Write your name here

Surname	Other names

Edexcel Certificate
Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Unit: KPH0/4PH0
Science (Double Award) KSC0/4SC0
Paper: 1P

Thursday 10 January 2013 – Afternoon
Time: 2 hours

Paper Reference
KPH0/1P 4PH0/1P
KSC0/1P 4SC0/1P

Materials required for examination.
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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1/

P 4 3 3 2 9 A 0 1 3 2

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad v = \frac{2 \times \pi \times r}{T}$$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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Answer ALL questions.

1 Carbon-14 is a radioactive isotope of carbon.

It has the symbol

$$^{14}_{6}C$$

(a) (i) The number of **nucleons** in a carbon-14 nucleus is

(1)

- ☒ **A** 6
- ☒ **B** 8
- ☒ **C** 14
- ☒ **D** 20

(ii) The number of **neutrons** in a carbon-14 nucleus is

(1)

- ☒ **A** 6
- ☒ **B** 8
- ☒ **C** 14
- ☒ **D** 20

(iii) The number of **electrons** in a neutral carbon-14 atom is

(1)

- ☒ **A** 6
- ☒ **B** 8
- ☒ **C** 14
- ☒ **D** 20

(b) When carbon-14 decays it emits a beta particle.

What is a **beta particle**?

(1)

- ☒ **A** an electron
- ☒ **B** a neutron
- ☒ **C** a nucleus
- ☒ **D** a proton

(c) Carbon-14 has a half-life of 5700 years.

A sample of cloth contains 6.0 g of carbon-14.

What mass of carbon-14 will remain in the cloth after 11 400 years?

(1)

- ☒ **A** 1.5 g
- ☒ **B** 2.0 g
- ☒ **C** 2.5 g
- ☒ **D** 3.0 g

(d) The carbon atoms in the cloth are mainly atoms of carbon-12, a different isotope of carbon.

What are **isotopes**?

(2)

.....

.....

.....

(Total for Question 1 = 7 marks)

2 This question is about the reflection of light.

(a) Light reflects from a plane mirror.

(i) Use words from the box to complete the sentence below.

(1)

less than	**equal to**	**greater than**

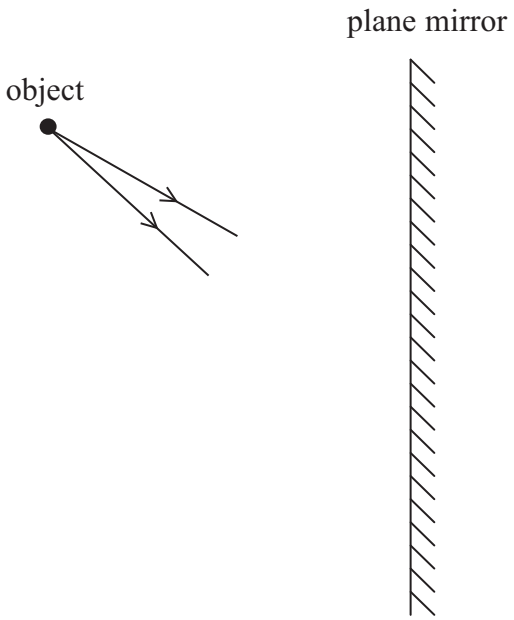
When light reflects from the surface of a plane mirror, the angle

of incidence is ..... the angle of reflection.

(ii) The diagram shows two rays of light coming from an object.

Continue the two rays and add further lines to the diagram to show how an image is formed by a plane mirror.

(2)



(iii) The image in a plane mirror is a **virtual image**.

How can you tell this from your diagram?

(1)

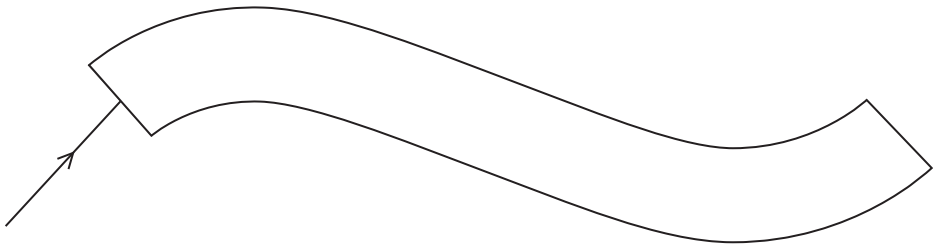
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(b) Light can also reflect along optical fibres by total internal reflection.

(i) Complete the diagram to show the path of the ray of light as it enters and passes through the optical fibre.

(2)



(ii) State **two** conditions required for total internal reflection to happen.

(2)

1 .....

.....

2 .....

.....

(iii) Telephone signals can be sent along optical fibres using light. In earlier systems the signals were sent using electric currents in copper wires.

Suggest **one** advantage of sending signals using optical fibres.

(1)

.....

