Write your name here

Surname		Other names

Pearson Edexcel Certificate
Pearson Edexcel
International GCSE

Centre Number

Candidate Number

Physics

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

Wednesday 20 May 2015 – Afternoon
Time: 2 hours

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

You must have:
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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EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time

$$E = I \times V \times t$$

pressure × volume = constant

$$p_1 \times V_1 = p_2 \times V_2$$

frequency = $\dfrac{1}{\text{time period}}$

$$f = \dfrac{1}{T}$$

power = $\dfrac{\text{work done}}{\text{time taken}}$

$$P = \dfrac{W}{t}$$

power = $\dfrac{\text{energy transferred}}{\text{time taken}}$

$$P = \dfrac{W}{t}$$

orbital speed = $\dfrac{2\pi \times \text{orbital radius}}{\text{time period}}$

$$v = \dfrac{2 \times \pi \times r}{T}$$

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

P 4 4 2 3 8 A 0 2 3 2

Answer ALL questions.

1   The diagram shows a nuclear reactor.

control rod

moderator — reactor vessel

coolant out

fuel rod — coolant in
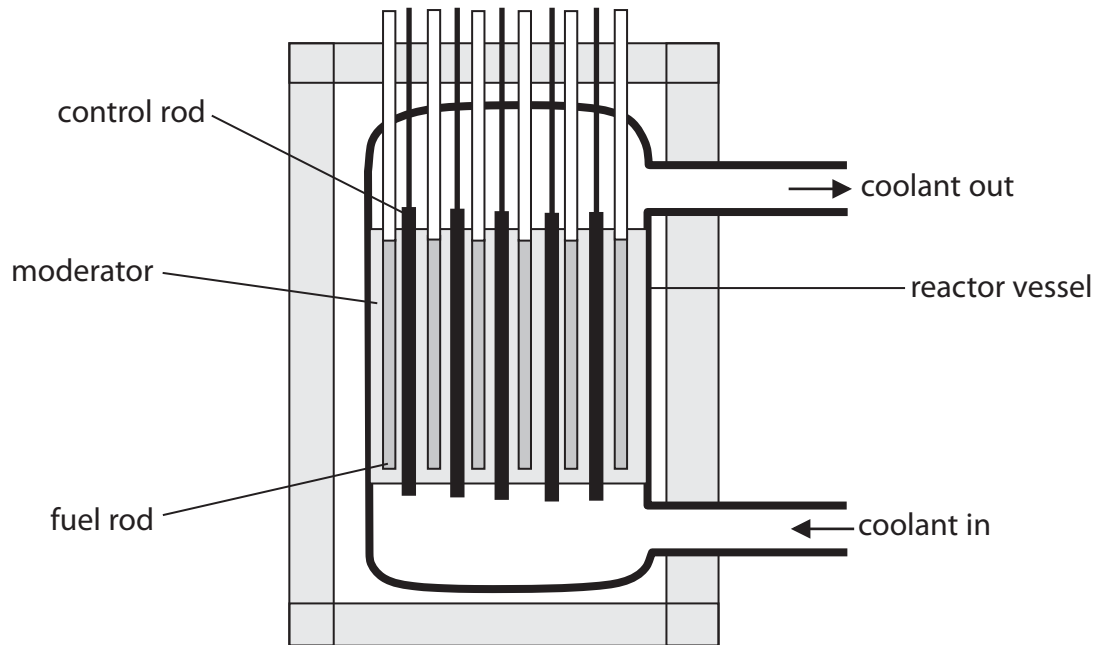
(a) A uranium nucleus in the fuel rod may split when a neutron hits it.

