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)

Monday 16 June 2025

Morning (Time: 1 hour 15 minutes)

Paper reference **4PH1/2PR**

Physics

UNIT: 4PH1

PAPER: 2PR

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

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/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 70.
- 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 $\qquad E = I \times V \times t$

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

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

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

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

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

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

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

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

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}} \qquad F = \frac{(mv - mu)}{t}$$

$$\frac{\text{change of wavelength}}{\text{wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}} \qquad \frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$$

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta T$$

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

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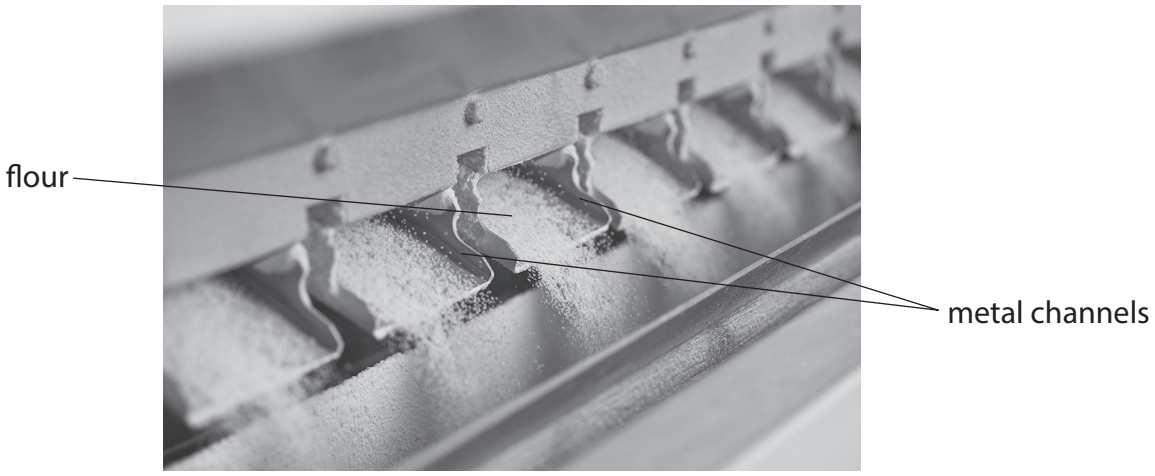
Answer ALL questions.

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 A flour mill is a factory where flour is produced.

The photograph shows some flour moving through metal channels in the flour mill.



(Source: © Retan/Shutterstock)

(a) The flour particles can become charged as they move through the metal channels.

(i) Explain how the flour particles can become charged.

(2)

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(ii) The charged flour particles move away from each other as they fall from the end of each channel.

Complete the passage by writing a suitable word or words in each blank space.

(2)

Flour particles move away from each other because they have

..... charges. This causes the flour particles

to exert ..... forces on each other.

(b) The dust created by producing flour in a flour mill is dangerous because the dust is flammable. This creates a risk of an explosion.

Explain why connecting the metal channels to earth reduces the risk of an explosion in a flour mill.

(2)

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(Total for Question 1 = 6 marks)

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2 Uranium-239 is an isotope of the element uranium.

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

(2)

(b) Uranium-239 can be represented using the symbol

$$^{239}_{92}U$$

Protons are one type of particle found in the nucleus of an atom.

(i) How many protons are in the nucleus of an atom of uranium-239?

(1)

- ☒ **A** 92
- ☒ **B** 147
- ☒ **C** 239
- ☒ **D** 331

(ii) Give the name of the other particle found in the nucleus of an atom of uranium-239.

(1)

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(c) Uranium-239 is radioactive and decays by beta emission.

Uranium-239 has a half-life of 23 minutes.

(i) A sample of uranium-239 has an initial mass of 60 g.

Calculate the mass of uranium-239 remaining after 46 minutes.

(2)

mass = ... g

(ii) When uranium-239 undergoes beta decay, an isotope of the element neptunium, Np, is produced.

Which of these is the correct symbol for the neptunium nucleus produced in the beta decay of uranium-239?