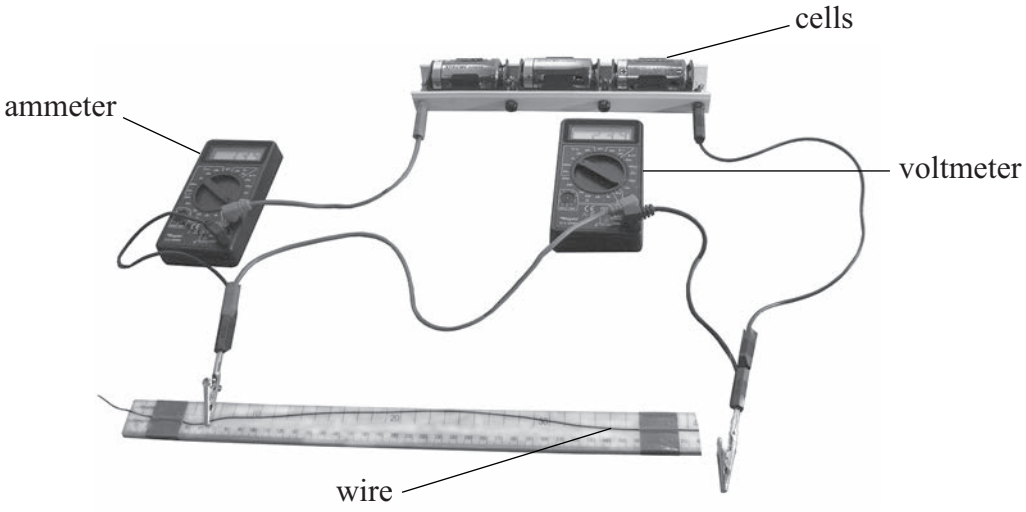
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(Total for Question 2 = 9 marks)

3 A student investigates how the resistance of a wire depends on its length.

The photograph shows the circuit that the student uses.



(a) Draw a circuit diagram to show how the components in the photograph are connected.

(3)

(b) (i) Complete the table by naming the key variables in this investigation.

(1)

independent variable	
dependent variable	

(ii) Describe the method the student should use for this investigation.

(5)

(c) The table shows the student's measurements.

Length of wire in cm	Voltage in V	Current in A	Resistance of wire in Ω
20	4.5	3.6	1.3
40	4.5	1.8	2.5
60	4.5	1.2	3.8
80	4.5	0.9	5.0
100	4.5	0.7	

(i) State the equation linking voltage, current and resistance.

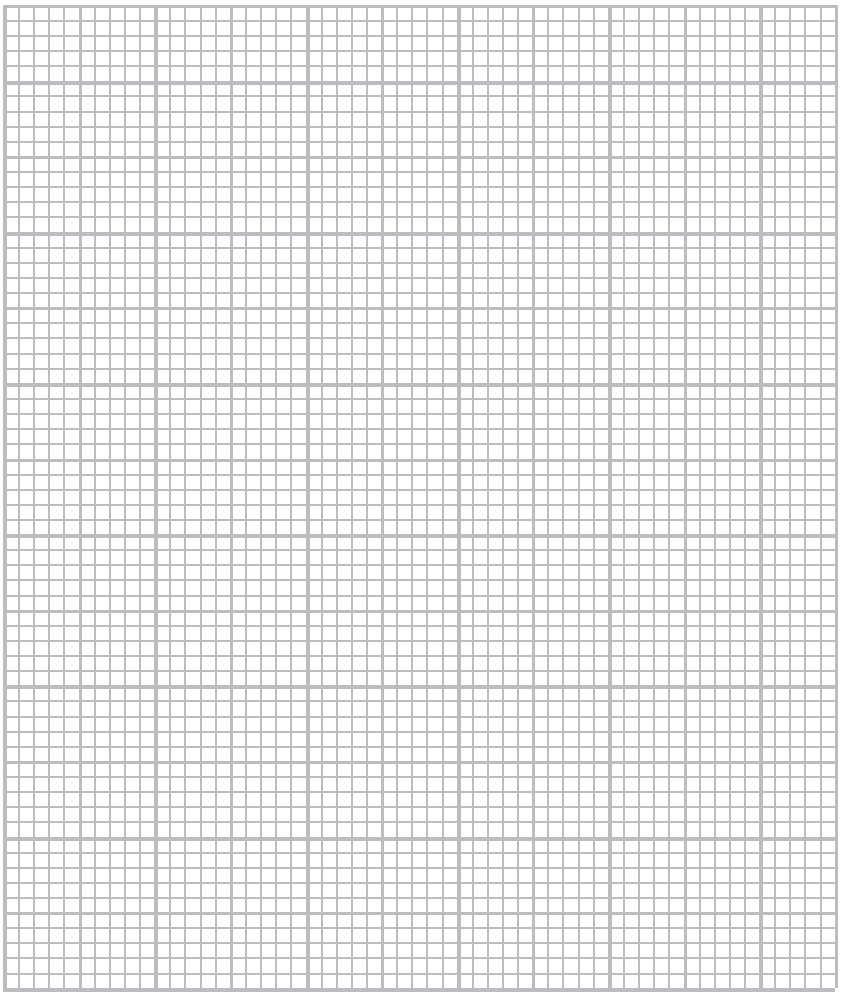
(1)

(ii) Complete the table by calculating the missing value of resistance.

