Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Thursday 14 November 2024

Morning (Time: 2 hours)

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

Physics

UNIT: 4PH1
Science (Double Award) 4SD0
PAPER: 1P

You must have:
Ruler, calculator, protractor, Equation Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.

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.

Turn over ▶

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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.

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 ☒.

1 Diagram 1 shows a planet orbiting a star, and a moon orbiting a planet.

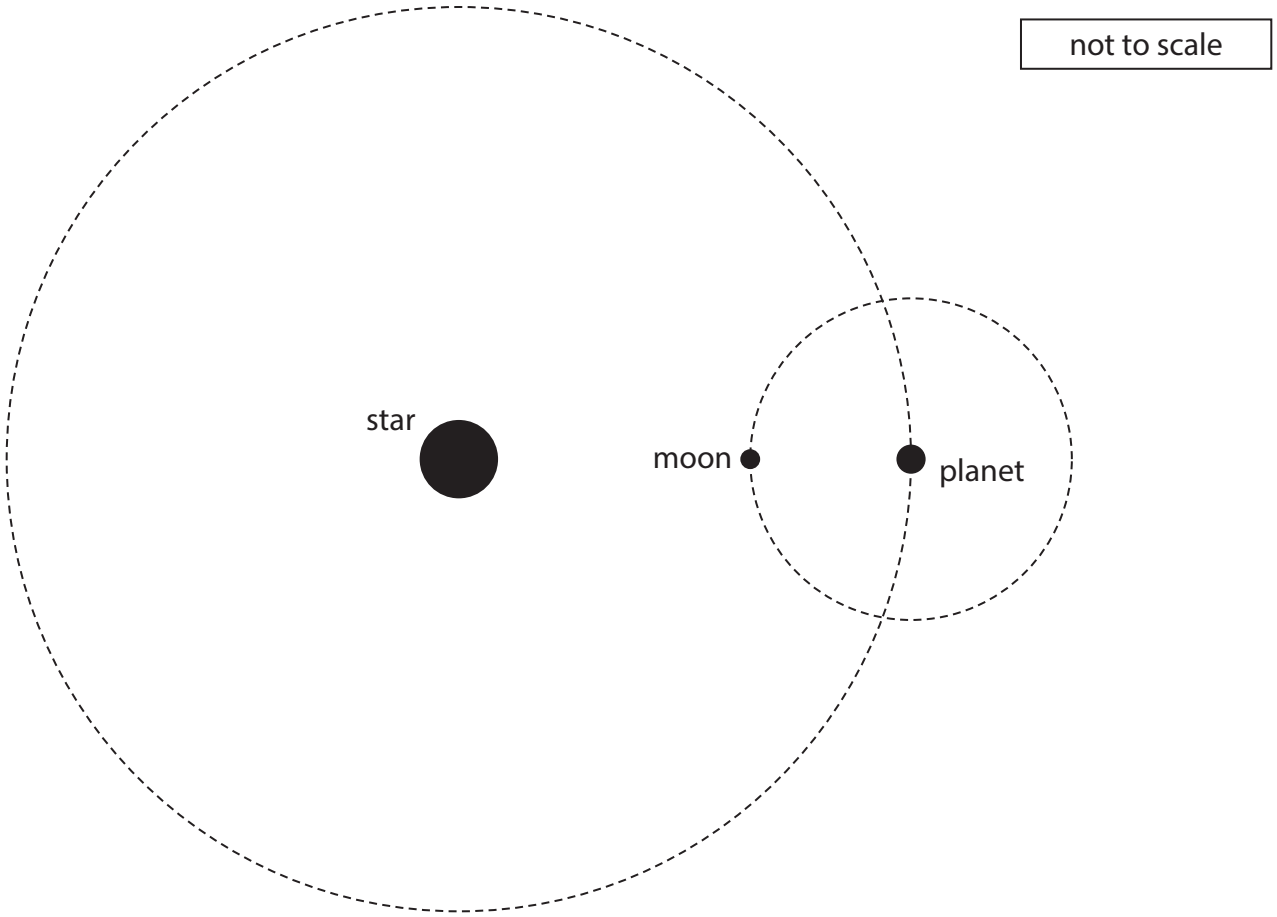

Diagram 1

(a) On Diagram 1, draw the orbit of a comet around the star.

(2)

(b) (i) On Diagram 1, draw an arrow to show the force the planet exerts on the moon.

(1)

(ii) What type of force does the planet exert on the moon?

(1)

☒ **A** electric

☒ **B** gravitational

☒ **C** magnetic

☒ **D** nuclear

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(c) The planet completes one orbit of the star in a time of 2.5×10^8 s.

The radius of the planet's orbit is 8.7×10^{10} m.

Calculate the orbital speed of the planet.

Give your answer to two significant figures.

(3)

orbital speed = ... m/s

(d) Diagram 2 shows the region around the Sun, a yellow star, where liquid water can exist on the surface of planets. This is because the surface temperature of the planet is between 0 °C and 100 °C.

