Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number	Candidate Number

Physics

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

Wednesday 23 May 2018 – Afternoon
Time: 2 hours

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

You must have:
Ruler, calculator, protractor

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

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

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

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

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

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

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Answer ALL questions.

1 (a) Diagram 1 shows the orbits of two objects.

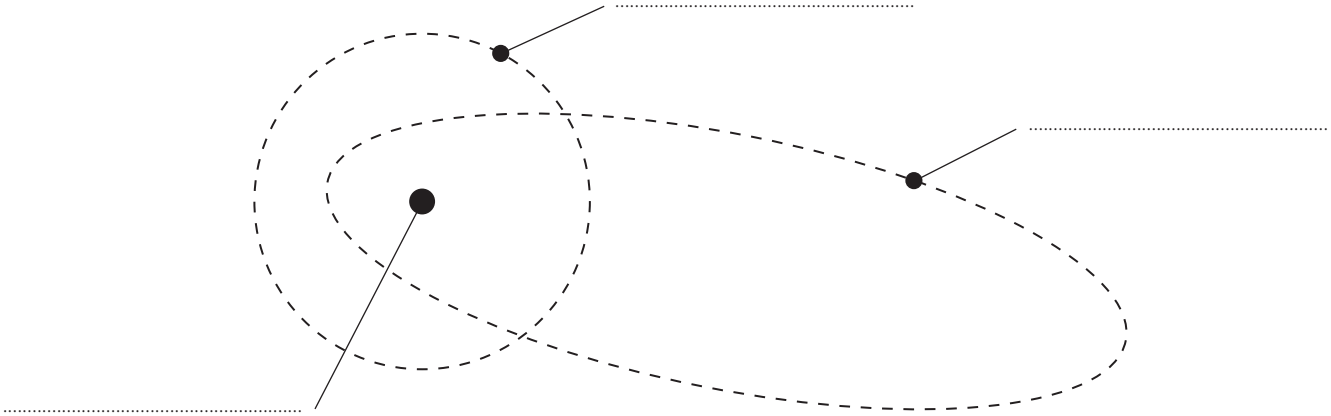

Diagram 1

Select words from the box to add the three missing labels to diagram 1.

(3)

comet	planet	solar system	star

(b) Diagram 2 shows the Moon orbiting the Earth.

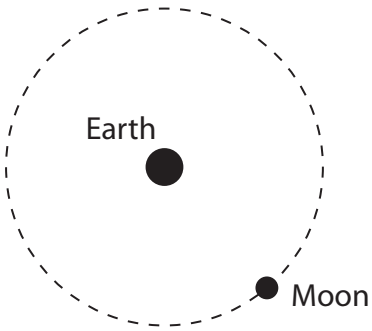

Diagram 2

Draw an arrow on diagram 2 to show the gravitational force acting on the Moon due to the Earth.

(1)

(c) Give a name for a large collection of billions of stars.

(1)

(Total for Question 1 = 5 marks)

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2 The photograph shows a child bouncing on a trampoline.

(a) The box lists some types of energy.

chemical	elastic	gravitational	kinetic	thermal

The passage describes the process of bouncing on the trampoline.

Use words from the box to complete the passage.

Each word may be used once, more than once or not at all.

(4)

As the child falls, his ..... energy

is mostly transferred to ..... energy.

When the child hits the trampoline, his ..... energy

is transferred to ..... energy.

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(b) Trampolines have springs that stretch and compress.

A student investigates a spring to see if it obeys Hooke's law.

She measures the extension of a spring for a range of different stretching forces.

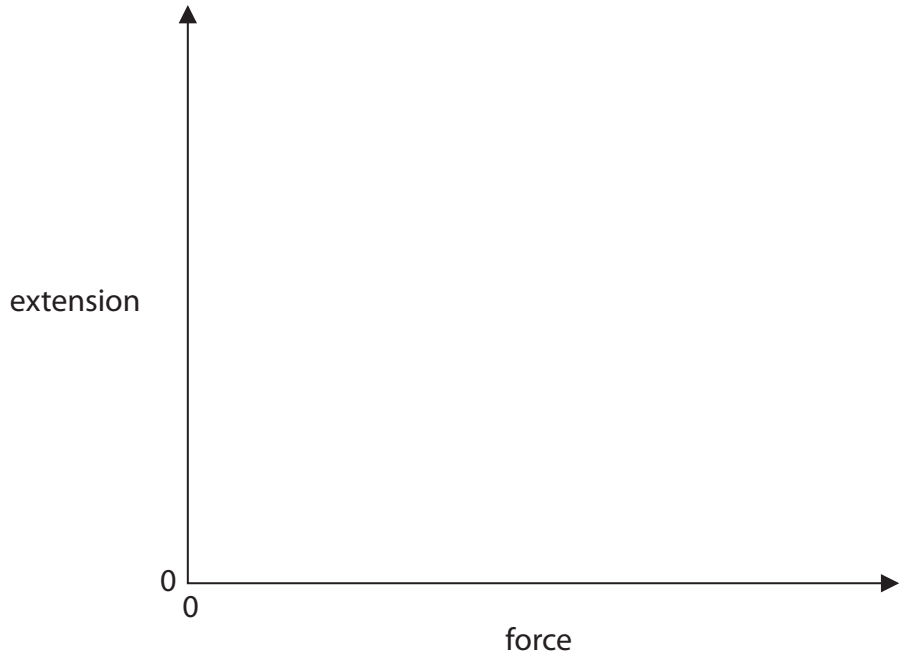
(i) Describe how the student could measure the extension of the spring.

