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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Time 2 hours

Paper reference **4PH1/1P 4SD0/1P**

Physics

Science (Double Award) 4SD0
PAPER: 1P

November 2021

You must have:
Ruler, protractor, 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 110.
- 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.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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1/1/1/1/1/1

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FORMULAE

You may find the following formulae useful.

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

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

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

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

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

(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)

$$v^2 = u^2 + (2 \times a \times s)$$

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

$$\frac{\text{pressure}}{\text{temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

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

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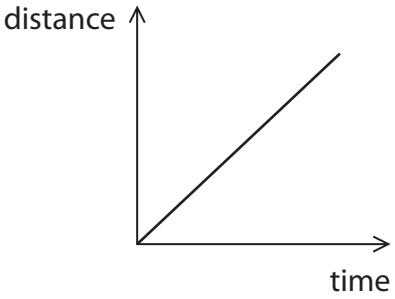
Answer ALL questions.

1 The motion of an object can be represented using graphs.

(a) The graphs, P, Q, R and S, show different types of motion.

P



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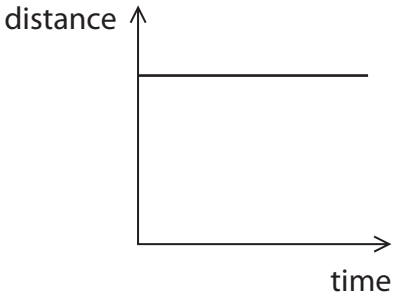

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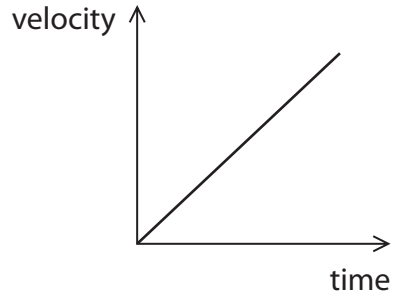
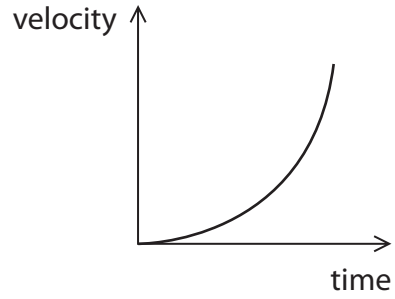


S



The table lists some types of motion.

Place one tick (✓) in each row of the table to show which graph represents which type of motion.

(4)

Type of motion	Graph			
	P	**Q**	**R**	**S**
constant acceleration				
increasing acceleration				
moving at constant velocity				
stationary				

(b) State the feature of a velocity-time graph that can be used to determine the distance travelled by an object.

(1)

.....

(Total for Question 1 = 5 marks)

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2 This question is about electric current.

(a) State what is meant by the term **electric current**.

(1)

.....

.....

(b) Give the name of the particles that flow if there is an electric current in a wire.

(1)

.....

(c) An electric heater contains wires that heat up when there is a current in the wires.

The electric heater has a power of 1.4 kW when connected to a mains voltage of 230 V.

(i) State the formula linking power, current and voltage.

(1)

(ii) Calculate the current in the wires.

(3)

current = ... A

(iii) Explain why the current in the wires causes the temperature of the wires to increase.

(2)

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(Total for Question 2 = 8 marks)