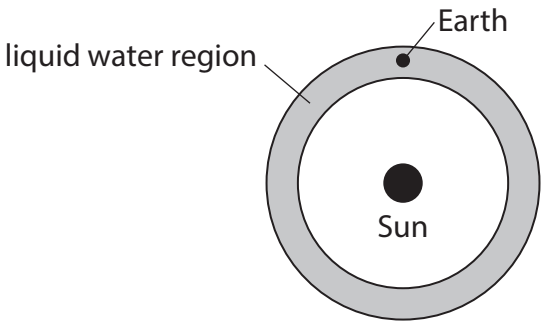

Diagram 2

Explain what would happen to the position of the liquid water region if the Sun was replaced with a blue star of the same size.

(2)

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(Total for Question 1 = 9 marks)

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2 An athlete jumps vertically from the ground.

(a) The athlete has a mass of 85 kg, and leaves the ground with an upwards velocity of 4.5 m/s.

(i) State the formula linking kinetic energy, mass and speed.

(1)

(ii) Calculate the athlete's kinetic energy at a speed of 4.5 m/s.

(2)

kinetic energy = ... J

(iii) At the maximum height of the jump, the athlete has a speed of 0 m/s.

State the increase in the amount of energy in the athlete's gravitational potential energy store from the ground to the maximum height of the jump.

(1)

increase in gravitational potential energy = ... J

(iv) State the formula linking gravitational potential energy, mass, gravitational field strength and height.

(1)

(v) Calculate the maximum height of the athlete's jump.

(3)

height = ... m

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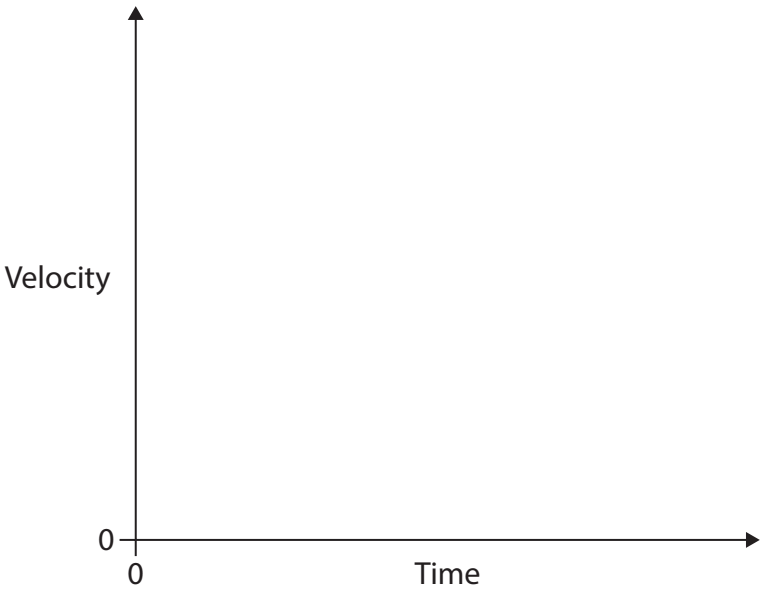
(b) (i) Sketch a velocity-time graph for the athlete's jump from the ground to the maximum height of the jump. No numbers are required.

Assume there is no air resistance.

(3)



(ii) What feature of the velocity-time graph gives the acceleration due to gravity?

(1)

☒ **A** area under the line

☒ **B** gradient

☒ **C** x-axis

☒ **D** y-axis

(iii) Explain why the gravitational field strength on the Moon is different from the gravitational field strength on the Earth.

(2)

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(Total for Question 2 = 14 marks)

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3 (a) Photograph 1 shows a power supply for some electrical equipment. The electrical equipment is connected to the mains supply.



(Source: © 2211575607/ Shutterstock)

Photograph 1

Explain why the power supply is completely covered in plastic.

(2)

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(b) The electrical equipment is connected to the mains power supply of 230 V.

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

(1)

(ii) The electrical equipment has a power of 350 W.

Calculate the current in the equipment when it is being used.

(2)

current = ... A

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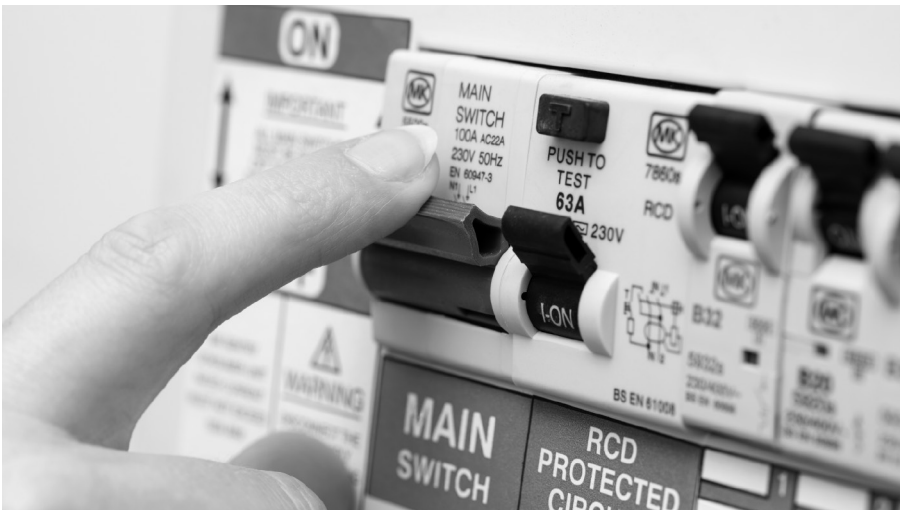
(c) Photograph 2 shows a circuit breaker.