(1)

(d) (i) Use the results from the table opposite to plot a graph of resistance (y-axis) against length of wire (x-axis) and draw the line of best fit.

(5)



(ii) Write a conclusion for the investigation.

(1)

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.....

(iii) Explain how the graph supports this conclusion.

(2)

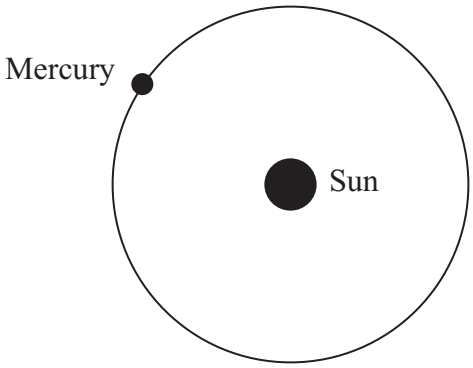
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(Total for Question 3 = 19 marks)

4 The planet Mercury orbits the Sun.



(a) Mercury takes 88 days to orbit the Sun.

The average radius of the orbit is 58 million km.

Calculate the average orbital speed of Mercury.

Give the unit.

(3)

Average orbital speed = ... Unit .....

(b) Comets also orbit the Sun.

(i) Name the force that causes comets and planets to orbit the Sun.

(1)

.....

(ii) Add to the diagram opposite to show the orbit of a typical comet.

(1)

(iii) The speed of a comet changes during its orbit.

On the orbit you have drawn, label with the letter **X** the position where the comet travels at its **fastest** speed.

(1)

(iv) Explain why the comet travels fastest at point **X**.

(2)

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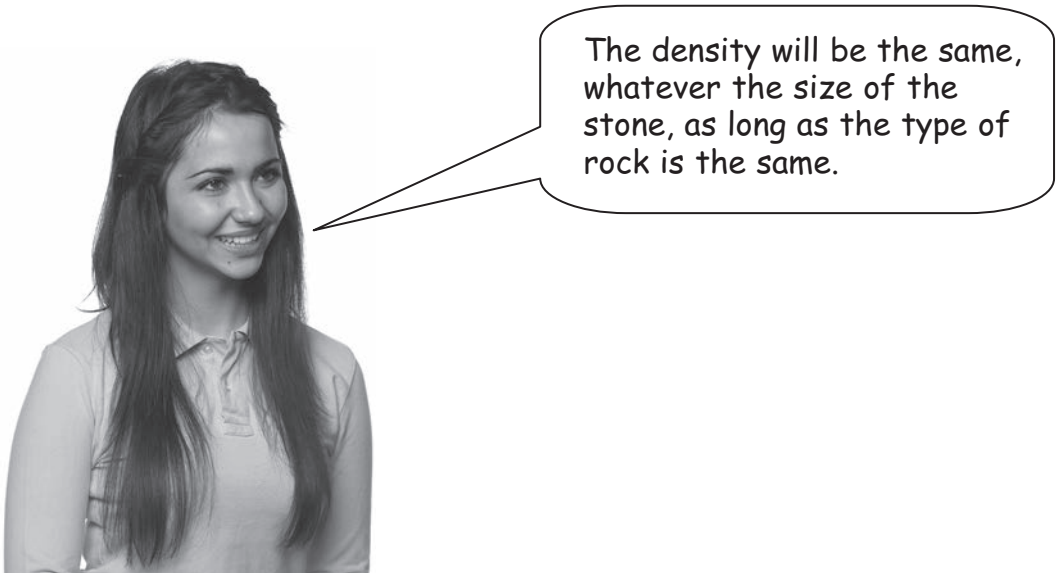
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(Total for Question 4 = 8 marks)

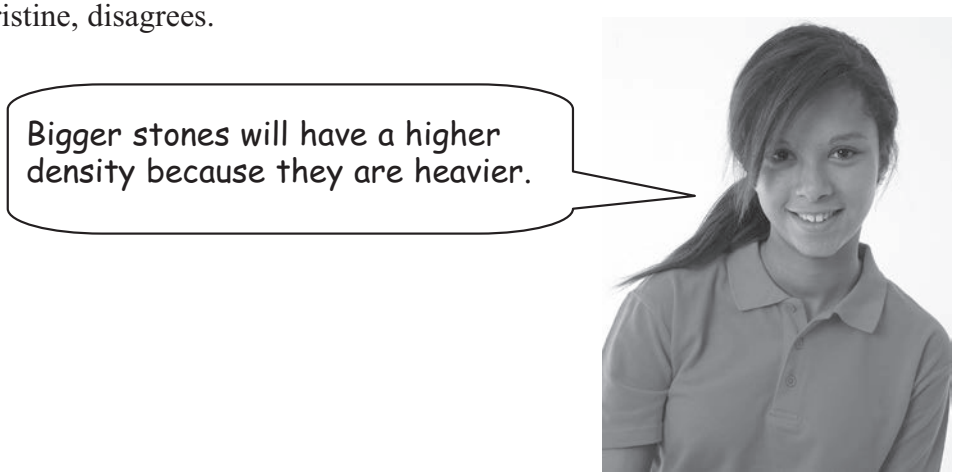
5 Kalpana finds a small stone.