(3)

(ii) The student finds that the spring does obey Hooke's law.

Sketch a graph of her results on the axes.

(2)



(Total for Question 2 = 9 marks)

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3 The photograph shows an electrical appliance called a toaster.

(a) The toaster has a power of 1800 W when operating at a voltage of 230 V.

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

(1)

(ii) Show that the current in the toaster is about 8 A.

(2)

(iii) Which fuse rating would be suitable for the toaster?

(1)

☒ **A** 1 A

☒ **B** 3 A

☒ **C** 7 A

☒ **D** 13 A

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(b) The toaster uses mains electricity.

Mains electricity provides alternating current.

(i) Describe the difference between alternating current (a.c.) and direct current (d.c.).

(2)

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(ii) State a source of direct current.

(1)

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(Total for Question 3 = 7 marks)

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4 A student has a small piece of steel.

Describe an experiment that he could do to find the density of steel.

You may draw a diagram to help your answer.

(5)

(Total for Question 4 = 5 marks)

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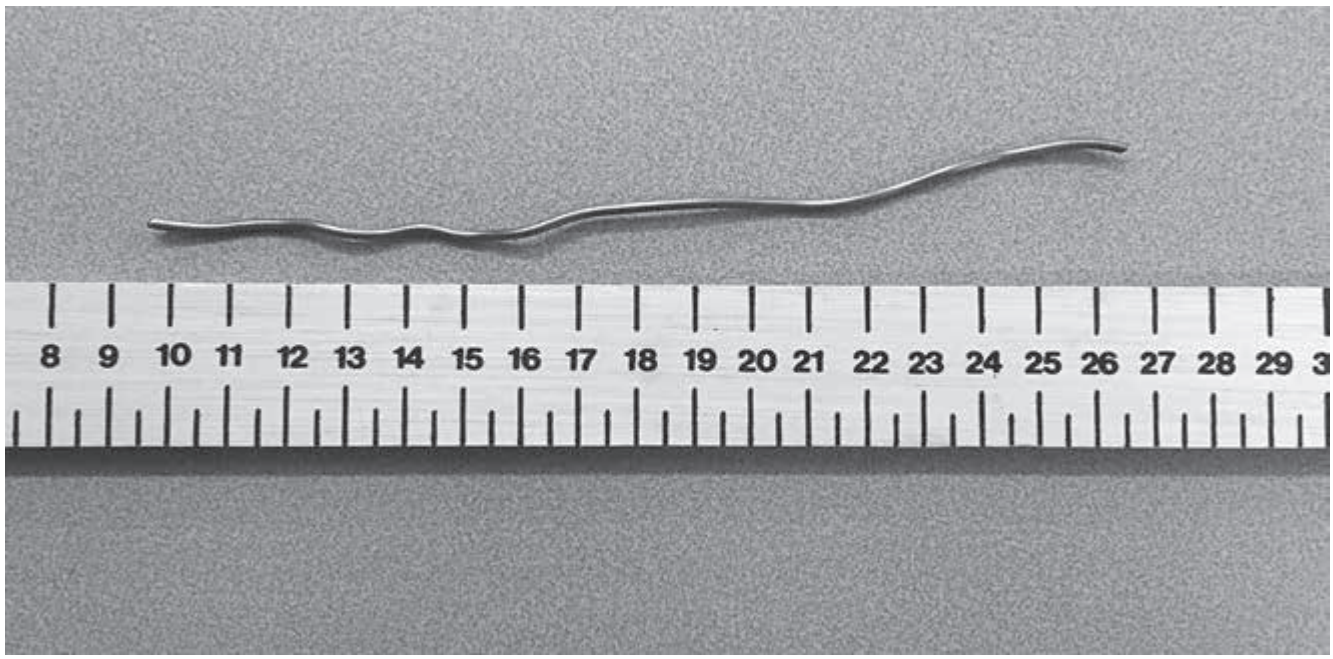
5 A student investigates how the length of a piece of wire affects its resistance.