This process of splitting is known as

(1)

☒ **A**   fission

☒ **B**   moderation

☒ **C**   reflection

☒ **D**   refraction

(b) The control rods control the reaction by

(1)

☒ **A**   absorbing some of the neutrons

☒ **B**   cooling the reactor vessel

☒ **C**   removing uranium nuclei from the reaction

☒ **D**   slowing the neutrons slightly

(Total for Question 1 = 2 marks)

P 4 4 2 3 8 A 0 3 3 2

2 A bus travels along a straight road.

The graph shows how the velocity of the bus changes during a short journey.
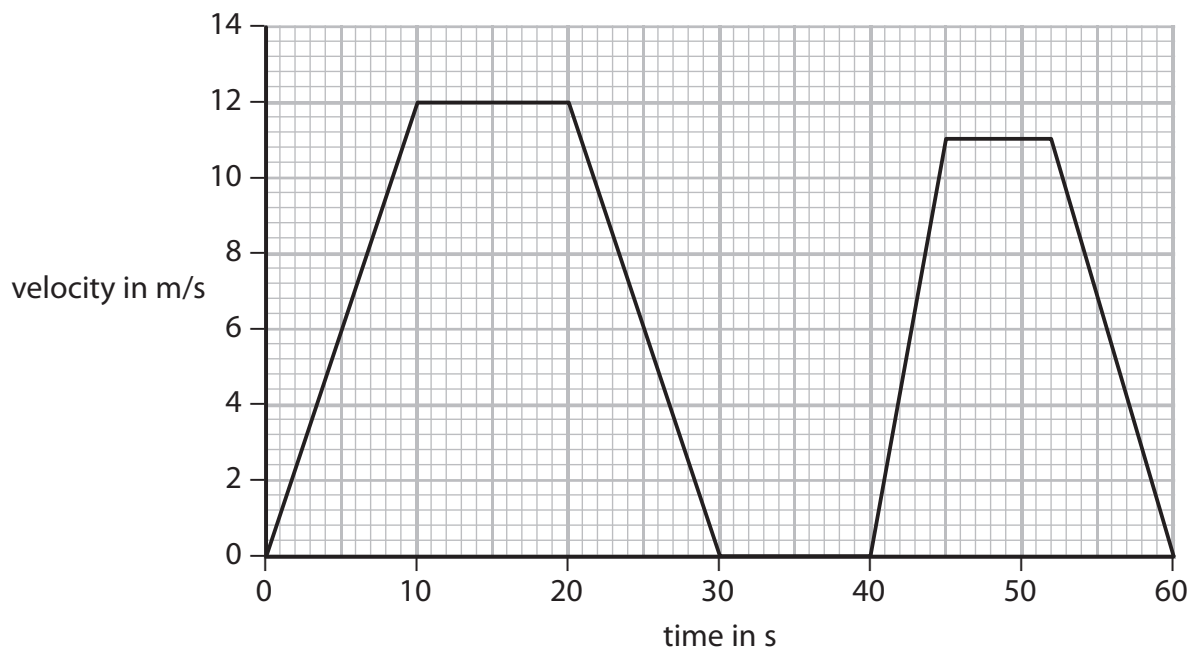
(a) (i) State the velocity of the bus after 25 s.

(1)

velocity = ... m/s

(ii) How long is the bus stationary during its journey?

(1)

time = ... s

(b) (i) State the equation linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the acceleration of the bus during the first 10 seconds.

Give the unit.

(3)

acceleration = ... unit ....

(c) (i) State the equation linking average speed, distance moved and time taken.

(1)

(ii) The bus moves a total distance of 390 m during the journey.

Calculate the average speed of the bus.

(2)

average speed = ... m/s

(d) The bus travels further in the first 30 seconds of its journey than it does during the last 30 seconds.

Explain how the graph shows this.

(2)

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(Total for Question 2 = 11 marks)

3 The diagram shows a lighting circuit in a house.

component X

230V

lamp Y
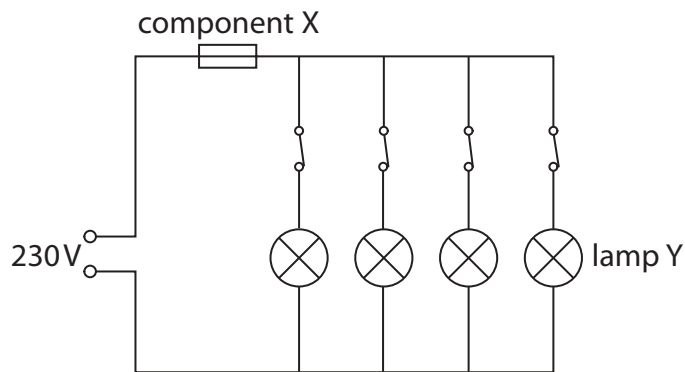
(a) (i) Component X is

(1)

☒ **A** a double insulated wire

☒ **B** an earth connection

☒ **C** a fuse

☒ **D** a switch

(ii) The lamps are connected in parallel.