To help her identify the type of stone, Kalpana decides to find its density.

Kalpana explains why she thinks this will help.



Her friend, Christine, disagrees.



(a) Who is correct – Kalpana or Christine?

(2)

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Explain your answer.

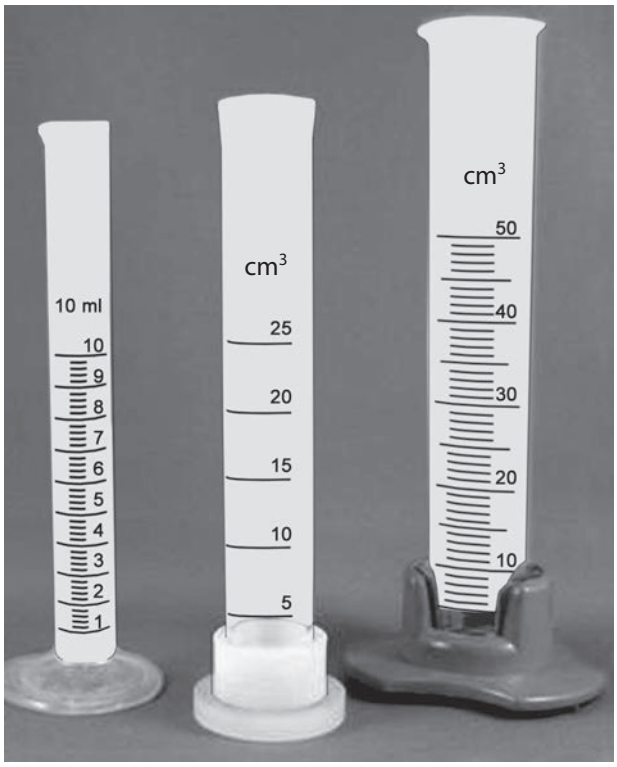
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(b) Kalpana uses a measuring cylinder to find the volume of water displaced by the stone.

She has three measuring cylinders to choose from.



A **B** **C**

(i) Which measuring cylinder would give the most **precise** measurement? Explain your answer.

(2)

.....

.....

.....

.....

(ii) The most precise measuring cylinder may not give an **accurate** reading.

Suggest why.

(1)

.....

.....

.....

(c) The table shows the measurements that Kalpana makes.

Mass of stone in g	Volume of stone in cm^3
54	23

(i) State the equation linking density, mass and volume.

(1)

(ii) Calculate the density of the stone.

State your answer to an appropriate number of significant figures.

Give the unit.

(3)

Density = ... Unit .....

(d) (i) How can Kalpana use her value of density to identify the type of stone?

(2)

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(ii) Kalpana may still be unsure about the type of stone.

Suggest why.

(1)

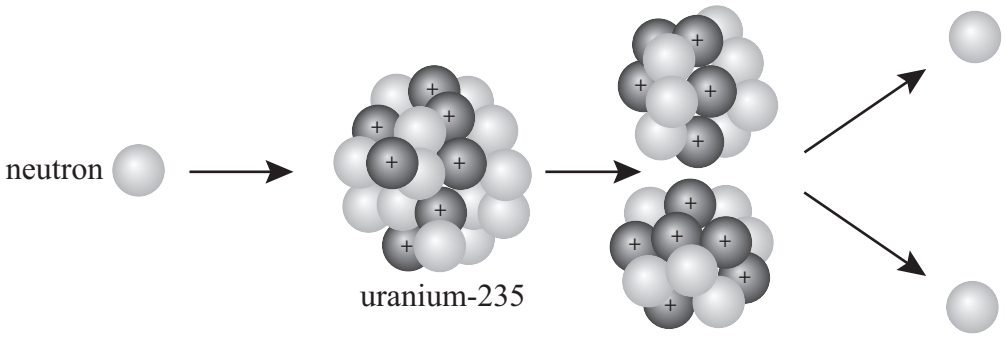
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(Total for Question 5 = 12 marks)

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6 The diagram shows a neutron colliding with a nucleus of uranium-235, producing a number of products.



(a) Name the process shown in the diagram.

(1)

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(b) Explain how the process shown in the diagram can lead to a chain reaction.

(3)

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(c) This process releases energy.

Explain the form that this energy takes.