(a) The photograph shows how he uses a ruler to measure the length of the wire.



(i) State how the student could improve the precision of his measurement.

(1)

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(ii) Suggest three ways the student could improve the accuracy of his measurement.

(3)

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3 .....

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(b) The student finds the resistance for seven different lengths of wire.

He does this by passing a small current through each wire.

(i) Explain why the current in each wire must be small.

(2)

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(ii) The table shows the student's results.

Length of wire in cm	Resistance in ohms
10	2.8
15	4.5
20	6.1
50	14.9
55	16.3
60	18.0
65	19.4

Suggest two improvements the student could make to the data he collects.

(2)

1 .....

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2 .....

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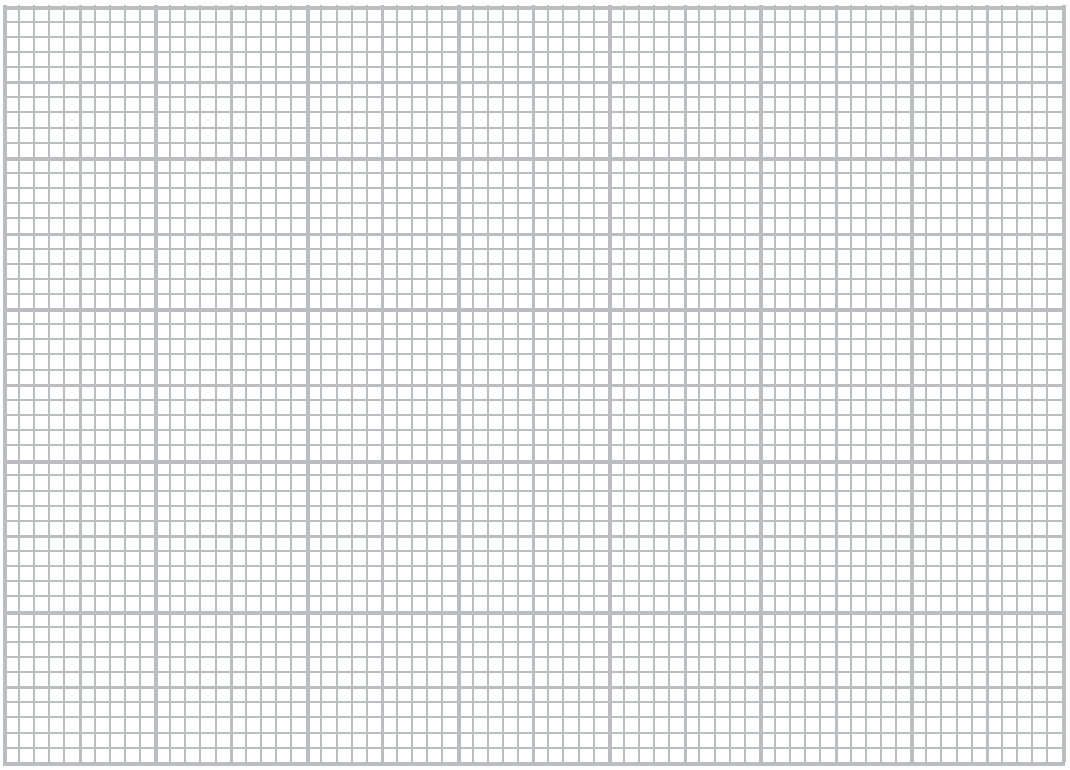
(iii) Plot a graph of the student's results on the grid.

(4)

(iv) Draw the line of best fit.

(1)



(v) Describe the relationship shown by the graph.

(2)

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(Total for Question 5 = 15 marks)

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6 This question is about parts of the electromagnetic spectrum.

gamma	x-ray	ultraviolet	visible	infrared	microwave	radio

(a) Which of these parts has the longest wavelength?

(1)

☒ **A** gamma

☒ **B** infrared

☒ **C** radio

☒ **D** visible

(b) State two properties that are the same for all parts of the electromagnetic spectrum.

(2)

1 .....

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2 .....

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(c) Discuss a use and a harmful effect for three parts of the electromagnetic spectrum.

(6)

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2 .....

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3 .....

