

1

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

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



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- (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.

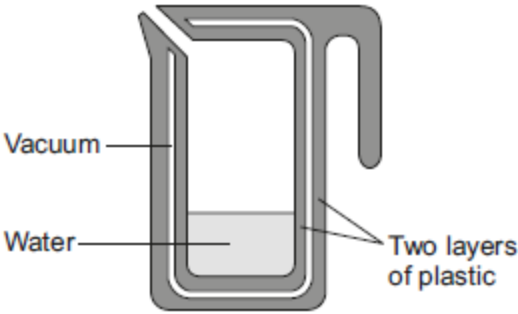
(2)

(Total 8 marks)

2

A new design for a kettle is made from two layers of plastic separated by a vacuum. After the water in the kettle has boiled, the water stays hot for at least 2 hours.

The new kettle is shown below.



- (a) The energy transferred from the water in the kettle to the surroundings in 2 hours is 46 200 J.

The mass of water in the kettle is 0.50 kg.

The specific heat capacity of water is 4200 J/kg °C.

The initial temperature of the water is 100 °C.

Calculate the temperature of the water in the kettle after 2 hours.

Temperature after 2 hours = _____ °C

(3)

- (b) Calculate the average power output from the water in the kettle to the surroundings in 2 hours.

Average power output = _____ W

(2)

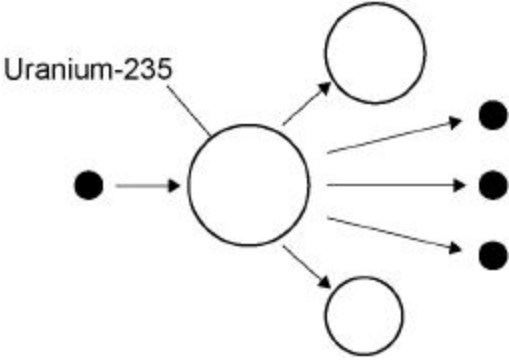
(Total 5 marks)

3

Nuclear power can be used to generate electricity through nuclear fission.

Figure 1 shows the process of nuclear fission.

Figure 1



(a) Complete the sentences.

Choose answers from the box.

gamma rays	light rays	proton	neutron	nucleus	X-rays
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During the process of nuclear fission, a uranium _____

absorbs a _____ .

Electromagnetic radiation is released in the form of _____ .

(3)

(b) The UK needs at least 25 000 000 kW of electrical power at any time.

A nuclear power station has an electrical power output of 2 400 000 kW

Calculate how many nuclear power stations are needed to provide 25 000 000 kW of electrical power.

Number of nuclear power stations = _____

(2)

(c) State **two** environmental issues caused by generating electricity using nuclear power stations.

1. _____

2. _____

(2)

(d) The UK currently generates a lot of electricity by burning natural gas. This process releases carbon dioxide into the atmosphere.

Figure 2 shows how the concentration of carbon dioxide in the atmosphere has changed over the past 115 years.