(Source: © 509531608 / Shutterstock)

Photograph 2

Explain the advantages of using a circuit breaker rather than a fuse.

(2)

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(Total for Question 3 = 7 marks)

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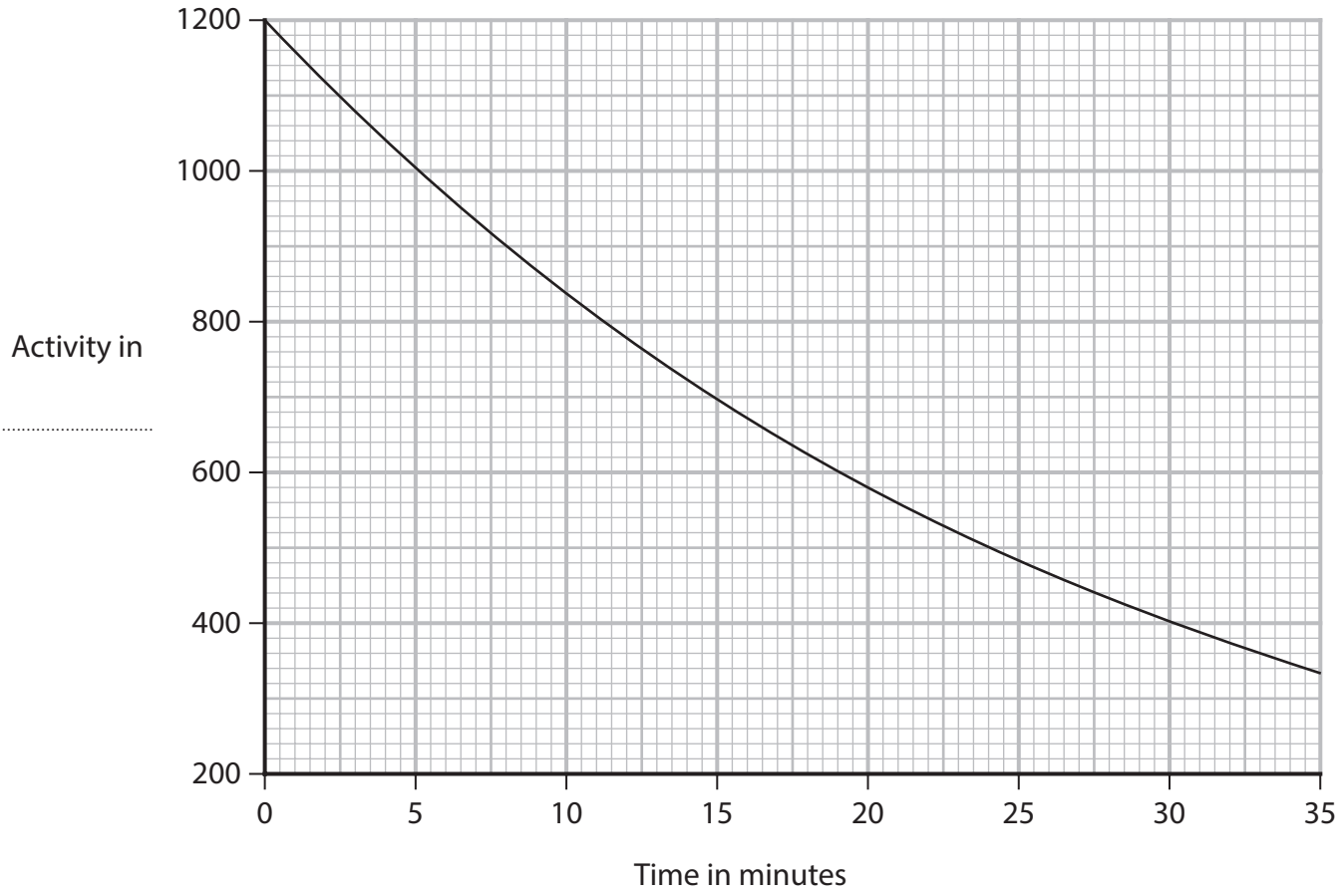
4 A teacher investigates a sample of radioactive material.

The graph shows their results.



(a) On the graph, give the unit for activity.

(1)

(b) Describe what is meant by the term **background radiation**.

(2)

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

(2)

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(ii) Use the graph to determine the half-life of this radioactive sample.

(2)

half-life = ... minutes

(d) The teacher suggests that this formula shows the relationship between activity and time taken.

$$\text{activity} \times \text{time taken} = \text{constant}$$

Use data from the graph to determine if this relationship is correct.

(4)

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(Total for Question 4 = 11 marks)

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5 Diagram 1 shows two magnetic poles.