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(Total for Question 6 = 9 marks)

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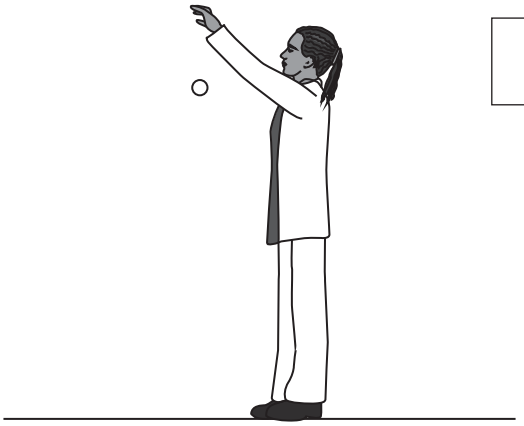
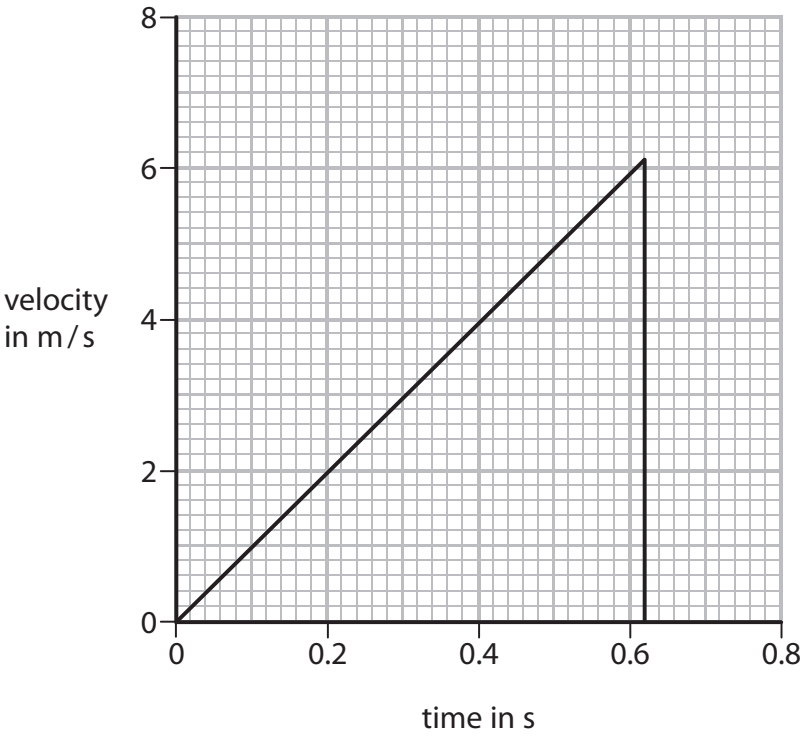
7 (a) The diagram shows a coin being dropped from a height.



Not to scale

The graph shows how the velocity of the coin changes until it hits the ground.



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

(1)

(ii) The coin hits the ground in a time of 0.62 s with a velocity of 6.1 m/s.

Calculate the acceleration of the coin as it falls.

Give the unit.

(3)

acceleration = ... unit .....

(iii) State the feature of the graph that shows this acceleration.

(1)

.....

(iv) Calculate the height from which the coin was dropped.

Use the graph to help with your calculation.

(3)

height = ... m

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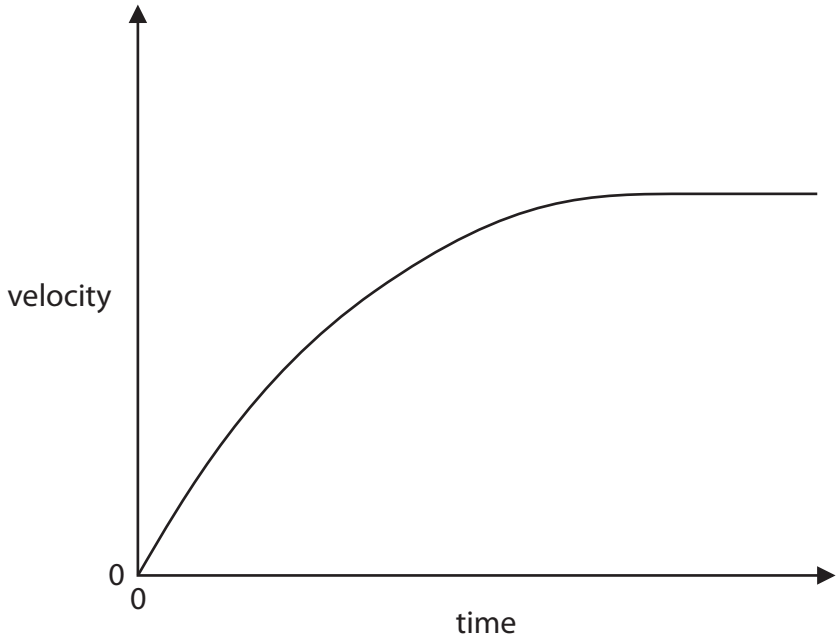
(b) A ball is dropped from a very large height.

The graph shows how the velocity of the ball changes until just before it hits the ground.