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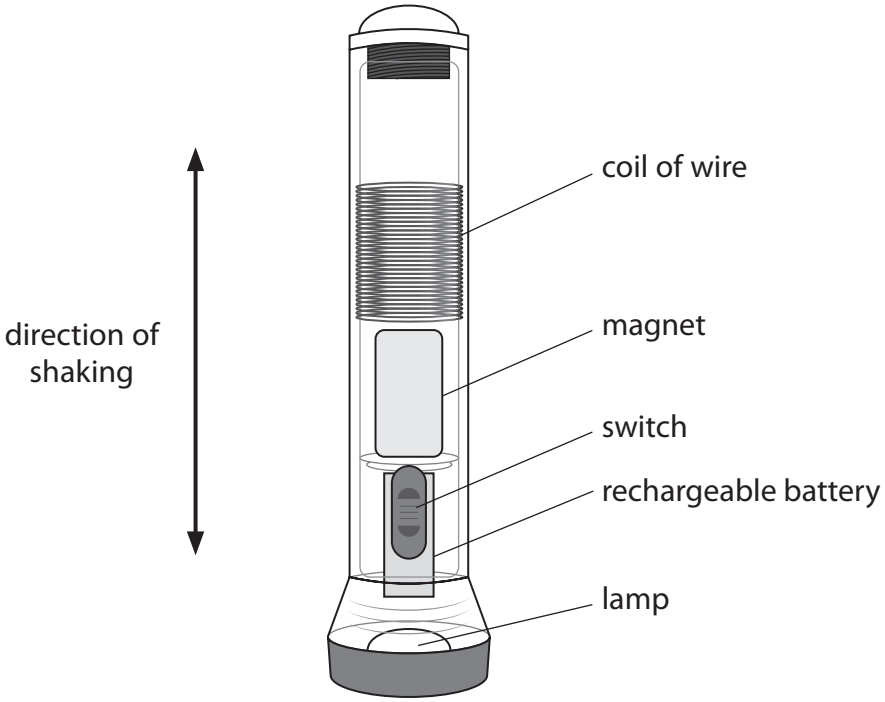
3 The diagram shows a torch that uses a rechargeable battery.

The battery is recharged by shaking the torch up and down.



(Source: adapted from © www.shutterstock.com/1328720216)

(a) Shaking the torch causes the magnet to move up and down inside the coil of wire.

Explain why the movement of the magnet causes a current in the coil.

(3)

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(b) Using a stronger magnet could increase the current in the coil of wire.

State two other factors that could increase the current in the coil.

(2)

1 .....

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2 .....

.....

(Total for Question 3 = 5 marks)

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4 Cobalt-60 is a radioactive isotope of cobalt.

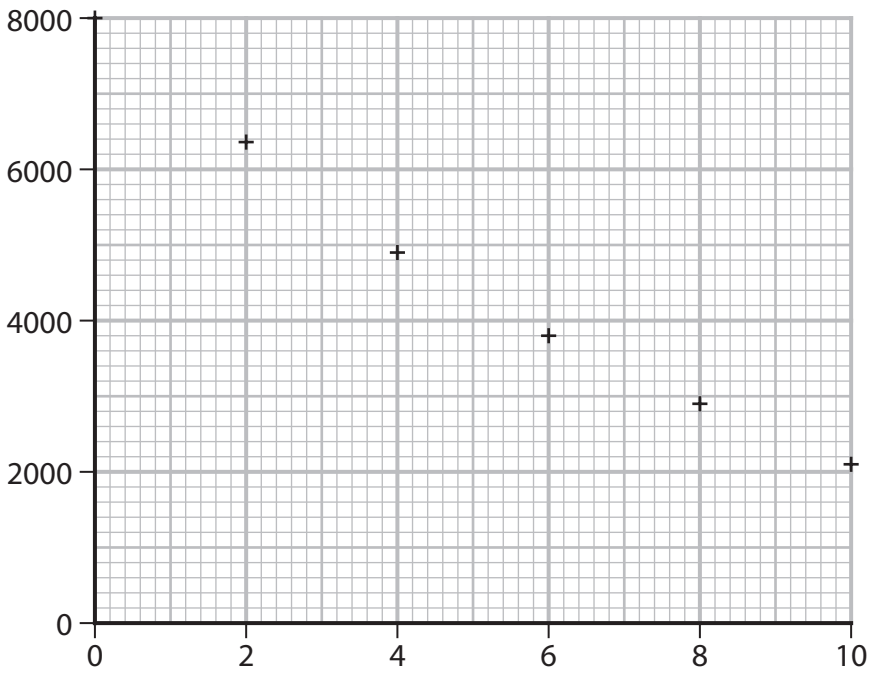
The table gives the activity of a sample of cobalt-60 over a period of 10 years.

Time in years	Activity
0	8000
2	6350
4	4900
6	3800
8	2900
10	2100

(a) Give a suitable unit for activity.

(1)

(b) The graph shows the data.



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(i) Label both axes.

(1)

(ii) Draw the curve of best fit.

(1)

(iii) Use the graph to determine the half-life of cobalt-60.

(2)

half-life = ... years

(iv) Estimate the time taken for the activity to decrease to $\frac{1}{8}$ of its initial value.