(1)

☒ **A** $^{239}_{92}Np$

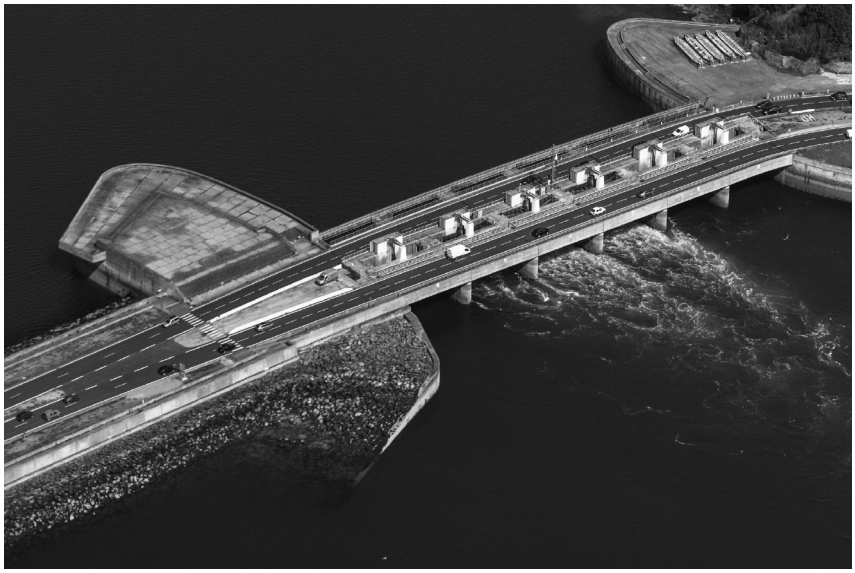
☒ **B** $^{240}_{92}Np$

☒ **C** $^{239}_{93}Np$

☒ **D** $^{240}_{93}Np$

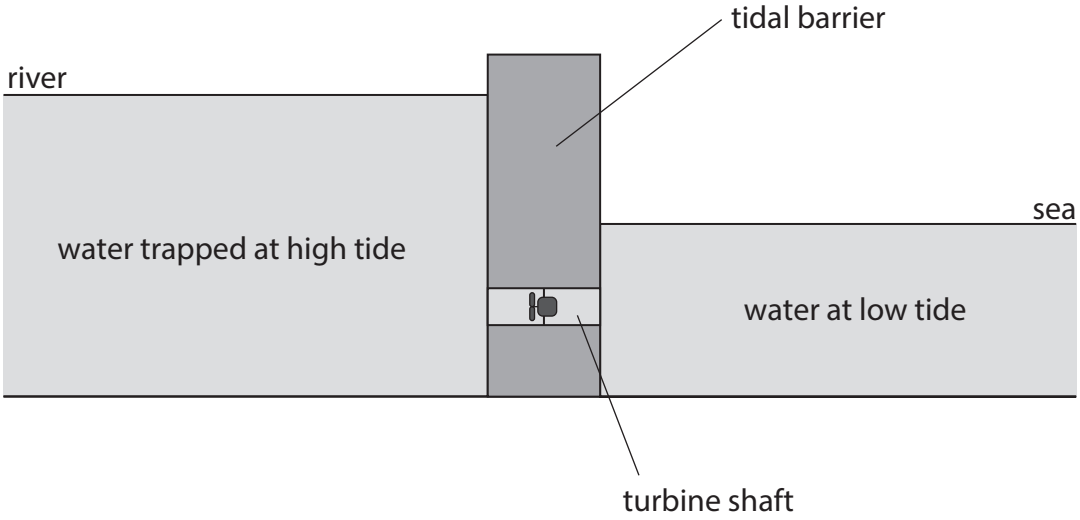
(Total for Question 2 = 7 marks)

3 The photograph shows the tidal power station across the estuary of the river Rance in France.



(Source: © Francois BOIZOT/Shutterstock)

The diagram shows a simplified view of the tidal power station.



At high tide, water is trapped behind the tidal barrier.