(2)

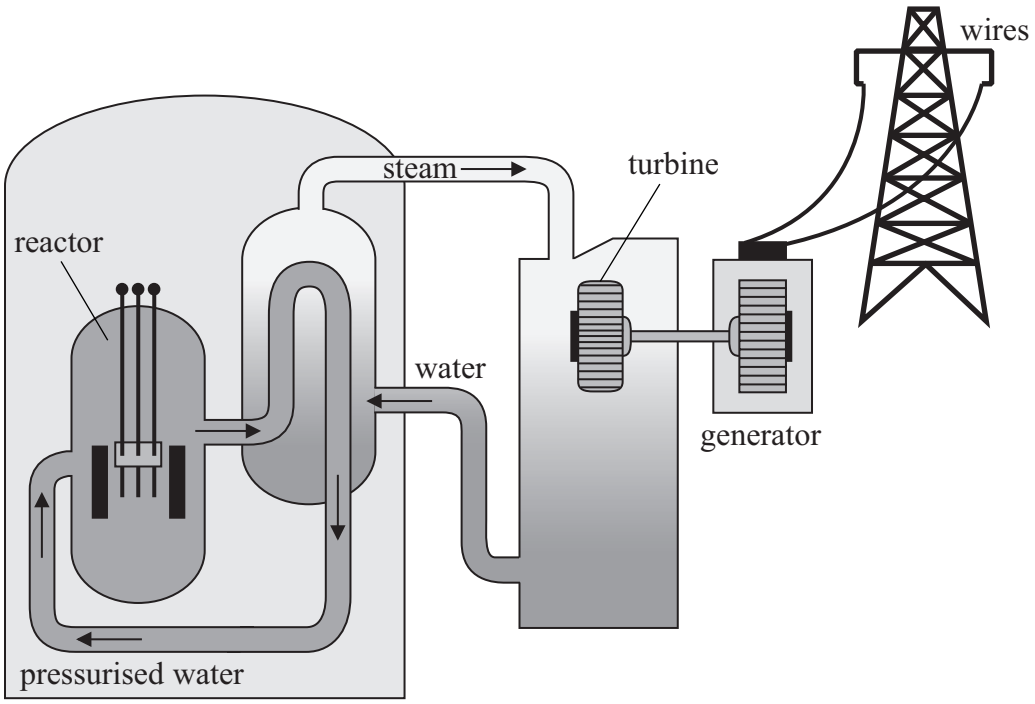
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(d) The energy released in this process can be used in a nuclear power station.



(i) The pressurised water acts as a coolant. It also acts as a moderator.

What is the purpose of a **moderator**?

(1)

.....

.....

(ii) Complete the chart below to show the main useful energy transfers in a nuclear power station.

(4)

Heat energy released by reactor	..... energy in water/steam	..... energy in turbine	..... energy in generator	..... energy in wires

(Total for Question 6 = 11 marks)

7 A student is listening to a radio.



(a) The radio is powered by batteries that provide a direct current (d.c.).

What is **direct current**?

(1)

.....

(b) Radio waves are part of the electromagnetic spectrum.

(i) Suggest a property of radio waves that makes them suitable for use in communication.

(1)

.....

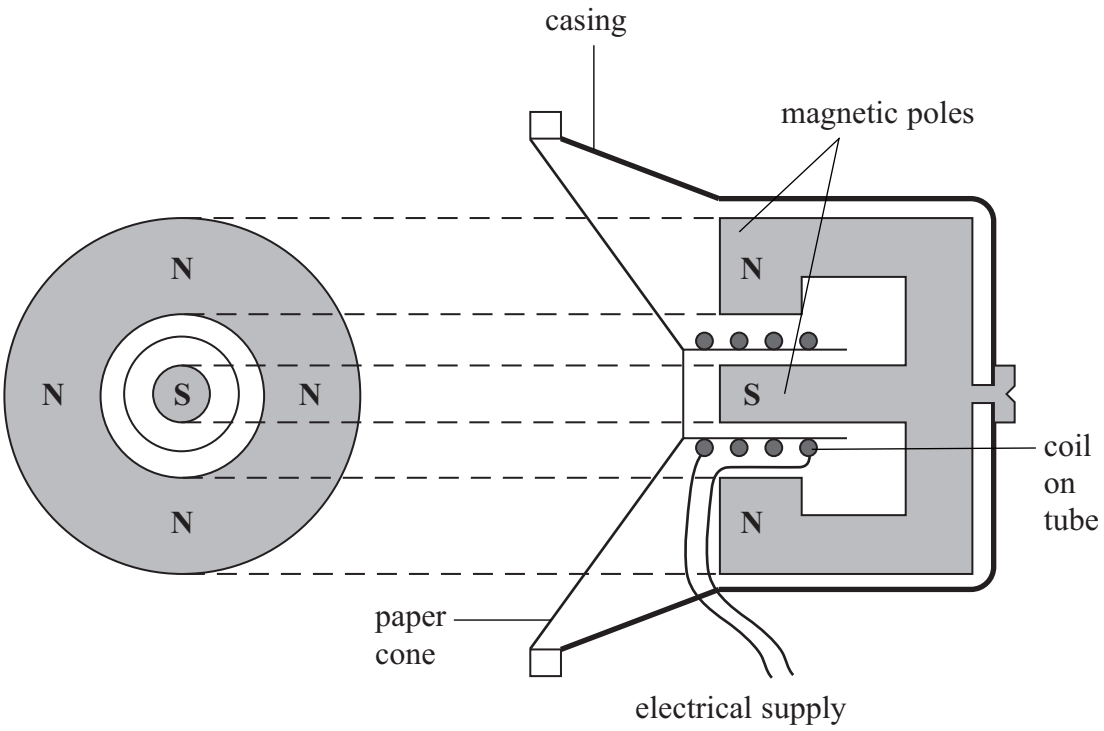
(ii) Complete the table to show uses and possible harmful effects of some other parts of the electromagnetic spectrum.

