washing machine.

Figure 2



If a fault makes the metal case live, the earth wire and fuse inside the plug prevent the mains cable from overheating and causing a fire.

Explain how.

.....

(2)