State an advantage of using a parallel circuit for lighting.

(1)

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(b) The lighting circuit is connected to a mains supply that provides an alternating current.

Explain what is meant by an alternating current.

You may draw a diagram to help your answer.

(2)

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(c) Lamp Y is removed and replaced with a low-energy lamp.

When the low-energy lamp is connected to a 230 V supply, the current in it is 0.12 A.

(i) Calculate the amount of energy transferred by the low-energy lamp in 7 hours.

(3)

energy transferred = ... J

(ii) The low-energy lamp gives the same amount of light as lamp Y, but uses much less power.

Which row of the table compares the low-energy lamp correctly to lamp Y?

(1)

	Voltage across low-energy lamp compared to voltage across lamp Y	Current in low-energy lamp compared to current in lamp Y
☒ A	less than	same as
☒ B	same as	less than
☒ C	less than	less than
☒ D	same as	same as

(Total for Question 3 = 8 marks)

4 A kitchen has a water supply, an electricity supply and electric lighting.

There are several electrical appliances in the kitchen including a toaster, a kettle, a clothes iron, a microwave oven and a dishwasher.

Discuss three hazards of using electricity in this kitchen.

(6)

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(Total for Question 4 = 6 marks)

5 A student uses this apparatus to investigate forces stretching a spring.

She uses a ruler to measure the vertical distance h between the bottom of the mass hanger and the base of the stand.

(a) Suggest two ways that the student can measure distance h more accurately.

(2)

1 ....

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2 ....

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(b) The student continues her investigation by loading the spring with different masses.

The table shows her results.

Mass in g	Force in N	Distance h in cm
20	0.2	4.6
40	0.4	3.9
60	0.6	3.1
80	0.8	2.3
100	1.0	1.6
120	1.2	0.9

(i) Name the dependent variable in this investigation.

(1)

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(ii) Explain how the force values in the table are calculated.

(2)

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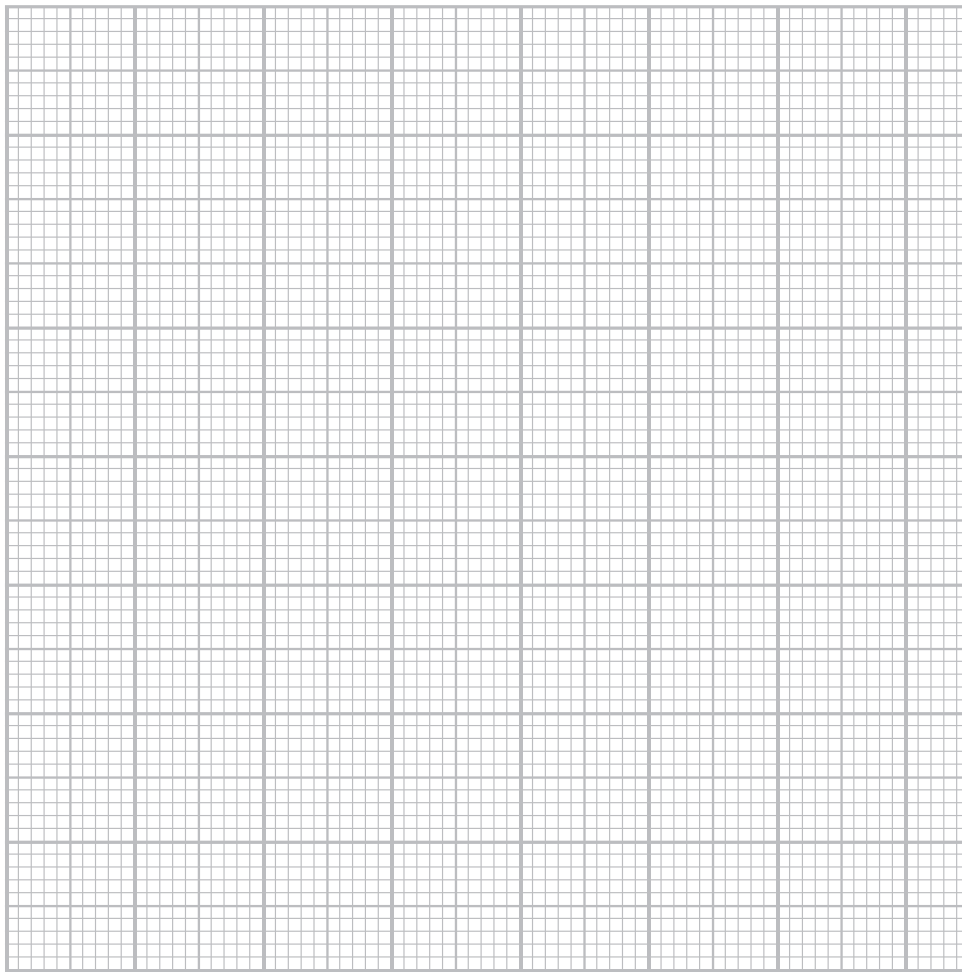
(iii) Plot a graph of distance *h* against force, and draw the line of best fit.

