Please write clearly in block capitals.

Centre number		Candidate number	

Surname ______________________

Forename(s) ______________________

Candidate signature ______________________

GCSE PHYSICS

H

Higher Tier Paper 1

Wednesday 23 May 2018 Afternoon Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the Physics Equation Sheet (enclosed).

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the space provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

0 1 **Figure 1** shows a student walking on a carpet.

Figure 1

0 1 . 1 The student becomes negatively charged because of the friction between his socks and the carpet.

Explain why the friction causes the student to become charged.

[2 marks]

Do not write outside the box

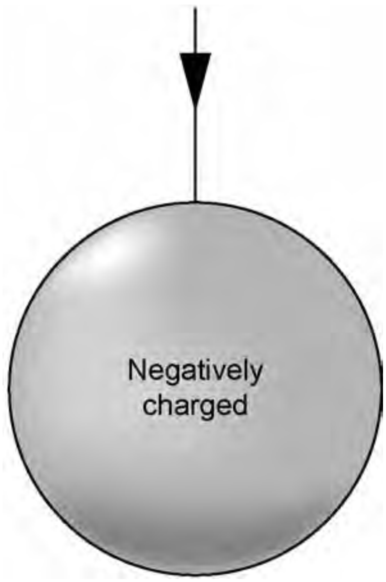
0 1 . 2 The student's head is represented by the sphere in **Figure 2.**

The student is negatively charged. The arrow shows part of the electric field around the student's head.

Draw **three** more arrows on **Figure 2** to complete the electric field pattern.

[1 mark]

Figure 2



0 1 . 3 The negatively charged student touches a metal tap and receives an electric shock.

Explain why.

[3 marks]

Turn over ►

Do not write outside the box

0 1 . 4 Some carpets have thin copper wires running through them. The student is less likely to receive an electric shock after walking on this type of carpet.

Suggest why.

[2 marks]

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8

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0 2 A teacher used a Geiger-Muller tube and counter to measure the number of counts in 60 seconds for a radioactive rock.

0 2 . 1 The counter recorded 819 counts in 60 seconds. The background radiation count rate was 0.30 counts per second.

Calculate the count rate for the rock.

[3 marks]

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Count rate = ____________________ per second

0 2 . 2 A householder is worried about the radiation emitted by the granite worktop in his kitchen.

1 kg of granite has an activity of 1250 Bq. The kitchen worktop has a mass of 180 kg.

Calculate the activity of the kitchen worktop in Bq.

[2 marks]

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Activity = ____________________ Bq

Question 2 continues on the next page

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0 2 . 3 The average total radiation dose per year in the UK is 2.0 millisieverts.

Table 1 shows the effects of radiation dose on the human body.

Table 1

Radiation dose in millisieverts	**Effects**
10 000	Immediate illness; death within a few weeks
1000	Radiation sickness; unlikely to cause death
100	Lowest dose with evidence of causing cancer

The average radiation dose from the granite worktop is 0.003 millisieverts per day.

Explain why the householder should **not** be concerned about his yearly radiation dose from the granite worktop.

One year is 365 days.

[2 marks]

0 2 . 4 Bananas are a source of background radiation. Some people think that the unit of radiation dose should be changed from sieverts to Banana Equivalent Dose.

Suggest **one** reason why the Banana Equivalent Dose may help the public be more aware of radiation risks.

[1 mark]

8

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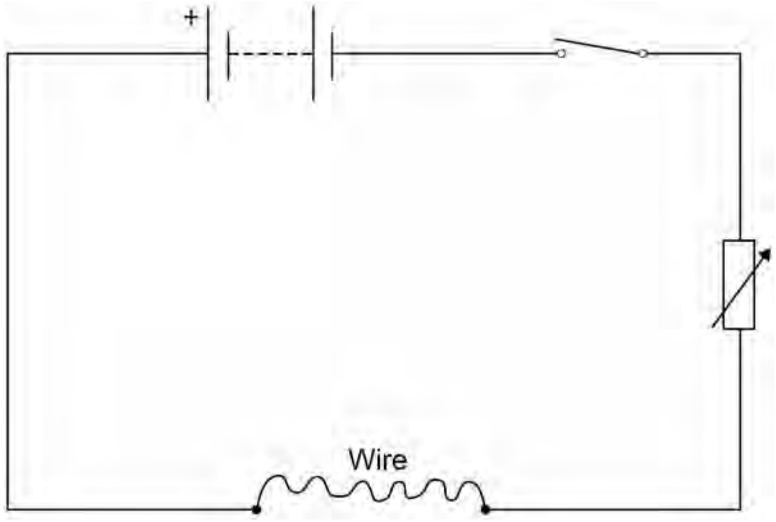
0 3 A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 3 shows part of the circuit that the student used.