(2)

time = ... years

(c) Cobalt-60 is produced when a neutron is absorbed by the nucleus of a stable atom of cobalt-59.

The nuclei of these two isotopes can be represented as

$^{60}_{27}Co$ $^{59}_{27}Co$

Describe a similarity and a difference for the nuclei of these two isotopes of cobalt.

(2)

.....

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.....

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(d) Cobalt-60 decays by beta emission.

Describe what happens to the nucleus of a cobalt-60 atom during beta decay.

(2)

(e) Cobalt-60 also emits gamma radiation.

Cobalt-60 is produced in a nuclear reactor.

Discuss the hazards involved and the precautions taken when disposing of cobalt-60.

(4)

(Total for Question 4 = 15 marks)

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5 A student uses a balance to measure the mass of an object.

This is the student's method.

- adjust the balance so that it displays a reading of zero
- place the object on the balance and record the reading

The student repeats this measurement several times.

(a) What is improved by adjusting the balance to give a reading of zero before the object is placed on it?

(1)

- ☒ **A** accuracy of the measurement
- ☒ **B** precision of the measurement
- ☒ **C** reliability of the measurement
- ☒ **D** validity of the measurement

(b) What is improved by repeating the measurement?

(1)

- ☒ **A** accuracy of the measurement
- ☒ **B** precision of the measurement
- ☒ **C** reliability of the measurement
- ☒ **D** validity of the measurement

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(c) The student measures the mass of the object using six different balances.

The table shows the student's results.

Mass in g
18.96
19.01
19.05
18.98
19.34
19.04

(i) Draw a circle around the anomalous reading in the table.

(1)

(ii) Calculate the mean mass of the object.

(3)

mean mass = ... g

(iii) State what other measurement the student would need to make to determine the density of the object.

(1)

.....

(Total for Question 5 = 7 marks)

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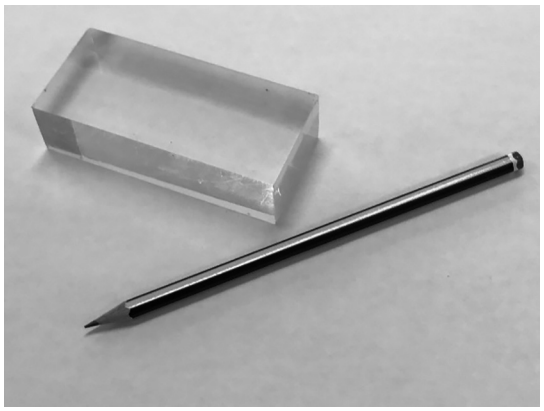
6 A student does an experiment to determine the refractive index of a glass block.



(a) The student places the glass block on a piece of paper and draws round the block with a pencil.

Name two additional pieces of equipment the student will need for his experiment.

(2)

1 .....

2 .....

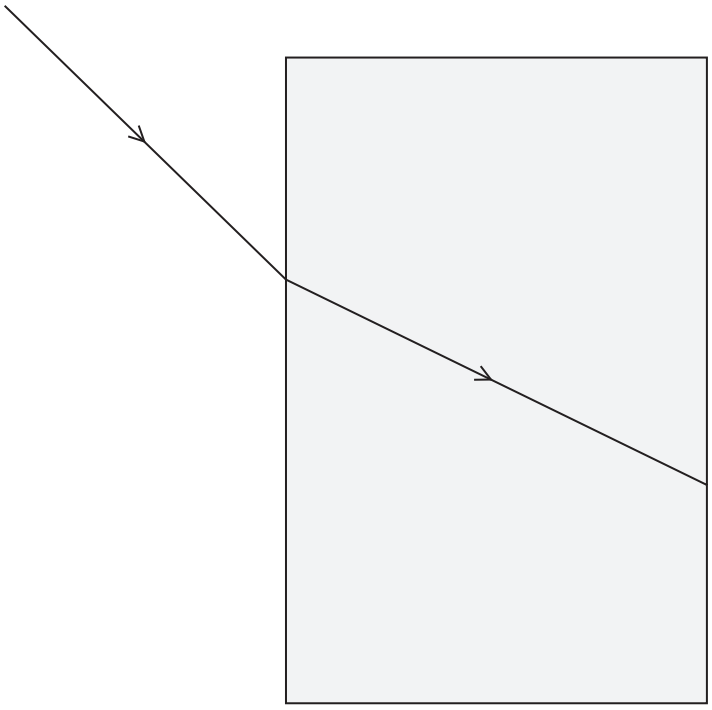
(b) The diagram shows the path of a ray of light as it travels towards and then through the glass block.