(5)

(iv) Use your graph to find the force for which *h* is zero.

(2)

force = ... N

(v) Explain whether the spring obeys Hooke's law.

(2)

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(Total for Question 5 = 14 marks)

6 Magnetic fields can have different shapes.

(a) (i) Describe an experiment to show the shape of the magnetic field around a bar magnet.

(2)

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(ii) The diagram shows a bar magnet.

Complete the diagram to show the shape of the field around the magnet.

(2)

N	S

P 4 4 2 3 8 A 0 1 2 3 2

(b) The diagram shows two bar magnets.

They produce a uniform magnetic field.

On the diagram, sketch the part of the field that is uniform and label the poles.

(3)

(Total for Question 6 = 7 marks)

7   A flying squirrel is an animal that can glide through the air.

It spreads out its limbs to stretch a membrane that helps it to glide.

© Robert Savannah

(a) The mass of a flying squirrel is 0.19 kg.

It climbs 17 m up a tree.

(i)   State the equation linking gravitational potential energy (GPE), mass, *g* and height.

(1)

(ii) Calculate the GPE gained by the squirrel during this climb.

(2)

GPE = ... J

(iii) State the amount of work done against the force of gravity by the squirrel during this climb.

(1)

work done = ... J

(b) The flying squirrel glides from P to Q with a constant velocity of 13 m/s.

not to scale

P

17 m

Q

ground level
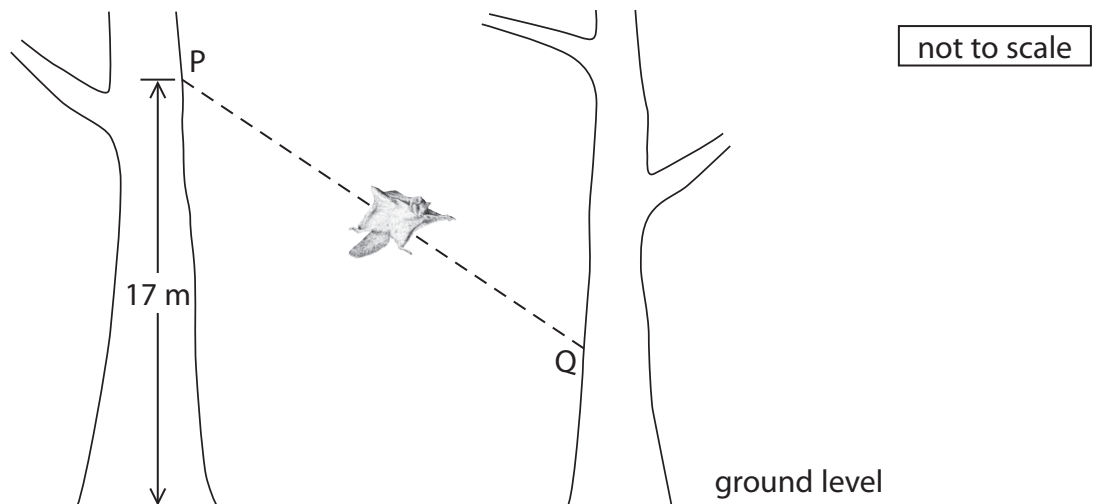
(i) Add labelled arrows to the diagram to show the directions of the forces of weight and drag acting on the squirrel.