(4)

Part of electromagnetic spectrum	Use	Possible harmful effect on people
microwaves		
ultraviolet		

(c) In the radio, sound is produced by a loudspeaker.

The diagram shows the construction of a loudspeaker.



Describe how a loudspeaker uses an electrical supply to produce sound waves.

(5)

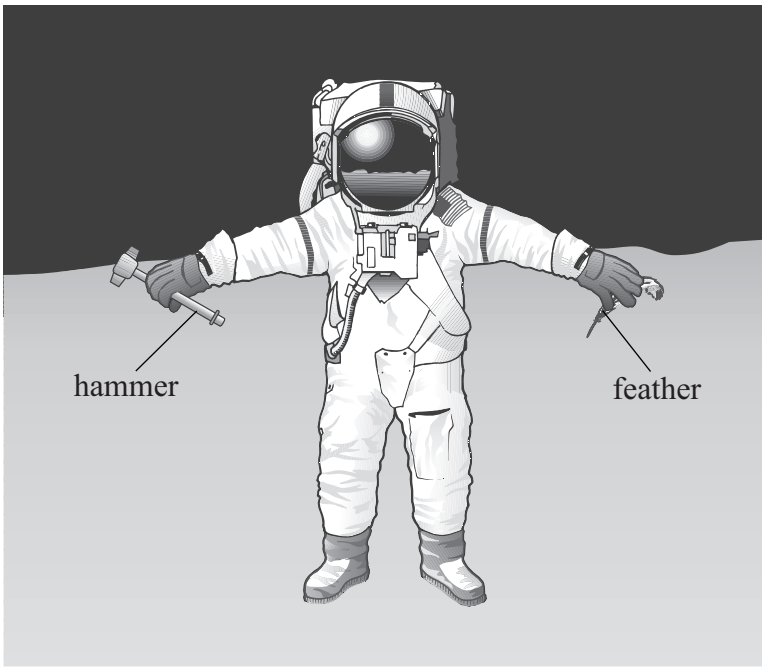
(Total for Question 7 = 11 marks)

8 The Apollo 15 mission landed on the Moon in 1971.

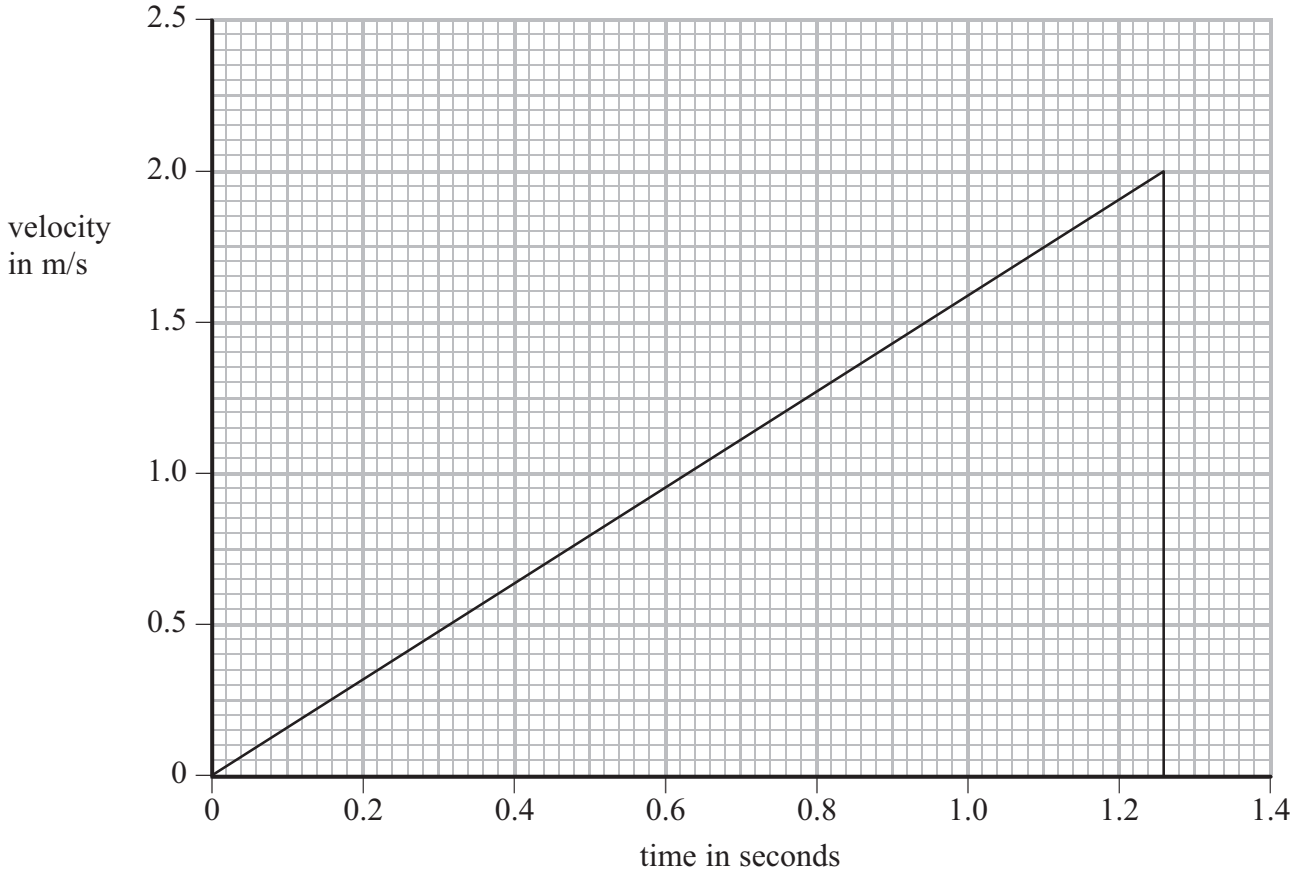
The astronaut David Scott dropped a hammer and a feather.