(i) Draw the path of the ray of light when it leaves the glass block.

(2)

(ii) Draw the normal line at the point where the ray of light enters the glass block.

(1)



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(iii) Determine the angle of incidence and the angle of refraction at the point where the ray of light enters the glass block.

(2)

angle of incidence = ... °

angle of refraction = ... °

(iv) State the formula linking refractive index, angle of incidence and angle of refraction.

(1)

(v) Calculate the refractive index of the glass block.

(2)

refractive index = ...

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(c) A teacher suggests that a more accurate value for the refractive index can be found using a graphical method.

Design a method to obtain a value for the refractive index of the glass block using a graph.

You may draw a diagram to support your answer.

(3)

(Total for Question 6 = 13 marks)

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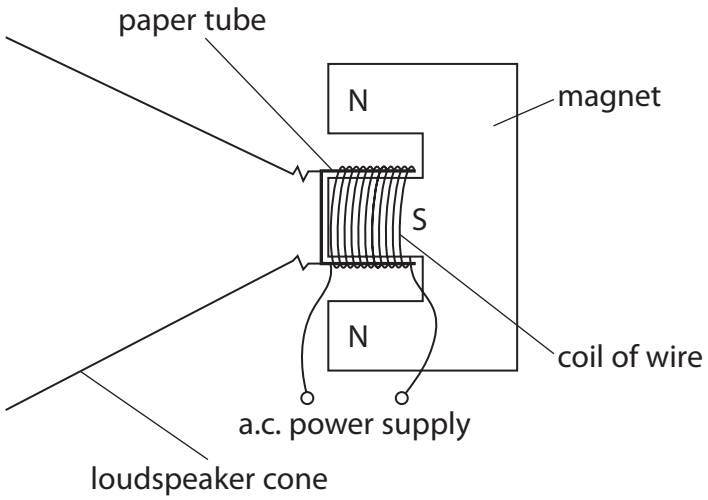
7 The diagram shows the construction of a simple loudspeaker.



A coil of wire is wrapped around a paper tube attached to the loudspeaker cone.

When there is an alternating current (a.c.) in the coil, the cone moves.

Explain how the loudspeaker produces a sound wave.

(5)

(Total for Question 7 = 5 marks)

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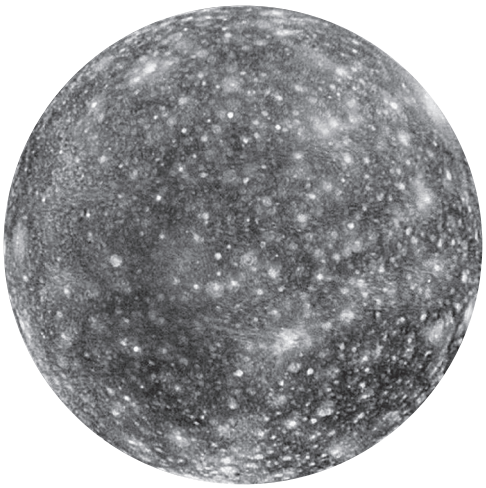
8 The photograph shows Callisto, a moon of the planet Jupiter.



(Source: © Elena11/Shutterstock)

(a) In the space below, draw a labelled diagram to show how Callisto orbits Jupiter.

(2)

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(b) Callisto orbits Jupiter at an orbital radius of 1 880 000 km and with an orbital period of 400 hours.

Calculate the orbital speed of Callisto in km/s.

Give your answer to 3 significant figures.

(4)

orbital speed = ... km/s

(c) Callisto has a gravitational field strength of 1.2 N/kg at its surface.

The Earth's moon has a gravitational field strength of 1.6 N/kg at its surface.

(i) Callisto has a larger mass than the Earth's moon.

Suggest why Callisto has a lower gravitational field strength than the Earth's moon.

(1)

.....

.....

.....

(ii) An object has a weight of 59 N on the surface of the Earth's moon.