(2)

(ii) State the equation linking kinetic energy (KE), mass and velocity.

(1)

(iii) Calculate the KE of the squirrel as it glides.

(2)

KE = ... J

(iv) The velocity of the squirrel decreases to zero when it reaches the second tree because

(1)

☒ **A**   an unbalanced force acts on the squirrel

☒ **B**   no force acts on the squirrel

☒ **C**   the GPE of the squirrel increases

☒ **D**   the KE of the squirrel increases

(Total for Question 7 = 10 marks)

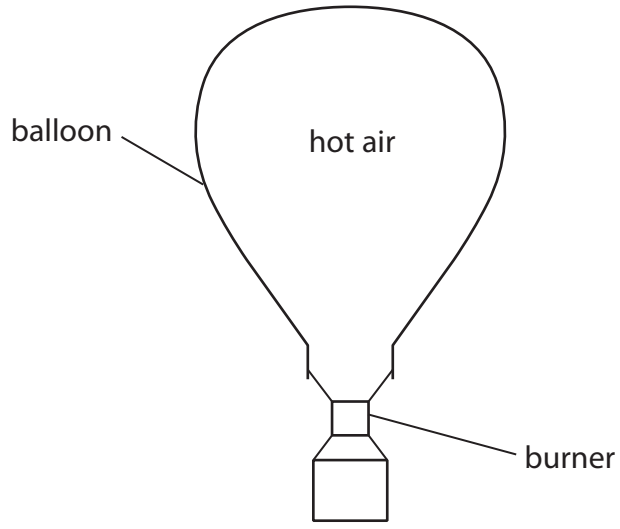**8** A hot air balloon is filled with air through an opening.

The air is heated using a burner.

(a) Describe the effect of an increase in temperature on the average speed of the air molecules.

(1)

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(b) The hot air causes a pressure on the inside of the balloon.

Use ideas about molecules to explain how the hot air causes this pressure.

(3)

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(c) Give a reason why the hottest air rises to the top of the balloon.

(1)

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(d) The average density of the hot air in the balloon is 0.95 kg/m³.

The volume of this air is 2800 m³.

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

(1)

(ii) Calculate the mass of hot air in the balloon.

(3)

mass of hot air = ... kg

(e) As the balloon climbs higher, the air pressure outside it decreases.

(i) Suggest a reason for this change in the outside air pressure.

(1)

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(ii) Suggest how the decrease in air pressure outside the balloon affects
the hot air inside.

(1)

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(Total for Question 8 = 11 marks)

Turn over ▶

9 A student has two computer hard drives.

One is black and one is white.

The student places the white hard drive on top of the black one as shown in photograph A.
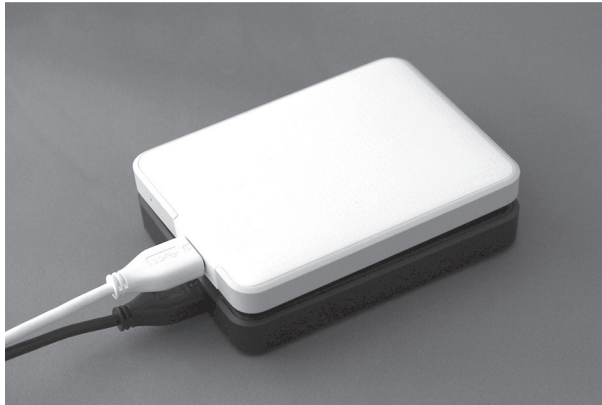
Photograph A

The student connects both hard drives to a computer so that they receive the same amount of electrical power. The temperature of the hard drives rises as they work.