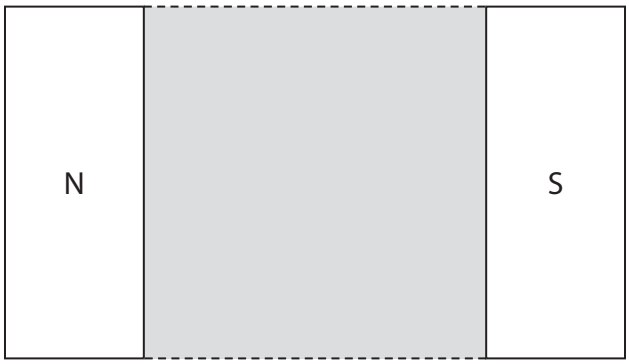

Diagram 1

(a) Draw three field lines on Diagram 1 to show the uniform magnetic field in the shaded region between the two poles.

(2)

(b) Diagram 2 shows a current-carrying wire in the uniform magnetic field between the poles of a magnet.

The arrow on the wire shows the direction of current.

Draw another arrow on Diagram 2 to show the direction of the force on the wire.

(2)

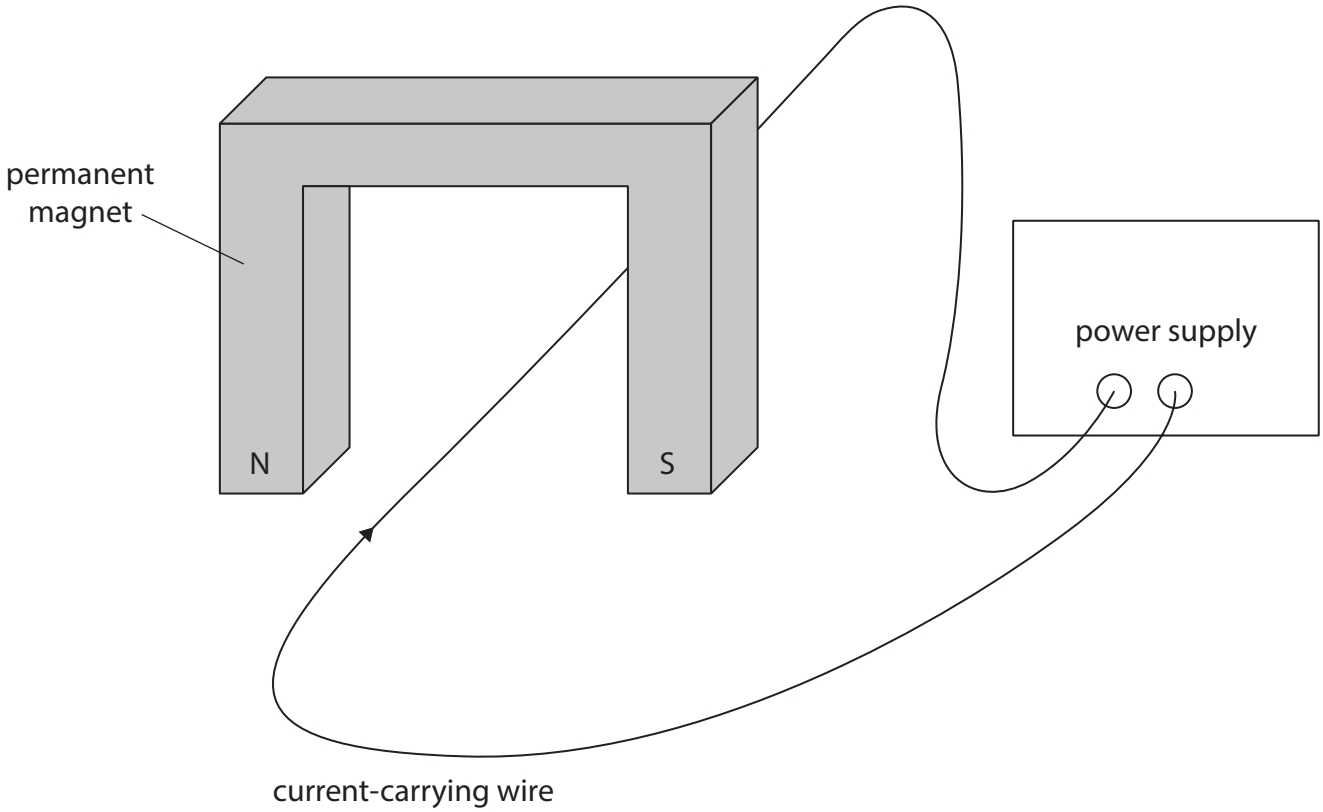

Diagram 2

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(c) Diagram 3 shows a rectangular loop of wire carrying a current in a uniform magnetic field.