Explain why the velocity of the ball changes in this way.

Refer to ideas about forces in your answer.

(5)

(Total for Question 7 = 13 marks)

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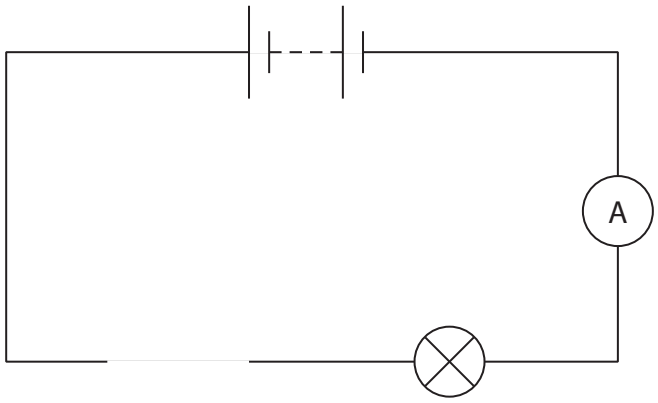
8 The diagram shows an incomplete series circuit.



(a) (i) Draw a thermistor to complete the circuit.

(1)

(ii) Add a voltmeter to the circuit to measure the voltage across the lamp.

(2)

(b) The voltmeter measures a voltage of 5.6 V.

The ammeter measures a current of 790 mA.

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

(1)

(ii) Calculate the resistance of the lamp.

(3)

resistance = ... Ω

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(c) The completed circuit is moved from a cold room to a hot room.

Explain how this would affect the brightness of the lamp.

(3)

(d) State how the current in the circuit would change if another lamp is added in series with the first lamp.

(1)

(Total for Question 8 = 11 marks)

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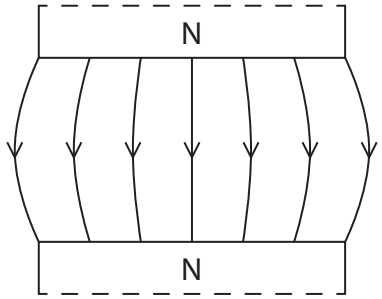
9 This question is about magnetic fields.

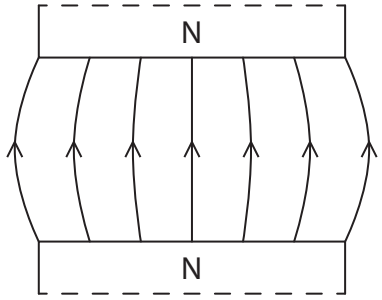
(a) Which diagram shows the correct magnetic field pattern between the north poles of two bar magnets?

(1)

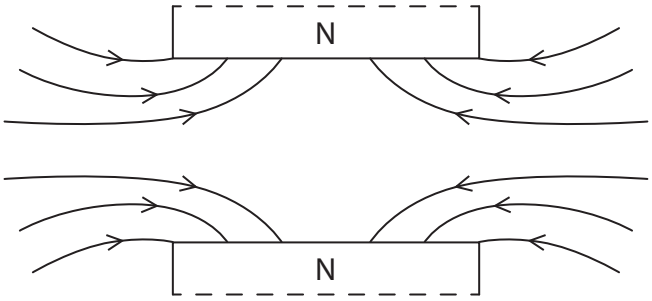
☒ **A**



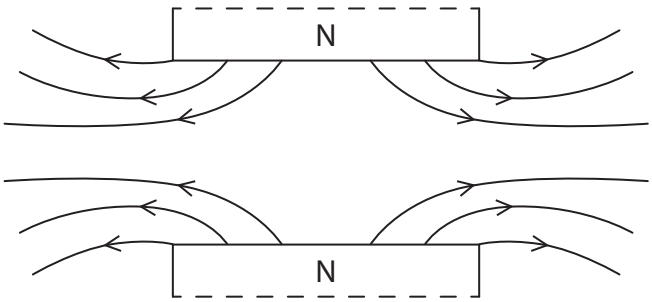
☒ **B**



☒ **C**



☒ **D**



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(b) The diagram shows part of a magnetic field.

(i) Two magnetic field lines have already been drawn.

Draw more magnetic field lines on the diagram to show a uniform magnetic field.

(3)

(ii) Describe how you would change your diagram to show a stronger magnetic field.

(1)

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(Total for Question 9 = 5 marks)

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10 Americium-241 is a radioactive isotope used in smoke detectors.

It has the symbol

$$^{241}_{95}\mathrm{Am}$$

(a) (i) How many protons are in an americium-241 nucleus?

(1)

- ☒ **A** 95
- ☒ **B** 146
- ☒ **C** 241
- ☒ **D** 336

(ii) How many neutrons are in an americium-241 nucleus?