At low tide, the trapped water is released through the turbine shaft. This causes a turbine to spin, which generates electricity.

(a) Give two advantages of generating electricity using tidal power.

(2)

1 .....

.....

2 .....

.....

(b) Give two disadvantages of generating electricity using tidal power.

(2)

1 .....

.....

2 .....

.....

(c) At low tide, water flows through the turbine shaft.

As the height of the trapped water in the river decreases, water falls through a height of 8.0 m to reach the turbine shaft.

(i) Calculate the energy transferred from the gravitational store of the water when 1.0 kg of water flows through the turbine shaft.

Use the formula

change in gravitational potential energy = mass × g × height

(2)

energy transferred = ... J

(ii) The tidal power station has a maximum power output of 240 000 kW when water falls through a height of 8.0 m.

Calculate the mass of water flowing through the turbine shaft in 1 second when the power station is operating at maximum power.

Assume the power station is 100% efficient.

(3)

mass of water = ... kg

(Total for Question 3 = 9 marks)

4 This question is about transformers.

(a) Describe the structure of a step-up transformer.

You may draw a diagram to help your answer.

(3)

(b) A step-up transformer has an input voltage of 230 V and an input current of 4.5 A.

The output current of the transformer is 0.21 A.

(i) State the formula linking input power and output power for a transformer that is 100% efficient.

(1)

(ii) Calculate the output voltage of the transformer.

(3)

output voltage = ... V

(Total for Question 4 = 7 marks)

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5 A tennis ball is dropped from a height above the ground.

(a) Diagram 1 shows the tennis ball at the instant it is released.

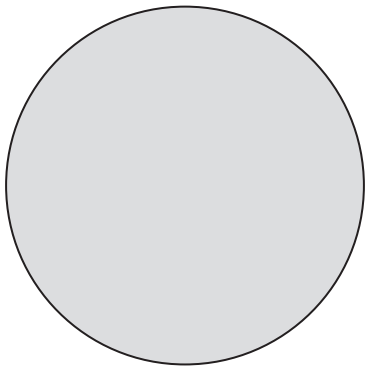

Diagram 1

On diagram 1, draw a labelled arrow to show the force acting on the tennis ball at the instant it is released.

(2)

(b) Diagram 2 shows the tennis ball at the instant it hits the ground.

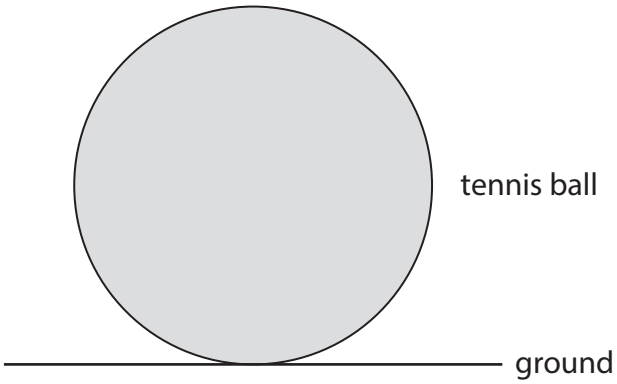

Diagram 2

Just before hitting the ground, the tennis ball is moving **downwards** at a velocity of 2.5 m/s.

Just after hitting the ground, the tennis ball is moving **upwards** at a speed of 1.9 m/s.

(i) The mass of the tennis ball is 0.057 kg.

Calculate the change in momentum of the tennis ball when it hits the ground.

Give the unit.

(4)

change in momentum = ... unit = ...

(ii) The ball is in contact with the ground for a time of 6.0 ms.

Calculate the force exerted on the ball by the ground.

Give the direction of this force.

(3)

force = ... N

direction = ...

(c) The coefficient of restitution can be used to determine how high a ball will bounce. The higher the value of the coefficient of restitution, the higher the ball will bounce.

Diagram 3 shows a ball being dropped from a height (h_1) above the ground.

The ball hits the ground and bounces.

At the top of its bounce, the ball reaches a height (h_2) above the ground.