The student then rearranges the hard drives so that the black one is on top as shown in photograph B.

Photograph B

The hard drives are still working, but their temperature is lower than before.

Explain why the hard drives work at a lower temperature when the black one is on top.

(4)

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(Total for Question 9 = 4 marks)

Turn over ▶

10 (a) Which list gives the astronomical objects in order of size, starting with the largest?

(1)

☒ **A** galaxy – Solar System – planet – Sun

☒ **B** galaxy – Solar System – Sun – planet

☒ **C** planet – galaxy – Solar System – Sun

☒ **D** planet – Solar System – Sun – galaxy

(b) The Earth and Mars are planets in our Solar System.

(i) State two ways in which the orbits of Earth and Mars are similar.

(2)

1 ....

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2 ....

....

(ii) State one way in which the orbits of Earth and Mars are different.

(1)

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P 4 4 2 3 8 A 0 2 0 3 2

(c) Deimos is a moon that orbits the planet Mars.

The radius of its orbit is 23 500 km and its time period is 1.26 days.

Calculate the orbital speed of Deimos.

Give your answer to 2 significant figures.

(3)

orbital speed = ... km/day

(d) Enceladus is a moon that orbits the planet Saturn.

Enceladus has a similar orbital period to that of Deimos, but its orbital speed is about 10 times larger.

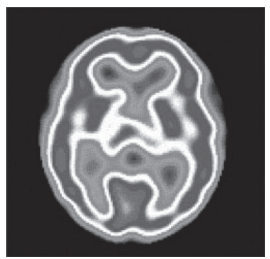Explain how this is possible.

(2)

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(Total for Question 10 = 9 marks)

11 A doctor uses gamma radiation to produce an image of a person's brain.

A radioactive isotope called technetium-99m is used in this process.

Technetium-99m emits gamma rays and has a short half-life.

(a) (i) Gamma radiation consists of

(1)

- ☒ **A** electromagnetic waves
- ☒ **B** negatively charged particles
- ☒ **C** positively charged particles
- ☒ **D** unstable atoms

(ii) What is meant by the term **half-life**?

(2)

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P44238A02232

(b) The doctor injects a solution of technetium-99m into the patient.

A detector outside the patient receives gamma radiation to form the image.

Suggest why isotopes that emit alpha particles or beta particles are not suitable for this use.

(2)

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(c) Technetium-99m has a half-life of 6 hours.

A sample of technetium-99m has an activity of 420 MBq.

(i) Explain why the activity of a radioactive sample reduces with time.

(2)

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....

(ii) Calculate the activity of the technetium-99m sample after 24 hours.

(3)

activity = ... MBq

(Total for Question 11 = 10 marks)

P 4 4 2 3 8 A 0 2 3 3 2

12 A light ray can undergo total internal reflection.

   (a) (i) What is meant by the term **total internal reflection**?

                                                                  (2)

     (ii) State two uses of total internal reflection.

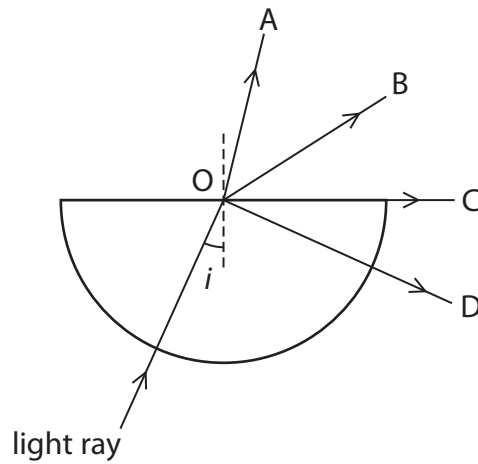   **(2)**

1 ....

2 ....

(b) The diagram shows a light ray entering a glass block and travelling towards point O.

light ray

The angle i is 25°.

The critical angle of the glass is 42°.

(i) Which path does the ray take after reaching point O?