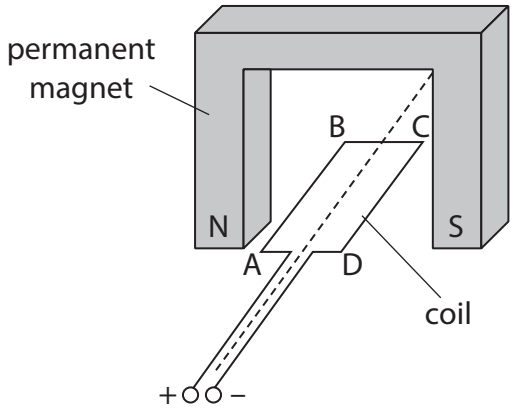

Diagram 3

Explain why the loop starts to turn but stops when the loop is vertical.

(4)

(Total for Question 5 = 8 marks)

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6 A student does an investigation to determine the refractive index of a rectangular block of transparent material.

The student uses this equipment in their investigation.

- ray box
- rectangular transparent block
- protractor
- pencil
- paper
- ruler

This is the formula linking refractive index, angle of incidence and angle of refraction.

$$\text{refractive index} = \frac{\sin(i)}{\sin(r)}$$

(a) Describe a method to determine the refractive index of the material.

You may draw a diagram to help your answer.

(5)

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(b) The refractive index of the material is 1.2

(i) State the formula linking the refractive index and the critical angle of a material.

(1)

(ii) Calculate the critical angle of this material.

(2)

critical angle = ... degrees

(iii) Describe what is meant by the term **total internal reflection**.

(2)

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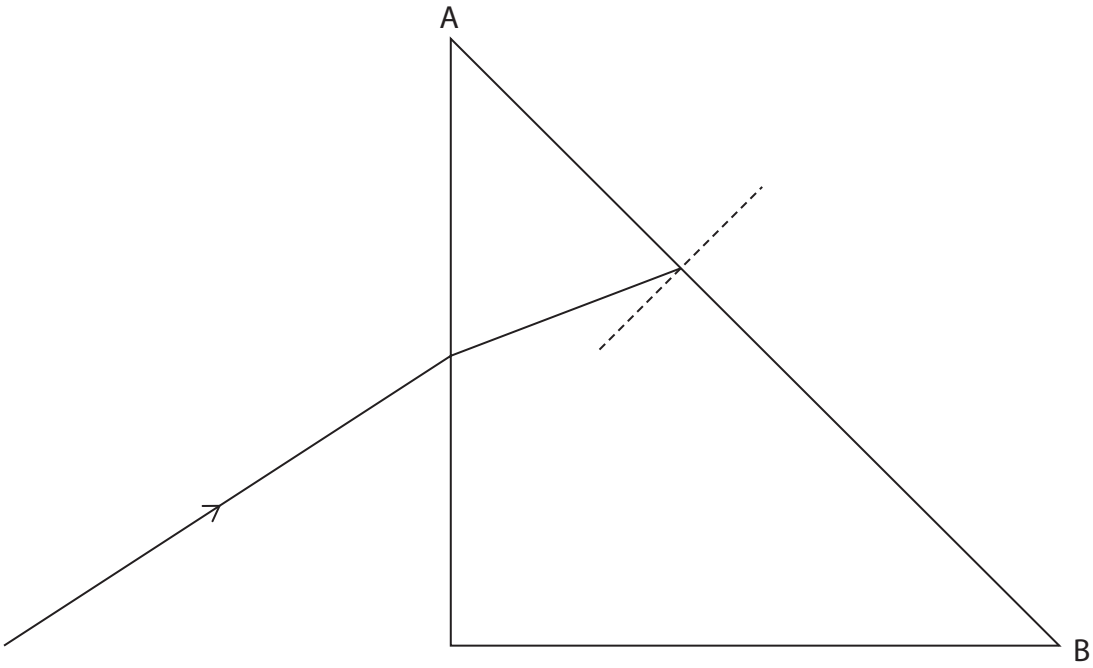
(c) The diagram shows a ray of light entering a prism made of the same material as the rectangular block used in the student's investigation.



(i) Use a protractor to determine the angle of incidence at the point where the ray of light is incident on side AB of the prism.

(1)

angle of incidence = ... degrees

(ii) Complete the path of the ray of light.

(2)

(Total for Question 6 = 13 marks)

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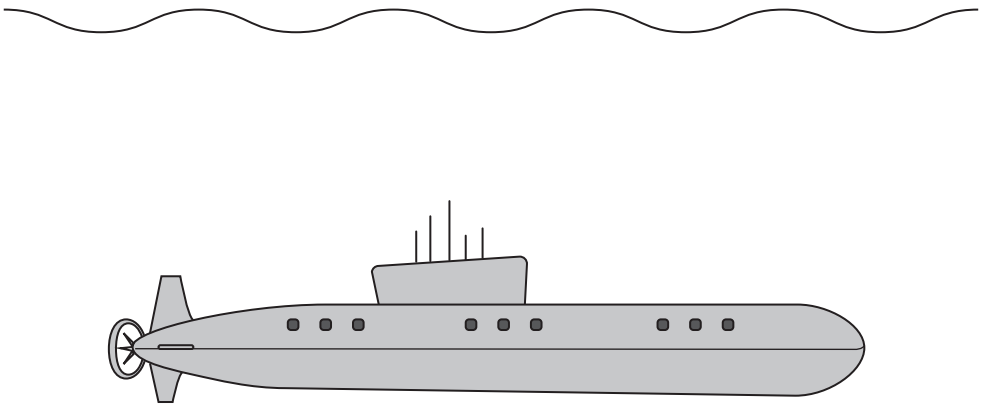
7 The diagram shows a submarine at rest underwater.