Figure 3



0 3 . 1 Complete **Figure 3** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

Turn over ►

Do not write outside the box

0 3 . 2 Describe how the student would obtain the data needed for the investigation.

Your answer should include a risk assessment for **one** hazard in the investigation.

[6 marks]

0 3 . 3 Why would switching off the circuit between readings have improved the accuracy of the student's investigation?

Tick **one** box.

[1 mark]

The charge flow through the wire would not change. ☐

The potential difference of the battery would not increase. ☐

The power output of the battery would not increase. ☐

The temperature of the wire would not change. ☐

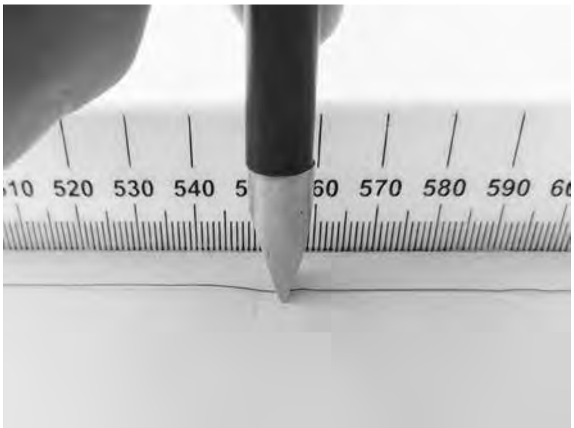
Do not write outside the box

0 3 . 4 The student used crocodile clips to make connections to the wire.

They could have used a piece of equipment called a 'jockey'.

Figure 4 shows a crocodile clip and a jockey in contact with a wire.

Figure 4



Crocodile clip **Jockey**

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

[2 marks]

The accuracy of the student's results would be higher. ☐

The accuracy of the student's results would be lower. ☐

The accuracy of the student's results would be the same. ☐

The resolution of the length measurement would be higher. ☐

The resolution of the length measurement would be lower. ☐

The resolution of the length measurement would be the same. ☐

12

PMT

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0 4 **Figure 5** shows a cyclist riding along a straight, level road at a constant speed.

Figure 5

0 4 . 1 Complete the sentences.

[2 marks]

As the cyclist rides along the road, the ________________________ energy store in the cyclist's body decreases.

The speed of the cyclist is constant when the work done by the cyclist is ________________________ the work done against air resistance.

Question 4 continues on the next page

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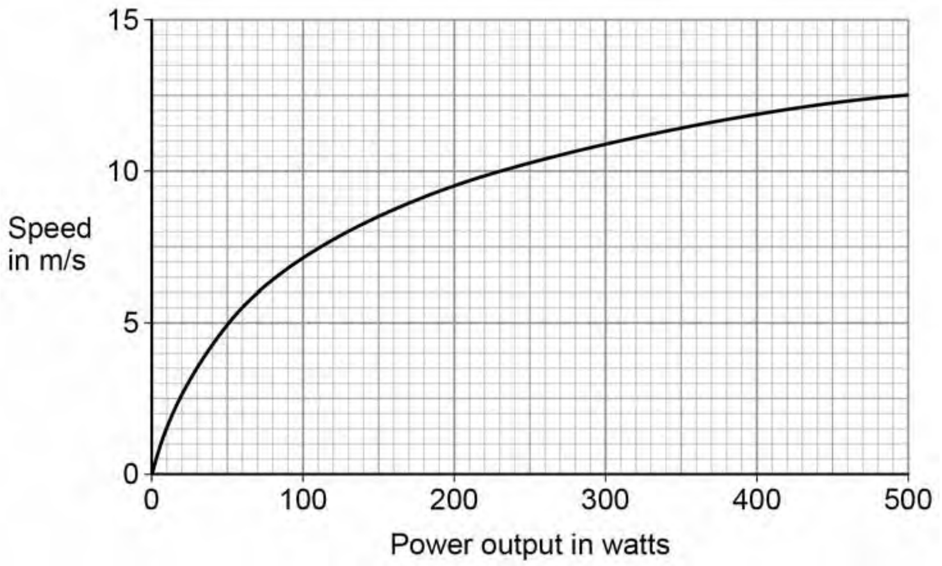
Figure 6 shows how the speed changes as the power output of the cyclist changes.