Calculate the weight of the same object if it were on the surface of Callisto.

(3)

weight = ... N

(Total for Question 8 = 10 marks)

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9 This question is about gas pressure.

(a) The diagram shows a cylinder containing propane gas.



(Source: © VitaminCo/Shutterstock)

The propane gas is stored in the cylinder at a pressure of 1.03×10^6 Pa.

(i) State the formula linking pressure, force and area.

(1)

(ii) The cylinder has an internal surface area of 1.13 m^2.

Calculate the force exerted on the walls of the cylinder by the propane gas.

(3)

force = ... N

(iii) Explain why the pressure exerted by the propane gas acts equally in all directions.

(2)

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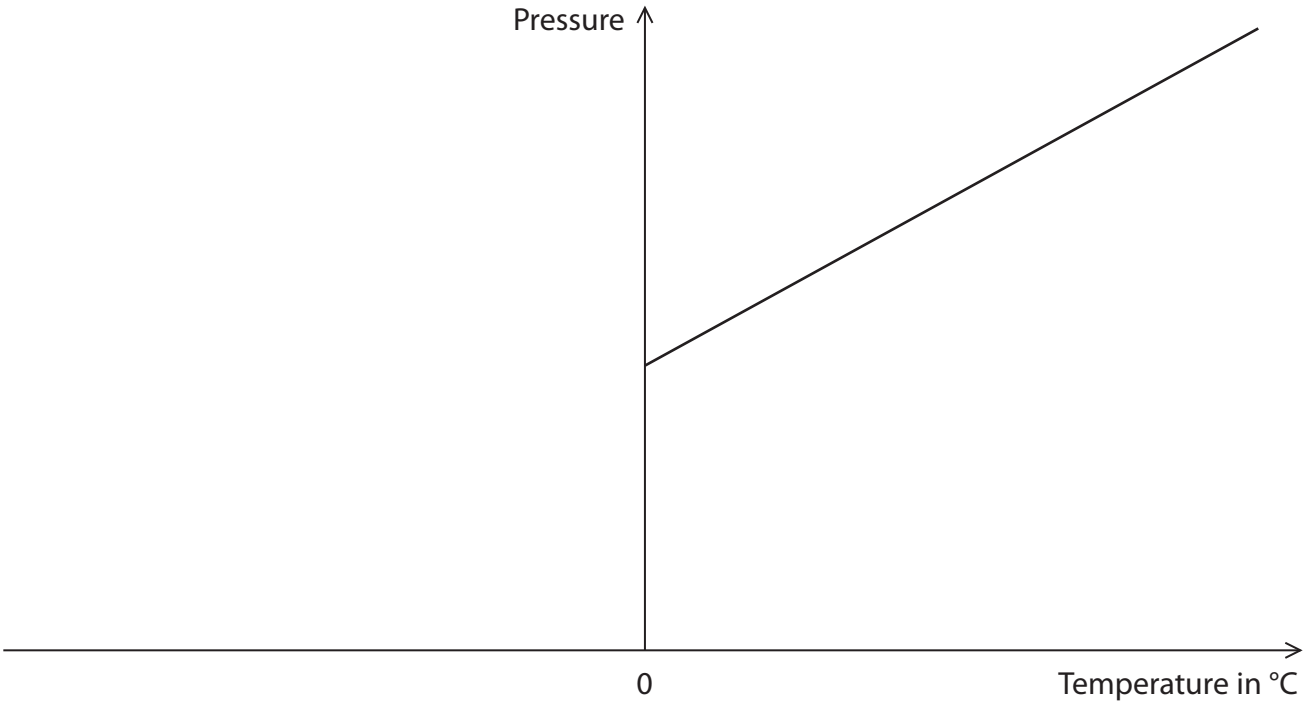
(b) The graph shows how the pressure of a gas varies with its temperature.



(i) Describe how the graph can be used to show that there is a minimum value of temperature, known as absolute zero.

(2)

.....

.....

.....

.....

(ii) Give the value of absolute zero in °C.