(a) There are two vertical forces acting on the submarine.

(i) One of the forces is called upthrust.

Give the name of the other force.

(1)

.....

(ii) Draw two arrows on the diagram to represent the vertical forces acting on the submarine.

(2)

(b) (i) State the formula linking pressure, density, gravitational field strength and height.

(1)

(ii) Calculate the pressure from the water at a point 38 m below the surface of the water.

[density of sea water = 1030 kg/m^3]

(2)

pressure = ... kPa

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(c) To rise back to the surface, air is pumped into a storage tank inside the submarine.

(i) Explain how the air exerts pressure on the walls of the storage tank.

(3)

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.....

(ii) The air in the storage tank starts at a pressure of 410 kPa.

As the submarine rises, the air in the storage tank increases in temperature from 2.5 °C to 18 °C. The volume of the storage tank remains constant.

Calculate the pressure of the air in the storage tank at 18 °C.

(4)

pressure = ... kPa

(Total for Question 7 = 13 marks)

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8 The diagram shows two whales in the sea.

Some species of whale communicate with sound signals and visual signals.



Whale A



Whale B

(Source: © 1974996491 / Shutterstock)

(a) Describe the difference between the motion of particles in a transverse wave and the motion of particles in a longitudinal wave.

You may use a diagram to help your answer.

(2)

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(b) Whale A makes a sound with a constant frequency. This sound is detected by whale B.

When whale A swims towards whale B, the frequency of the sound detected by whale B increases.

This is known as the Doppler effect.

Explain how the Doppler effect causes the frequency of sound detected by whale B to increase.

(3)

(c) Visible light from the Sun reaches whale B.

The wavelength of this light is 5.4×10^{-7} m.

Calculate the frequency of this light.

[speed of light = 3.0×10^{8} m/s]

(3)

frequency = ... Hz

(Total for Question 8 = 8 marks)

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9 A student investigates different electrical components.

(a) The student first investigates how the voltage of a diode affects the current in the diode.

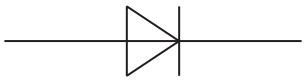
They use this equipment.

- diode
- cell
- variable resistor
- wires
- voltmeter
- ammeter

Draw a circuit diagram to represent a circuit the student could use.

The diode has been drawn for you.

(4)



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(b) In the second investigation, the student uses a circuit with two different resistors, A and B, and a battery with a voltage of 2.9 V.

Diagram 1 shows the circuit, and the current in each resistor.

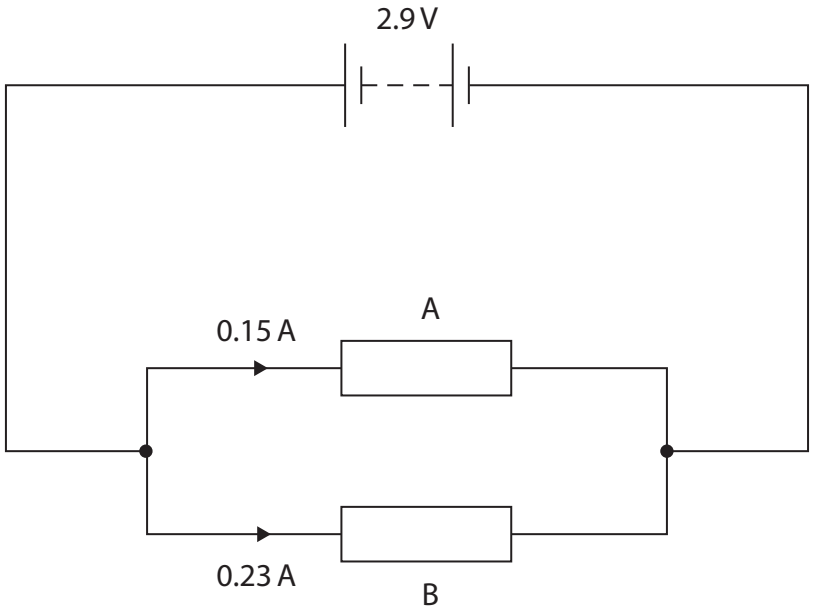

Diagram 1

(i) Calculate the current in the battery.

(1)

current = ... A

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

(1)

(iii) Calculate the resistance of resistor A.

(2)

resistance = ... Ω

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(iv) Diagram 2 shows the same three components connected in a different circuit.