Figure 6



0 4 . 2 Write down the equation that links power, time and work done.

[1 mark]

---

0 4 . 3 Calculate the work done by the cyclist when his power output is 200 W for 1800 seconds.

[3 marks]

Work done = ____________________ J

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0 4 . 4 Calculate the percentage increase in speed of the cyclist when the power output changes from 200 W to 300 W.

[2 marks]

Percentage increase in speed = ____________

0 4 . 5 The maximum speed this cyclist can travel on a level road is 14 m/s.

How does cycling uphill affect the maximum speed of this cyclist?

Explain your answer.

[3 marks]

11

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0 5 . 1 Complete the sentence. Choose answers from the box.

[2 marks]

charge	**potential difference**	**power**	**temperature**	**time**

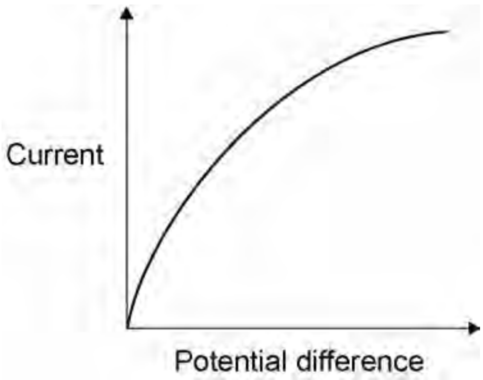
The current through an ohmic conductor is directly proportional to the

______________________________ across the component, provided

that the ______________________________ remains constant.

0 5 . 2 **Figure 7** shows a current – potential difference graph for a filament lamp.

Figure 7



Explain how the resistance of a filament lamp changes as the potential difference across it increases.

[3 marks]

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0 5 . 3 Many householders are replacing their filament lamps with LED lamps which are more energy efficient.

What does more energy efficient mean?

[1 mark]

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Question 5 continues on the next page

Turn over ►

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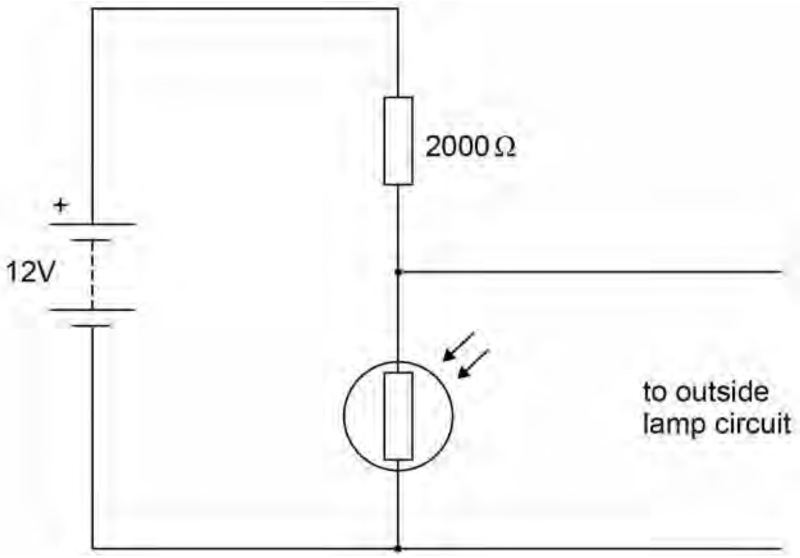
A Light Dependent Resistor (LDR) is used to turn on an outside lamp when it gets dark.

Part of the circuit is shown in **Figure 8**.

Figure 8



0 5 . 4 The light intensity decreases.

What happens to the potential difference across the LDR and the current in the LDR?

[2 marks]

Potential difference ____________________

Current ____________________

0 5 . 5 What is the resistance of the LDR when the potential difference across it is 4 V?