(1)

- ☒ **A** 95
- ☒ **B** 146
- ☒ **C** 241
- ☒ **D** 336

(iii) How many electrons are in a neutral americium-241 atom?

(1)

- ☒ **A** 95
- ☒ **B** 146
- ☒ **C** 241
- ☒ **D** 336

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(b) When americium-241 decays, it emits alpha particles to form neptunium-237.

Np is the symbol for neptunium.

Complete the nuclear equation for the decay of americium-241.

(3)

$$\begin{matrix}241\\95\end{matrix}\mathrm{Am} \longrightarrow \begin{matrix}237\\\ \end{matrix}\mathrm{Np} + \begin{matrix}\ \\\ \end{matrix}\alpha$$

(c) After the decay, the neptunium-237 nucleus emits gamma radiation.

State what happens to the number of protons and neutrons in a nucleus as a result of gamma emission.

(2)

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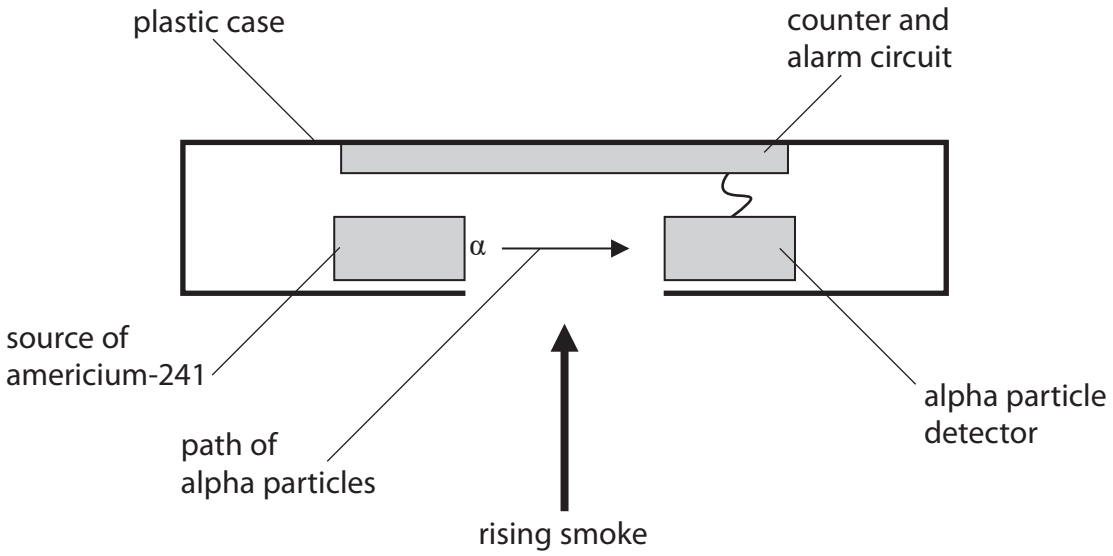
(d) The diagram shows a cross-section through a smoke alarm.



In normal operation, the count rate measured by the counter is 100 counts per second.

If the count rate falls below 80 counts per second, the alarm sounds.

Explain how the rising smoke causes the alarm to sound.

(2)

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(e) Americium-241 has a half-life of 430 years.

(i) Describe what is meant by the term **half-life**.

(2)

(ii) Americium-242 has a half-life of 16 hours and is a beta emitter.

Explain why americium-242 is not suitable for use in the smoke detector.

(3)

(Total for Question 10 = 15 marks)

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11 This question is about how light travels in water.

(a) Diagram 1 shows a ray of light from a torch submerged in a swimming pool.

The ray of light does not pass through the water surface.

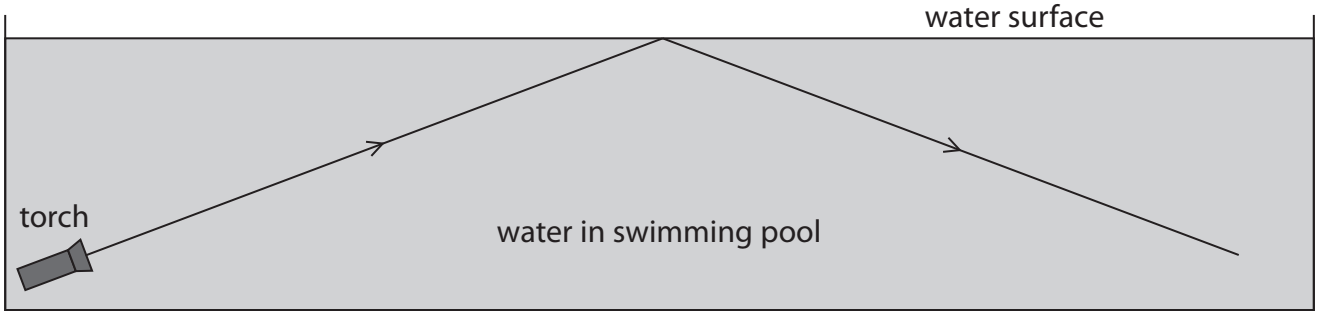

Diagram 1

(i) State the name of this process.