(1)

absolute zero = ... °C

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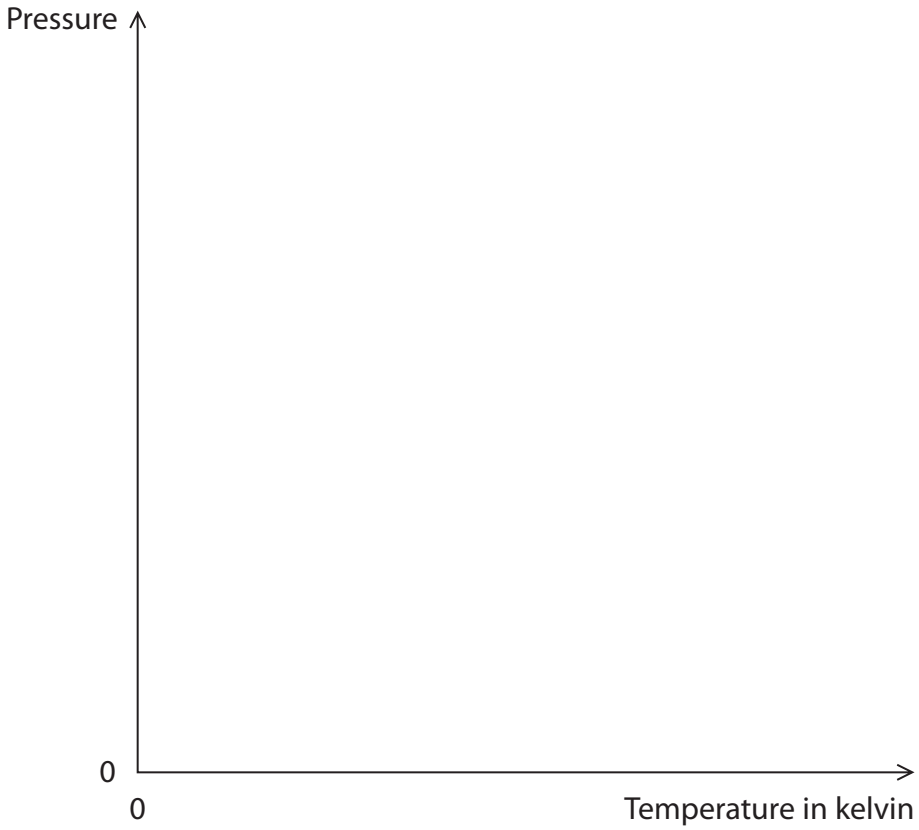
(iii) Temperature can also be measured in kelvin.

On the axes below, sketch a graph to show how the pressure of a gas varies with its kelvin temperature.

(2)



(Total for Question 9 = 11 marks)

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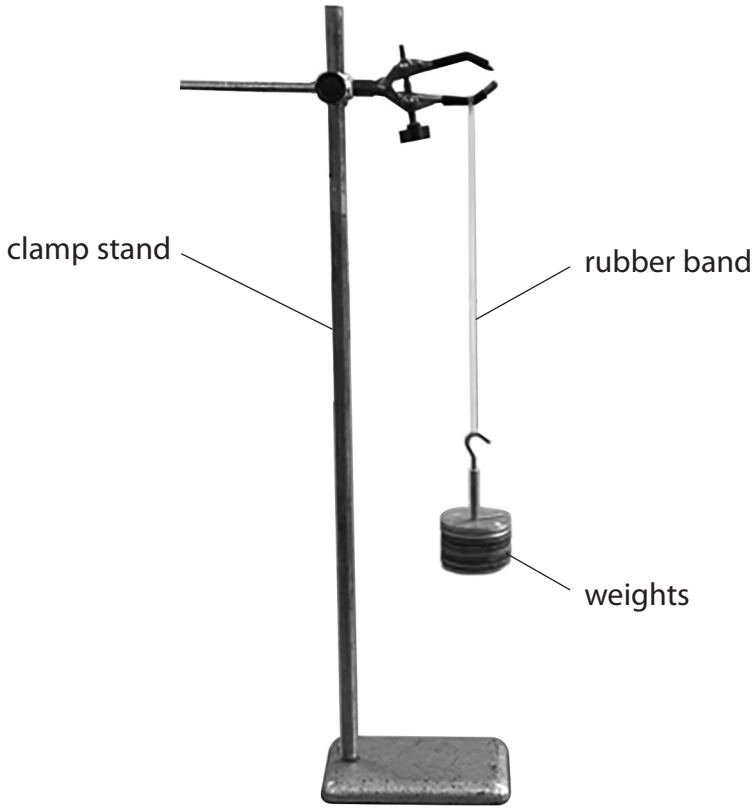
10 A student uses this apparatus to investigate the stretching of a rubber band.