Give a reason for your answer.

[2 marks]

Resistance = ____________________ Ω

Reason ____________________

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Do not write outside the box

0 5 . 6 Calculate the current through the LDR when the resistance of the LDR is 5000 Ω.

Give your answer to 2 significant figures.

[4 marks]

Current = ____________________ A

14

Turn over for the next question

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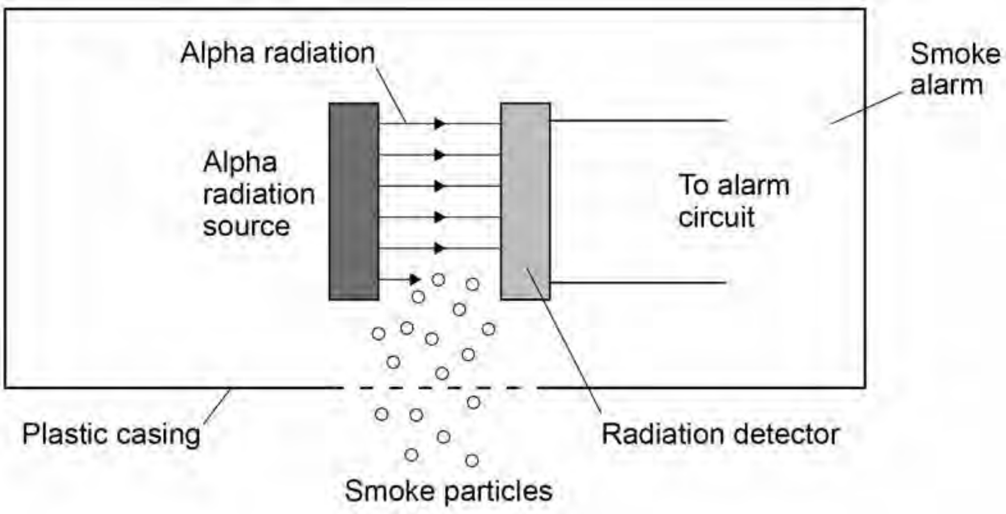
0 6 Smoke alarms contain an alpha radiation source and a radiation detector.

Figure 9 shows part of the inside of a smoke alarm.

Figure 9



0 6 . 1 The smoke alarm stays off while alpha radiation reaches the detector.

Why does the alarm switch on when smoke particles enter the plastic casing?

[1 mark]

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0 6 . 2 Why is it safe to use a source of alpha radiation in a house?

[1 mark]

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0 6 . 3 The smoke alarm would not work with a radiation source that emits beta or gamma radiation.

Explain why.

[2 marks]