They were released from rest at the same time and from the same height.

The hammer and the feather landed at the same time.



(a) The graph shows how the velocity of the hammer changed with time.



(i) Use the graph to calculate the acceleration due to gravity on the Moon.

Give the unit.

(3)

Acceleration = ... Unit .....

(ii) Use the graph to calculate the height the hammer was dropped from.

(2)

Height = ... m

(b) The gravitational field strength is smaller on the Moon than on the Earth.

Suggest why.

(1)

.....

.....

(c) If the same experiment is carried out on Earth, air resistance affects both objects.

The feather reaches the ground after the hammer, even though the force of air resistance is smaller on the feather than on the hammer.

Explain why the feather reaches the ground after the hammer.

(4)

(Total for Question 8 = 10 marks)

9 A student uses an electric heater to investigate efficiency.

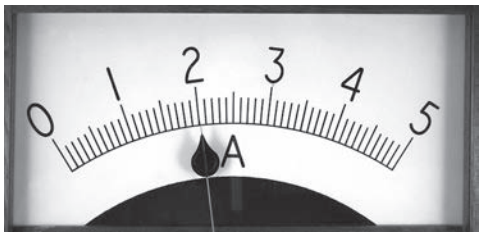
He places the heater in an aluminium block, switches the heater on and measures the temperature of the block each minute for 20 minutes.

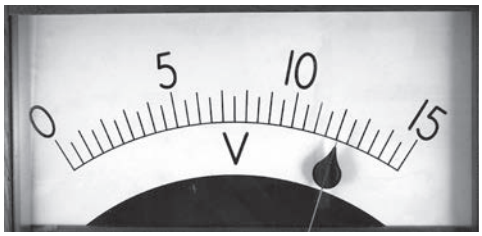


(a) The student wants to calculate the electrical energy supplied to the heater.

(i) Complete the table by recording the readings shown on the meters below.

(2)





Current in amps, A	
Voltage in volts, V	

(ii) Show that the energy supplied to the heater in 20 minutes is about 30 000 J.

(3)

(b) The student is told that only 22 000 J are used to raise the temperature of the aluminium block by 25 °C.

(i) State the equation linking efficiency, useful energy output and total energy input.

(1)

(ii) Calculate the efficiency of heating the aluminium block.

(2)

Efficiency = ...

(iii) The efficiency of the **heater** will be **higher** than this value.

Suggest why.

(1)

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.....

.....

(iv) State **one** way in which the student could increase the efficiency of heating the aluminium block.

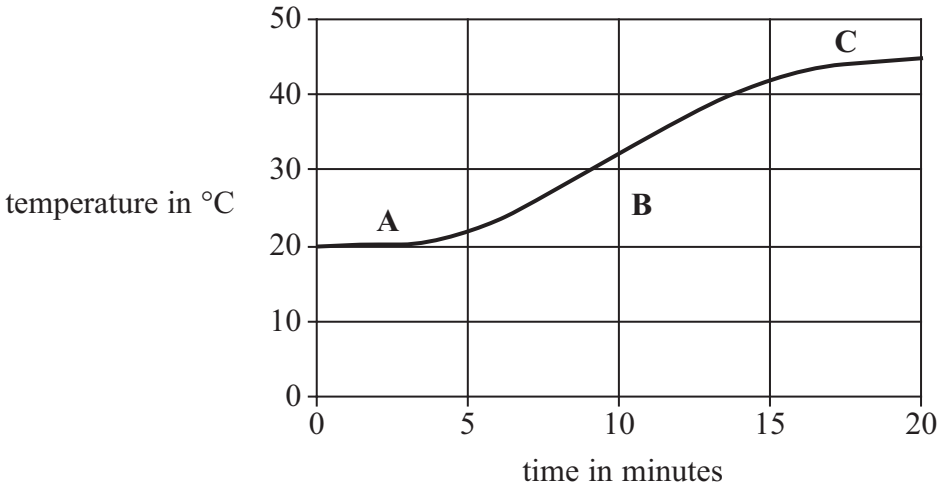
(1)

.....