This is the student's method.

- attach the 12 cm long rubber band to a clamp stand
- hang a 1 N weight from the other end of the rubber band
- determine the extension of the rubber band

The student repeats this method, increasing the weight by 1 N each time until the weight is 10 N.

(a) Describe how the student could determine the extension of the rubber band.

(3)

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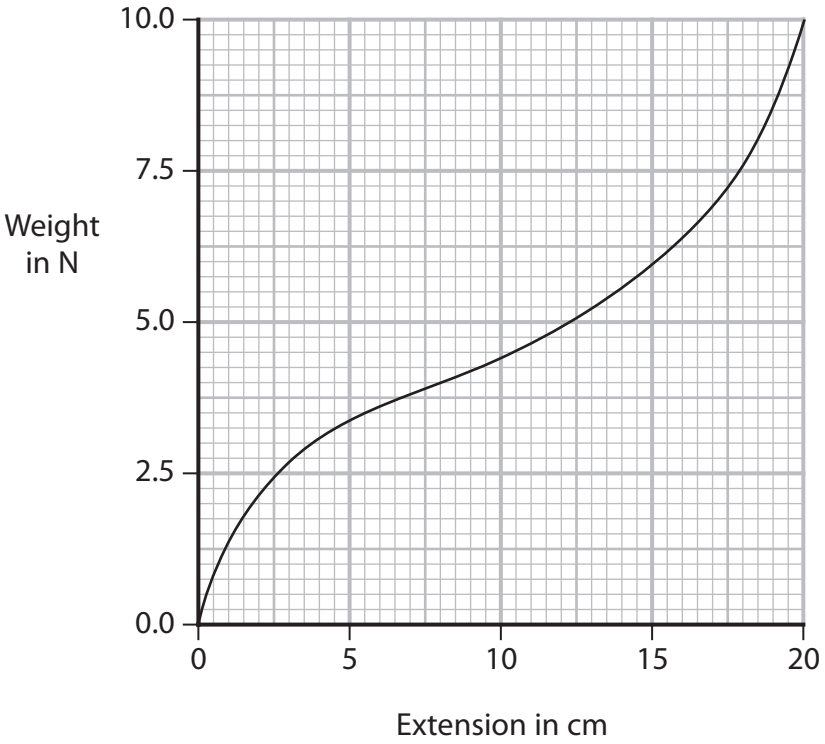
(b) The graph shows the student's results.



(i) Explain how the graph shows that the rubber band does not obey Hooke's Law.

(2)

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(ii) The area under the curve on the graph is equal to the increase in the rubber band's elastic energy store.

Estimate the increase in the rubber band's elastic energy store when the rubber band has been extended by 20 cm.

(4)

increase = ... J

(Total for Question 10 = 9 marks)