Question 6 continues on the next page

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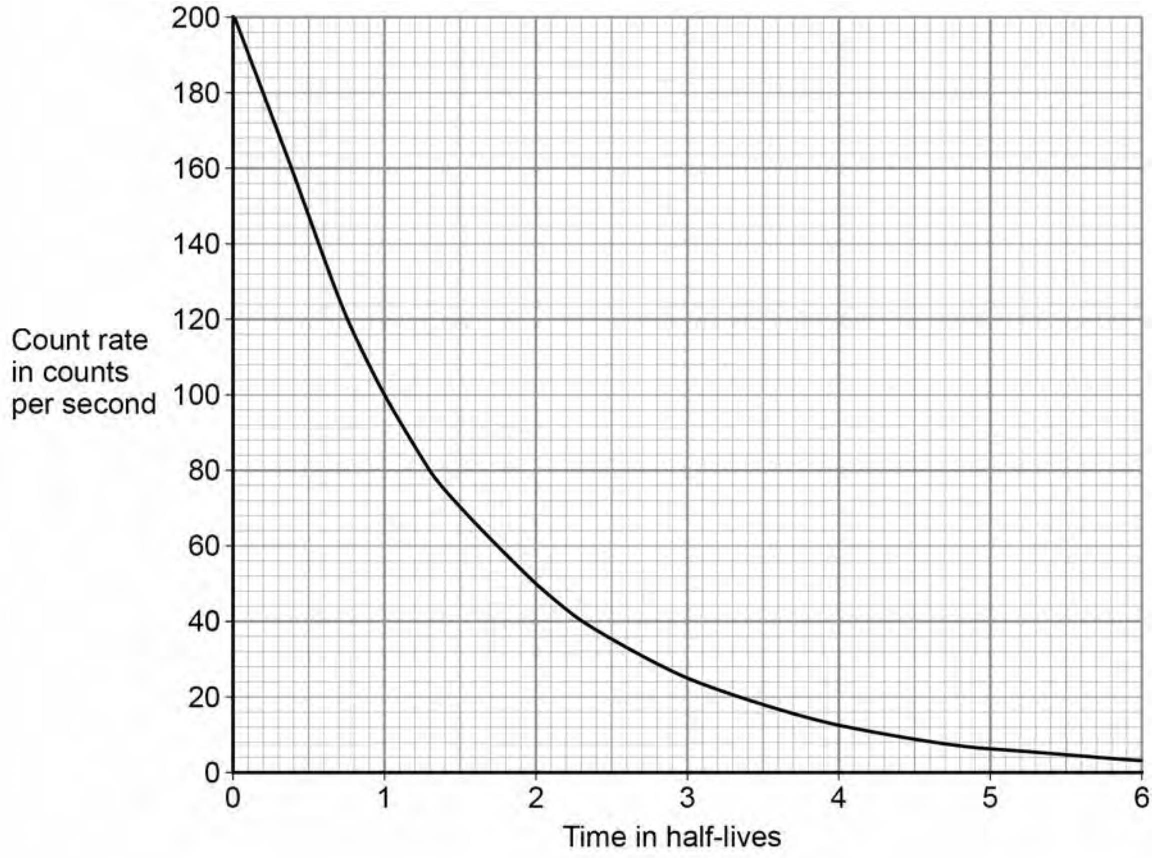
0 6 . 4 **Figure 10** shows how the count rate detected from the radiation source in the smoke alarm changes with time.

Figure 10



The smoke alarm switches on when the count rate falls to 80 counts per second.

Explain why the radiation source inside the smoke alarm should have a long half-life.
[2 marks]

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0 6 . 5 **Figure 11** shows a patient who has been injected with a radioactive source for medical diagnosis.

Figure 11

Explain the ideal properties of a radioactive source for use in medical diagnosis.

[4 marks]

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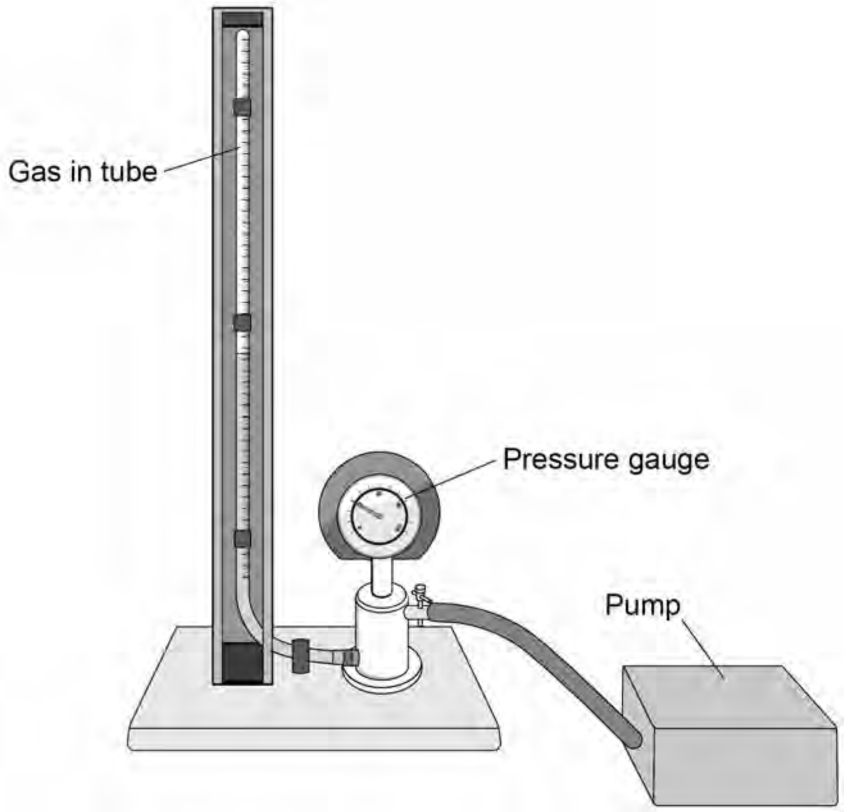
0 7 A student investigated how the pressure exerted by a gas varied with the volume of the gas.