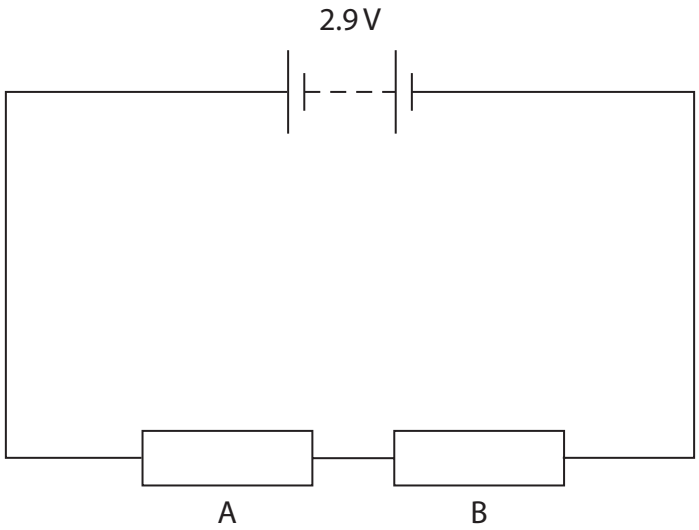

Diagram 2

Resistor B has a resistance of 13 ohms.

Comment on the difference between the current in the battery in Diagram 2 and the current in the battery in Diagram 1.

Use calculations to support your answer.

(4)

(Total for Question 9 = 12 marks)

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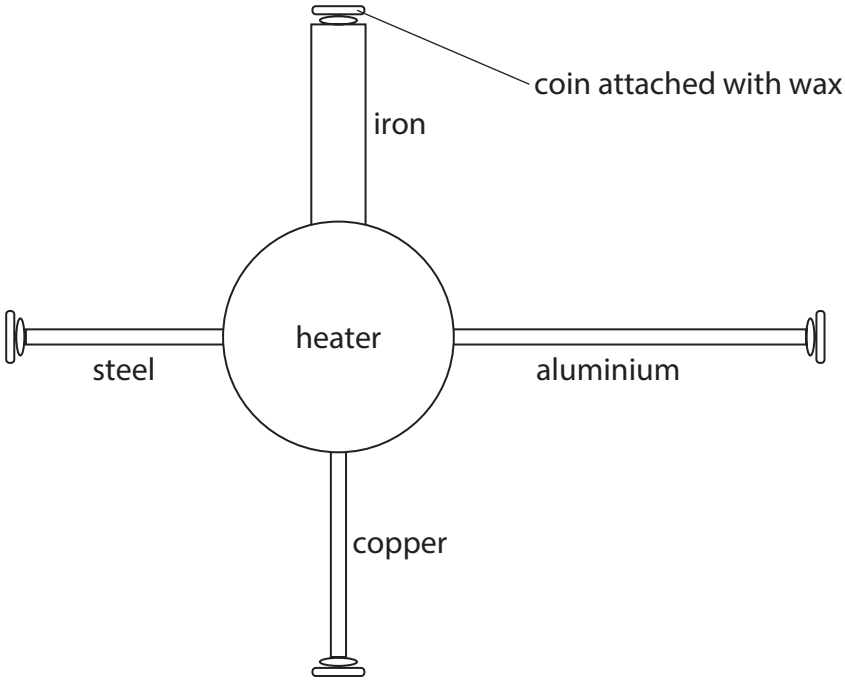
10 A student investigates energy transfer by conduction in different metals.

The student uses wax to attach one coin to each of four different metal rods, and connects the rods to a heater.

When the heater is on, energy is transferred through the metal rods. This melts the wax and causes the coins to fall.

The diagram shows the student's equipment viewed from above.



(a) This is the student's method.

Step 1 switch on the heater and start a stopwatch

Step 2 record the time taken for the coin to fall from each metal rod

(i) Give the independent variable in this investigation.

(1)

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(ii) Give the dependent variable in this investigation.

(1)

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(iii) A teacher tells the student that their investigation is not valid (a fair test).

Give two ways to improve the validity of the student's investigation.

(2)

1 .....

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2 .....

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(iv) The student improves the validity of their investigation.

Describe what the student should do to improve the reliability of their results.

(2)