(1)

☒ **A** OA

☒ **B** OB

☒ **C** OC

☒ **D** OD

(ii) State the equation linking critical angle and refractive index.

(1)

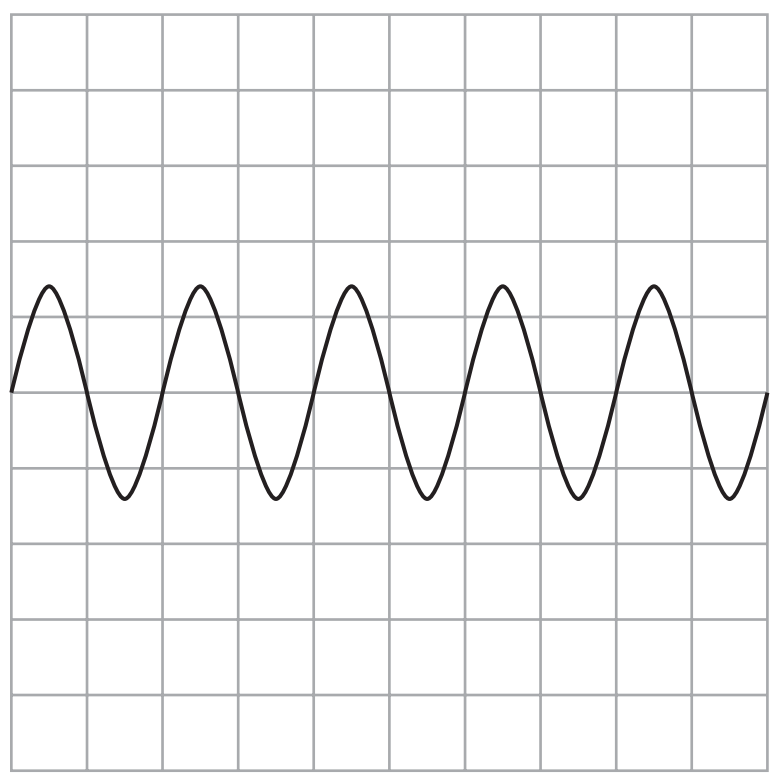(iii) Calculate the refractive index of the glass.

(2)

refractive index = ...

(Total for Question 12 = 8 marks)

13 Waves can travel on water, through air or in a vacuum.

   (a) The diagram shows the side-view of a wave on the surface of water.

      Each square on the grid represents 1 cm x 1 cm.

    (i) State the wavelength of the wave shown.

                                          (1)

                           wavelength = ... cm

    (ii) On the grid sketch the trace of a wave travelling at the same speed, but with a larger amplitude and a lower frequency.

                                            (2)

(b) Two students investigate the speed of sound waves in air.

They use a stopwatch that shows times to the nearest 0.1 s.

They use an outdoor running track as their measure of distance.

The track is straight and 100 m long.

Describe what else they must do to obtain a value for the speed of sound.

(5)

(c) (i) State the equation linking wave speed, frequency and wavelength.

(1)

(ii) The speed of radio waves is 300 000 000 m/s.

A radio wave has a frequency of 31 MHz.

Calculate the wavelength of this radio wave.

(3)

wavelength = ... m

(d) A sound wave and a radio wave have the same wavelength.

State why they have different frequencies.

(1)

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....

(Total for Question 13 = 13 marks)

14 A student investigates the current in a thermistor at different temperatures, using the circuit shown in the diagram.
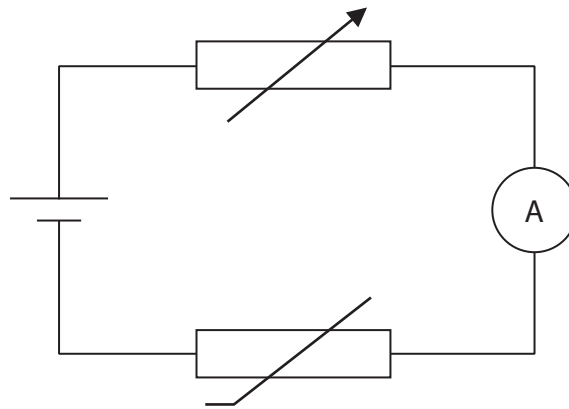
(a) The student uses a voltmeter to check that the voltage across the thermistor stays constant throughout the investigation.