(1)

.....

(ii) Draw the normal on diagram 1 where the ray of light meets the water surface.

(1)

(iii) Measure the angle of incidence.

(1)

angle of incidence = ...

(iv) State the angle of reflection.

(1)

angle of reflection = ...

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(b) The torch is moved and the ray of light now passes through the water surface.

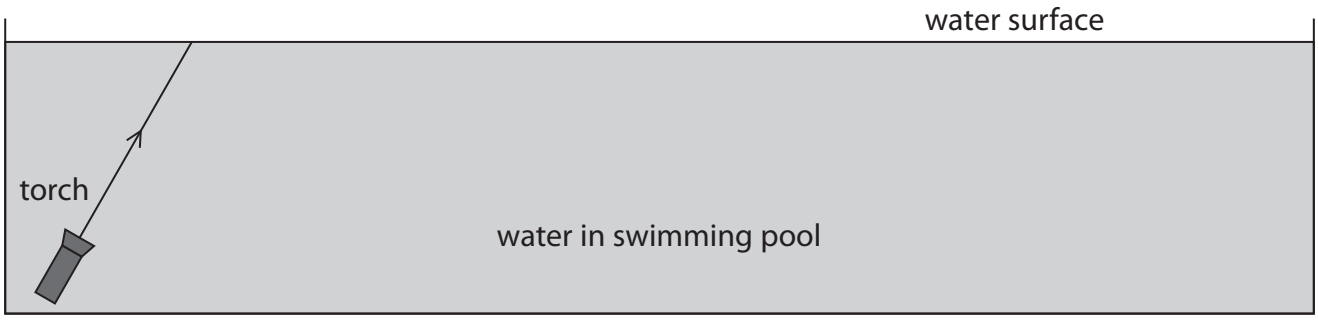

Diagram 2

(i) Draw a line on diagram 2 to continue the path of the ray of light.

(2)

(ii) State the name of this process.

(1)

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

(1)

(ii) The refractive index of water is 1.33

Calculate the critical angle for the boundary between water and air.

Give your answer to three significant figures.

(3)

critical angle = ...

(iii) The torch is moved again so that the ray of light now meets the water surface at an angle of incidence of 52°.

Explain what happens to this ray of light.

(2)

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(Total for Question 11 = 13 marks)

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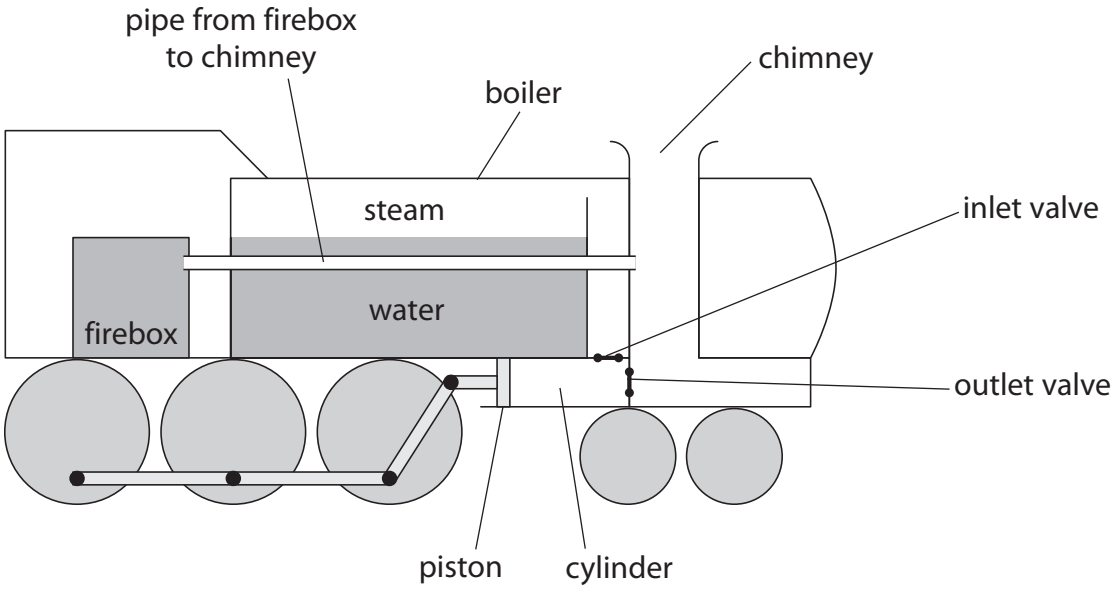
12 The diagram shows the basic details of a steam engine used in a steam train.