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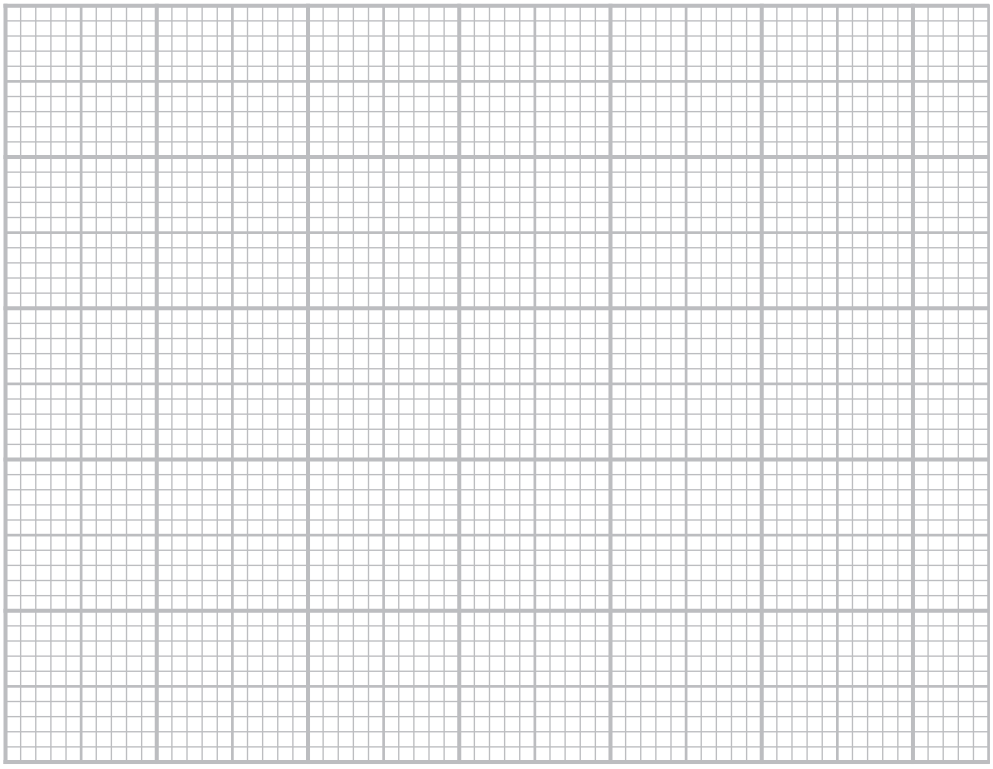
(b) The table gives the student's results.

Material	Time for coin to drop in seconds
iron	180
steel	230
aluminium	140
copper	90

(i) Plot a bar chart of the results on the grid.

(3)



(ii) State why a bar chart is a better choice than a line graph for this investigation.

(1)

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(Total for Question 10 = 10 marks)

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11 (a) Which of these is the main source of energy in stars?

(1)

- ☒ **A** alpha decay
- ☒ **B** beta decay
- ☒ **C** nuclear fission
- ☒ **D** nuclear fusion

(b) The table lists the stages of development of a star that has a very much larger mass than the Sun.

Give the stages in the correct order, using numbers 1 to 5.

(4)

Stages of development	Order number
a black hole is formed	
heavy elements are made in the core of the star	
the star becomes a red supergiant	
the star explodes in a supernova	
the core of the star runs out of hydrogen	

(Total for Question 11 = 5 marks)

TOTAL FOR PAPER = 110 MARKS

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Pearson Edexcel International GCSE (9–1)

Thursday 14 November 2024

Morning (Time: 2 hours)

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

Physics

UNIT: 4PH1

Science (Double Award) 4SD0

PAPER: 1P

Equation Booklet

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These equations may be required for both International GCSE Physics (4PH1) and International GCSE Combined Science (4SD0) papers.

1. Forces and Motion	
average speed = $\frac{\text{distance moved}}{\text{time taken}}$	
acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v-u)}{t}$
(final speed)^2 = (initial speed)^2 + (2 × acceleration × distance moved)	$v^2 = u^2 + (2 \times a \times s)$
force = mass × acceleration	$F = m \times a$
weight = mass × gravitational field strength	$W = m \times g$
2. Electricity	
power = current × voltage	$P = I \times V$
energy transferred = current × voltage × time	$E = I \times V \times t$
voltage = current × resistance	$V = I \times R$
charge = current × time	$Q = I \times t$
energy transferred = charge × voltage	$E = Q \times V$
3. Waves	
wave speed = frequency × wavelength	$v = f \times \lambda$
frequency = $\frac{1}{\text{time period}}$	$f = \frac{1}{T}$
refractive index = $\frac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$	$n = \frac{\sin i}{\sin r}$
$\sin(\text{critical angle}) = \frac{1}{\text{refractive index}}$	$\sin c = \frac{1}{n}$

4. Energy resources and energy transfers	
efficiency = $\frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$	
work done = force × distance moved	$W = F \times d$
gravitational potential energy = mass × gravitational field strength × height	$GPE = m \times g \times h$
kinetic energy = $\frac{1}{2}$ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
5. Solids, liquids and gases	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
pressure difference = height × density × gravitational field strength	$p = h \times \rho \times g$
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
8. Astrophysics	
orbital speed = $\frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$	$v = \frac{2 \times \pi \times r}{T}$

The equations on the following page will only be required for International GCSE Physics.

These additional equations may be required in International GCSE Physics papers 2P and 2PR.

1. Forces and Motion	
momentum = mass × velocity	$p = m \times v$
force = $\dfrac{\text{change in momentum}}{\text{time taken}}$	$F = \dfrac{(mv - mu)}{t}$
moment = force × perpendicular distance from the pivot	
5. Solids, liquids and gases	
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$
6. Magnetism and electromagnetism	
relationship between input and output voltages for a transformer	$\dfrac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \dfrac{\text{primary turns}}{\text{secondary turns}}$
input power = output power	$V_p I_p = V_s I_s$ for 100% efficiency
8. Astrophysics	
$\dfrac{\text{change in wavelength}}{\text{reference wavelength}} = \dfrac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\dfrac{\lambda - \lambda_0}{\lambda_0} = \dfrac{\Delta\lambda}{\lambda_0} = \dfrac{v}{c}$

END OF EQUATION LIST