Figure 12 shows the equipment the student used.

Figure 12



A pump was used to compress the gas in a tube. As the volume of the gas decreases, the pressure of the gas increases.

0 7 . 1 The student only recorded one set of results.

Give **two** reasons why taking repeat readings could provide more accurate data.

[2 marks]

1 ____

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2 ____

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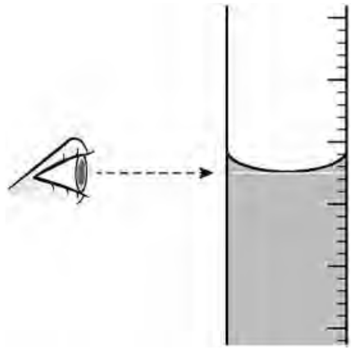
Do not write outside the box

0 7 . 2 **Figure 13** shows the position of the student's eye when taking volume measurements.

Figure 13



Explain what type of error would be caused if the student's eye was **not** in line with the level of the liquid in the tube.

[2 marks]

0 7 . 3 If the gas is compressed too quickly the temperature of the gas increases.

Explain how the temperature increase would affect the pressure exerted by the gas.

[2 marks]

Question 7 continues on the next page

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0 7 . 4 One of the student's results is given below.

pressure = 1.6×10^5 Pa
volume = 9.0 cm^3

Calculate the volume of the gas when the pressure was 1.8×10^5 Pa.

The temperature of the gas was constant.

[3 marks]

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Volume = ____________________ cm^3

Do not write outside the box

0 7 . 5 **Figure 14** shows a person using a bicycle pump to inflate a tyre.

Figure 14

The internal energy of the air increases as the tyre is inflated.

Explain why.

[2 marks]

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11

Turn over for the next question

Do not write outside the box

0 8 Nuclear power stations generate electricity through nuclear fission. Electricity can also be generated by burning shale gas.

0 8 . 1 Shale gas is natural gas trapped in rocks. Shale gas can be extracted by a process called fracking. There is some evidence that fracking causes minor earthquakes. Burning shale gas adds carbon dioxide to the atmosphere.

Describe the advantages of nuclear power compared with the use of shale gas to generate electricity.

[3 marks]

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0 8 . 2 What is the name of **one** fuel used in nuclear power stations?

[1 mark]

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Do not write outside the box

0 8 . 3 Describe the process of nuclear fission.

[4 marks]

8

Turn over for the next question

Do not write outside the box

0 9 **Figure 15** shows a coffee machine. The coffee machine uses an electric element to heat water.

Figure 15

0 9 . 1 The coffee machine has a metal case.

Why would it be dangerous for the live wire of the electric cable to touch the metal case?

[1 mark]

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0 9 . 2 The power output of the coffee machine is 2.53 kW.

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

[3 marks]

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Current = ____________________ A

Do not write outside the box

0 9 . 3 The coffee machine heats water from 20 °C to 90 °C.

The power output of the coffee machine is 2.53 kW.

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

Calculate the mass of water that the coffee machine can heat in 14 seconds.

[5 marks]

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Mass = ______________________ kg

9

Turn over for the next question

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1 0 **Figure 16** shows a wind turbine.

Figure 16

1 0 . 1 At a particular wind speed, a volume of 2.3×10^4 m^3 of air passes the blades each second.

The density of air is 1.2 kg/m^3.

Calculate the mass of air passing the blades per second.

[3 marks]

Mass of air per second = ____________________ kg

1 0 . 2 The power output of the turbine is directly proportional to the kinetic energy of the air passing the blades each second.

Describe the effect on the power output when the wind speed is halved.

[3 marks]

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10.3 At a different wind speed, the wind turbine has a power output of 388 kW.

The mass of air passing the wind turbine each second is 13 800 kg.

Calculate the speed of the air passing the blades each second.

Assume that the process is 100% efficient.

[3 marks]

Speed of air = ____________________ m/s

9

END OF QUESTIONS

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