.....

.....

(c) The graph shows how the temperature of the block increases from 20 °C to 45 °C during the investigation.



Use ideas about heat transfer to help you explain the shape of the graph in

(i) section **A**,

(1)

(ii) section **B**,

(2)

(iii) section **C**.

(2)

(Total for Question 9 = 15 marks)

10 Compressed air from a can is used to clean computer keyboards.



(a) Use ideas about particles to explain how a gas causes a pressure on the inside of a container.

(3)

(b) The can has a warning sign on it.

WARNING Pressurised container Do not expose to temperatures above 50 ºC

(i) How would increasing the temperature of the compressed air affect the pressure in the can?

(1)

.....

.....

(ii) Explain your answer.

(2)

.....

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(c) The can has a volume of 400 cm^3 and the pressure of the compressed air inside is 5 times atmospheric pressure.

Calculate the volume that the air would occupy if it were all released to atmospheric pressure.

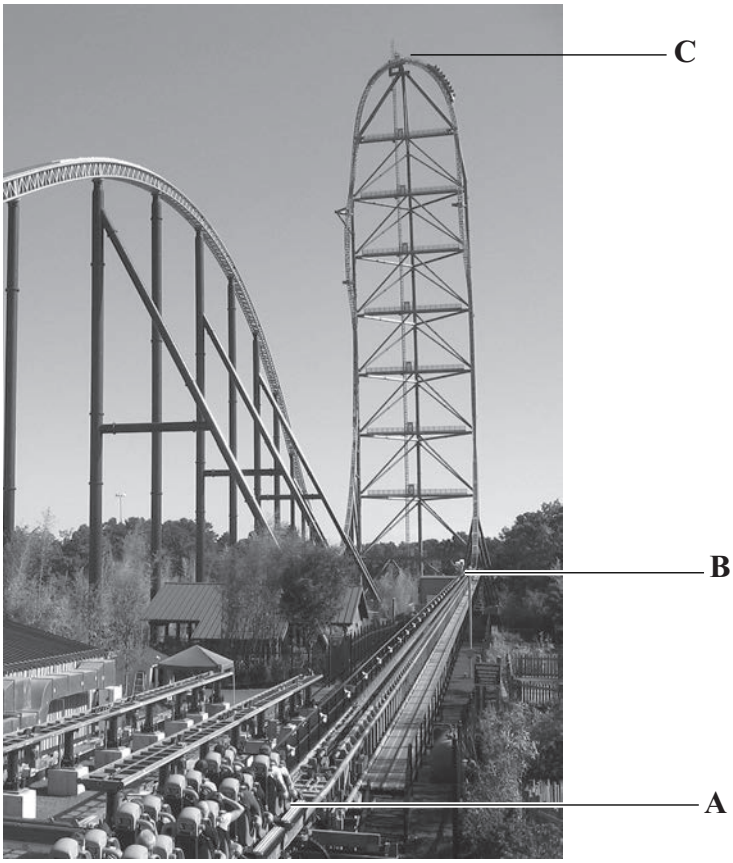
(2)

Volume = ... cm^3

(Total for Question 10 = 8 marks)

11 The photograph shows a type of rollercoaster.

The car is launched from point **A** in the photograph, accelerates to point **B** and then rises over point **C**.



(a) Each loaded car has a mass of 2000 kg.

C is 128 m above **B**.

(i) State the equation linking gravitational potential energy, mass, height and gravitational field strength.

(1)

(ii) Show that the gravitational potential energy gained by the car when it rises from **B** to **C** is about 2.6 MJ.

(2)

(b) The car gains kinetic energy when work is done on it by the launching system between **A** and **B**.

Assume there are no energy losses.

(i) State the minimum kinetic energy that the car must have at **B** for it to reach **C**.

(1)

.....

(ii) How is the kinetic energy gained related to the work done?

(1)

.....

(iii) Write down the equation linking work done, force and distance.

(1)

(iv) The launching system provides a force of 32 kN.

Calculate the minimum length of track needed between **A** and **B** for the car to reach **C**.

(2)

Length of track = ... m

(c) Sometimes the car does not reach **C**, but rolls backwards to the start.

This can happen when it becomes windy or the track becomes wet.

Explain why these conditions could cause the car to stop before it reaches **C**.

(2)

.....

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(Total for Question 11 = 10 marks)

TOTAL FOR PAPER = 120 MARKS

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