   (i)   Add this voltmeter to the circuit diagram.

(2)

   (ii) Give a reason for keeping the voltage across the thermistor constant.

(1)

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   (iii) Give a reason for including the variable resistor in the circuit.

(1)

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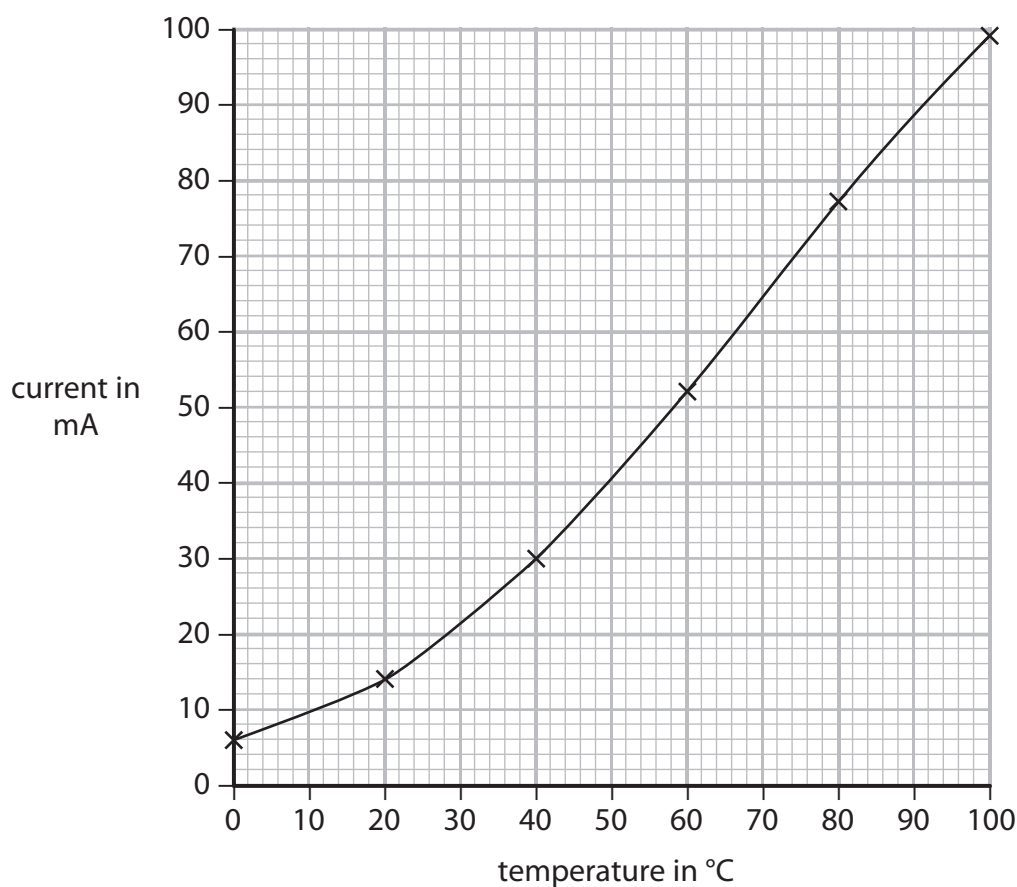
(b) The student increases the temperature of the thermistor and records the current and temperature readings.

The graph shows the student's results.

The student plans to use his circuit to make an electronic thermometer.

He notices that both the scales on the graph go up to 100.

He thinks that the current reading, measured in mA, gives a direct indication of the temperature measured in °C.

He labels the ammeter's scale 'temperature in °C'.

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Give three reasons why the student's electronic thermometer is unlikely to show the correct temperature.

You may use information from the circuit and the graph to support your answer.

(3)

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2 ....

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3 ....

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(Total for Question 14 = 7 marks)

TOTAL FOR PAPER = 120 MARKS

P 4 4 2 3 8 A 0 3 1 3 2

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