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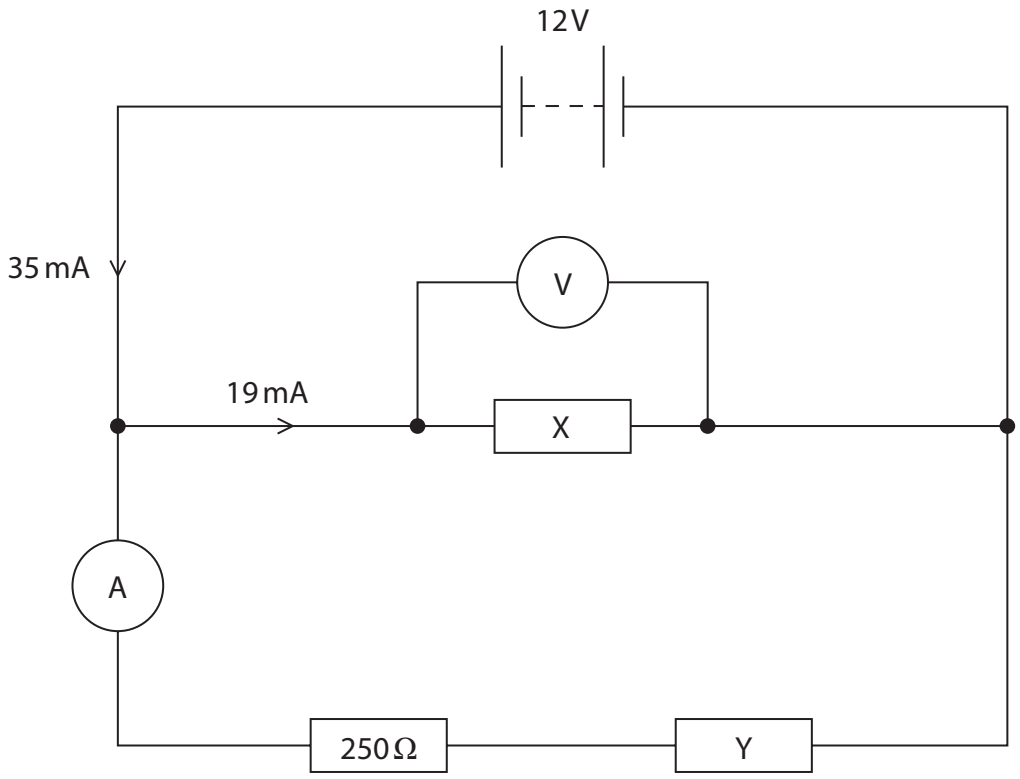
11 The diagram shows a circuit that includes a battery, an ammeter, a voltmeter and three different resistors.



(a) (i) Give the voltmeter reading.

(1)

voltage = ... V

(ii) State the formula linking voltage, current and resistance.

(1)

(iii) Calculate the resistance of resistor X.

(3)

resistance = ... Ω

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(b) (i) Give the reason why the reading on the ammeter would be 16 mA.

(1)

.....

.....

(ii) Calculate the resistance of resistor Y.

(4)

resistance = ... Ω

(c) Resistor X and the voltmeter are removed from the circuit, leaving a break in this part of the circuit.

Explain how the current in the battery changes when these components are removed.

(2)

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(Total for Question 11 = 12 marks)

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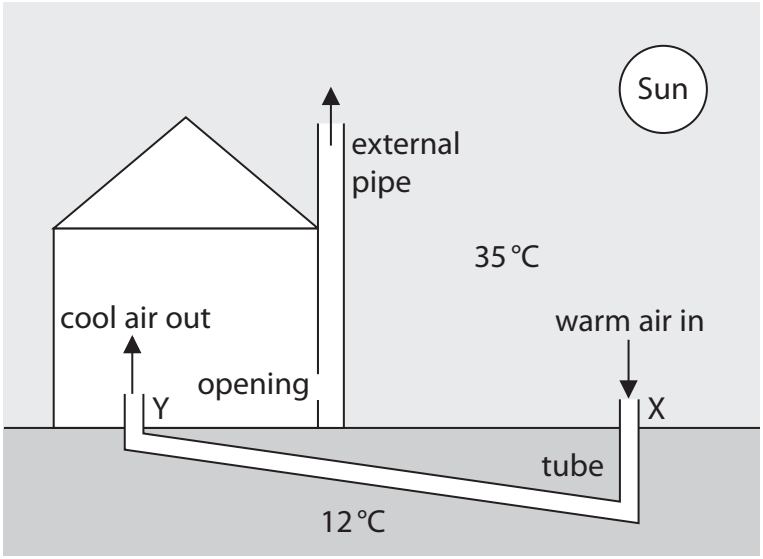
12 The diagram shows a building in a hot climate.

The air temperature is 35 °C and the underground temperature is 12 °C.

The external pipe is heated by the Sun. This causes cool air to enter the house through a tube in the ground.



(a) How is energy transferred to the external pipe from the Sun?

(1)

- ☒ **A** conduction
- ☒ **B** convection
- ☒ **C** evaporation
- ☒ **D** radiation

(b) Explain why air moves upwards through the external pipe.

(3)

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(c) Warm air enters the tube at point X.

Cool air leaves the tube at point Y.

Explain how the air is cooled as it travels through the tube.

(3)

(d) The external pipe is painted to increase the air flow through the building.

Explain what colour of paint would give the greatest increase in air flow.

(3)

(Total for Question 12 = 10 marks)

TOTAL FOR PAPER = 110 MARKS

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