(a) Coal is burned in the firebox to heat up water in the boiler.

Coal is a non-renewable fuel.

Give an example of another non-renewable fuel.

(1)

.....

(b) This is how the steam engine works.

- hot air from the firebox passes through a pipe to the chimney
- water is heated as the pipe passes through the boiler
- the water boils to form steam
- the steam is trapped by the closed inlet valve and continues to be heated

Explain why the pressure of the steam increases as its temperature increases.

(3)

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(c) When the inlet valve is opened, the steam moves into the cylinder.

The steam exerts a force on the piston in the cylinder.

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

(1)

(ii) The steam has a pressure of 1.45 MPa.

The piston has an area of 0.0243 m^2.

Calculate the force exerted on the piston.

(3)

force = ... N

QUESTION 12 CONTINUES ON NEXT PAGE

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(d) The force pushes the piston so that the wheels turn and the train moves.

This process transfers chemical energy from the coal into useful kinetic energy.

(i) State a type of energy that is wasted in this process.

(1)

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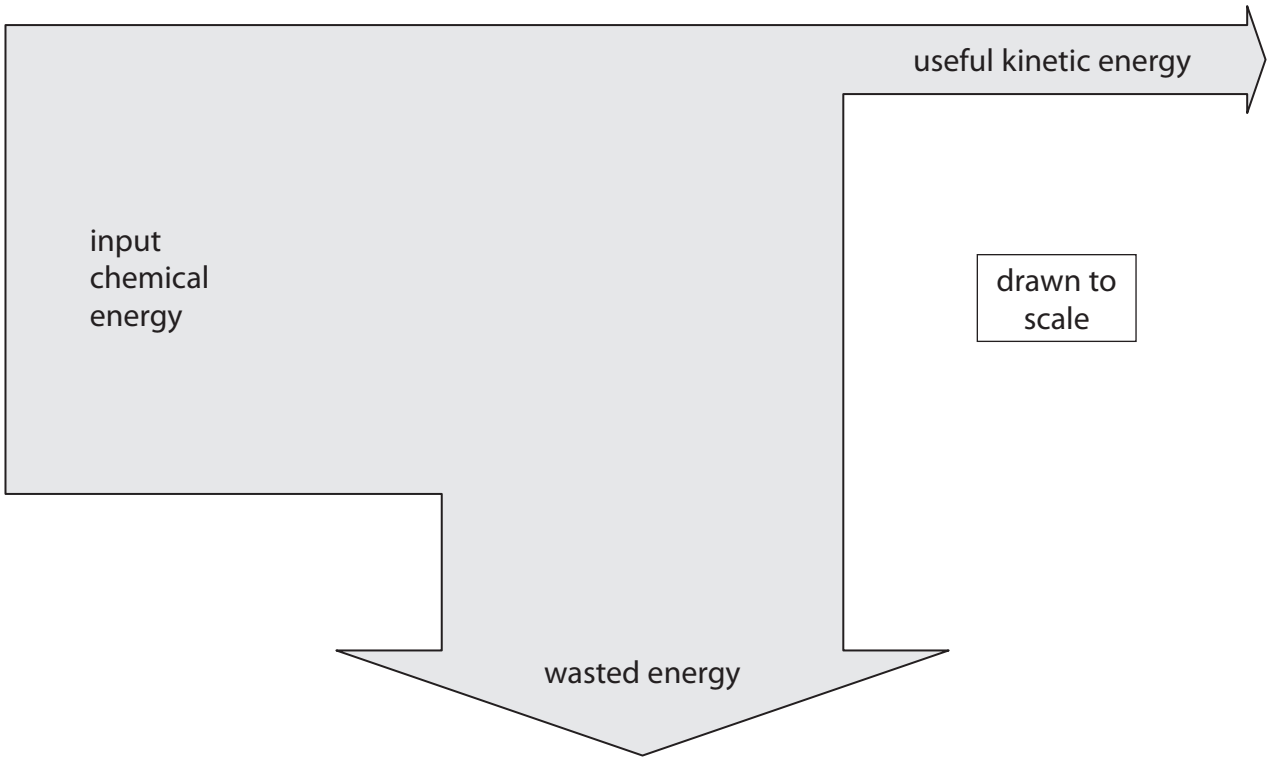
(ii) The Sankey diagram shows the energy transfers in the process.



Using the diagram, calculate the efficiency of the steam train.

(4)

efficiency = ...

(Total for Question 12 = 13 marks)

TOTAL FOR PAPER = 120 MARKS

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