Figure 2

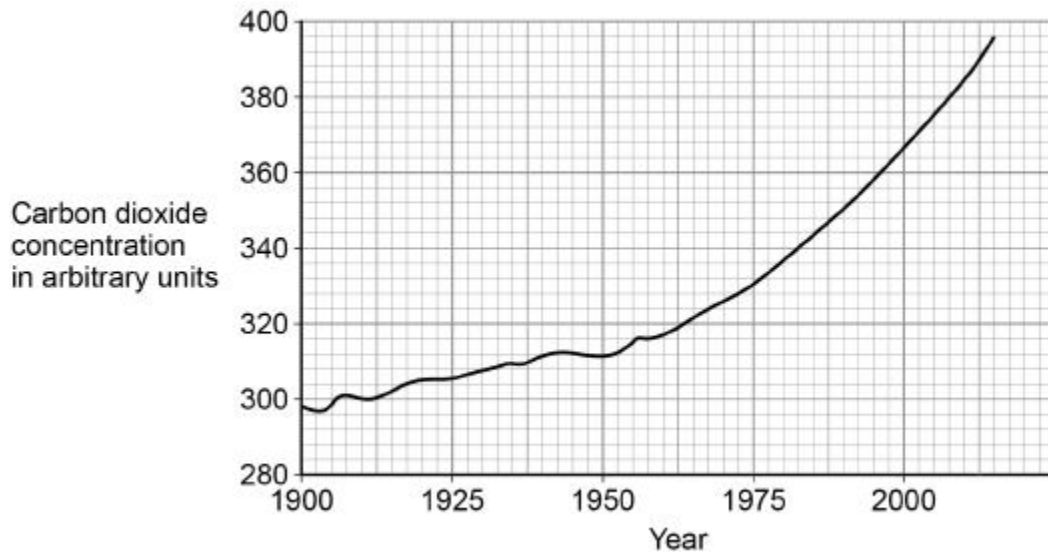
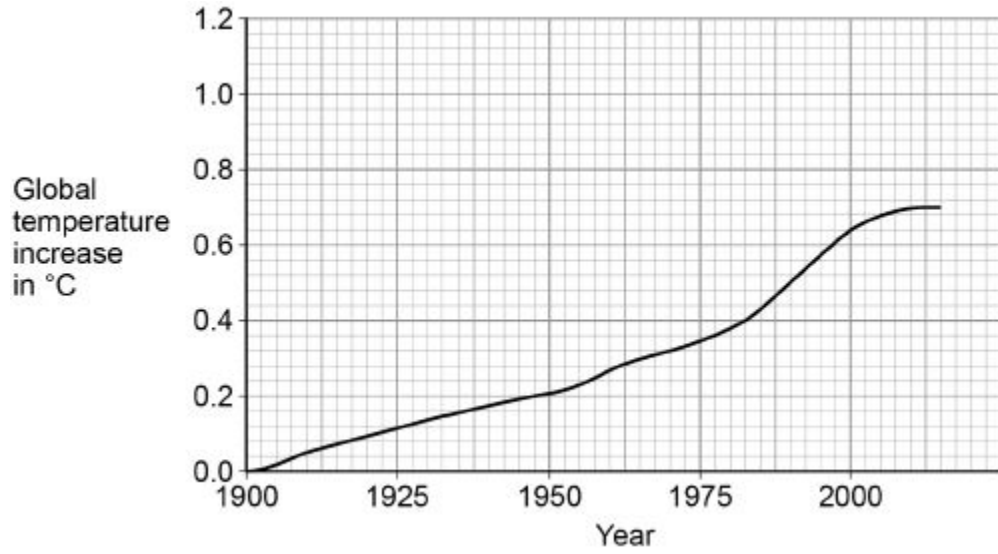


Figure 3 shows how the global temperature has changed over the past 115 years.

Figure 3



Give **one** similarity and **one** difference between the data in **Figure 2** and **Figure 3**.

Similarity _____

Difference _____

(2)
(Total 9 marks)

Mark schemes

- 1** (a) he may receive an electric shock
or
 he may be electrocuted
 if he touches the live wire
- (b) $10\,690 = I \times 230$
 $I = 10\,690 / 230$
 46.478(260) (A)
 46
allow 46 (A) with no working shown for 4 marks
- (c) cost is higher
 more energy is used (per second)
- 2** (a) 78 (°C)
allow 2 marks for correct temperature change ie 22 °C
allow 1 mark for correct substitution
ie $46\,200 = 0.5 \times 4200 \times \theta$
or

$$\frac{46200}{0.5 \times 4200} = \theta$$
- (b) 6.4 (W)
allow 2 marks for an answer that rounds to 6.4
allow 1 mark for correct substitution
ie $46\,200 = P \times 7200$
an answer of 23 000 or 23 100 or 385 gains 1 mark

[8]

3

2

[5]

3

- (a) nucleus 1
- neutron 1
- gamma rays 1
- in this order only*
- (b) $\frac{25\,000\,000}{2\,400\,000}$ 1
- 11
- an answer of 10.4 with no working scores 1 mark*
- an answer of 11 scores 2 marks*
- (c) any **two** from:
- waste is radioactive
allow nuclear waste
 - waste has a long half-life
allow waste remains dangerous for a long time
 - waste is toxic
 - waste needs to be buried
allow waste is difficult to dispose of
 - risk of catastrophic accidents
allow named accident e.g. Fukushima, Chernobyl, Three Mile Island
 - fuel is non-renewable
- 2
- (d) **similarity:**
(carbon dioxide concentration and global temperature have) both increased
allow they both show a positive correlation
- 1
- difference:**
the carbon dioxide (concentration) continues to increase whereas temperature (increase) levels off
allow carbon dioxide (concentration) increases more quickly than temperature (increase)
- 1

[9]