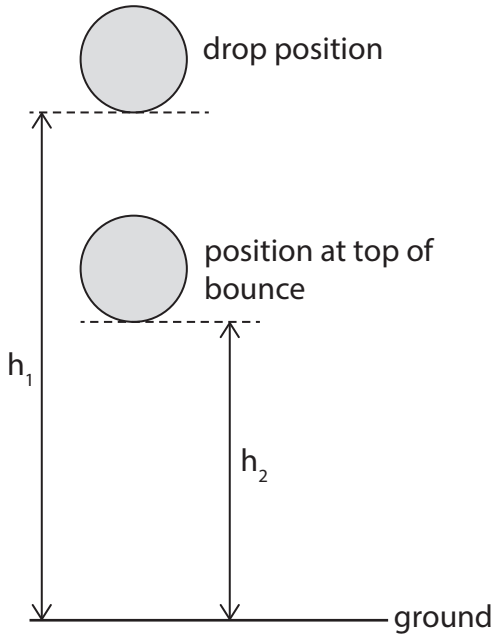

Diagram 3

The coefficient of restitution can be determined using the formula

$$\text{coefficient of restitution} = \sqrt{\frac{h_2}{h_1}}$$

A student decides to do an investigation to compare the coefficient of restitution for different types of ball.

Design a method for the student's investigation.

Your answer should include details of

- the variables in the investigation
- how to obtain accurate measurements
- how to obtain reliable results

You may add to diagram 3 or draw an additional diagram to help your answer.

(6)

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(Total for Question 5 = 15 marks)

6 This question is about cosmic microwave background radiation (CMBR) and the Big Bang.

(a) CMBR has a mean frequency of 1.6×10^{11} Hz.

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

(1)

(ii) Show that the mean wavelength of CMBR is about 2 mm.

[speed of light = 3.0×10^{8} m/s]

(3)

(b) CMBR was first released after the Big Bang.

When CMBR was first released it had a wavelength of about 9×10^{-5} mm, but now it has a wavelength of about 2 mm.

Using this information, explain how CMBR supports the Big Bang theory.

(2)

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(c) Explain how the cosmological red-shift of galaxies also supports the Big Bang theory.

(4)

(Total for Question 6 = 10 marks)

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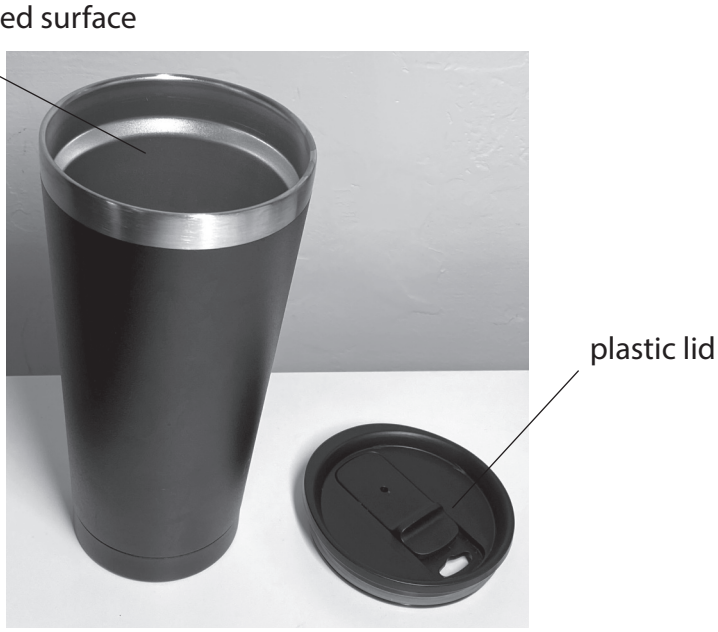
7 The photograph shows a cup that is designed to keep a drink hot.



(a) The inside surface of the cup is shiny and silver-coloured.

Explain how the shiny silver-coloured surface helps to keep a drink hot.

(2)

(b) Explain why a drink in the cup will stay hot for longer when the lid is placed on the cup.

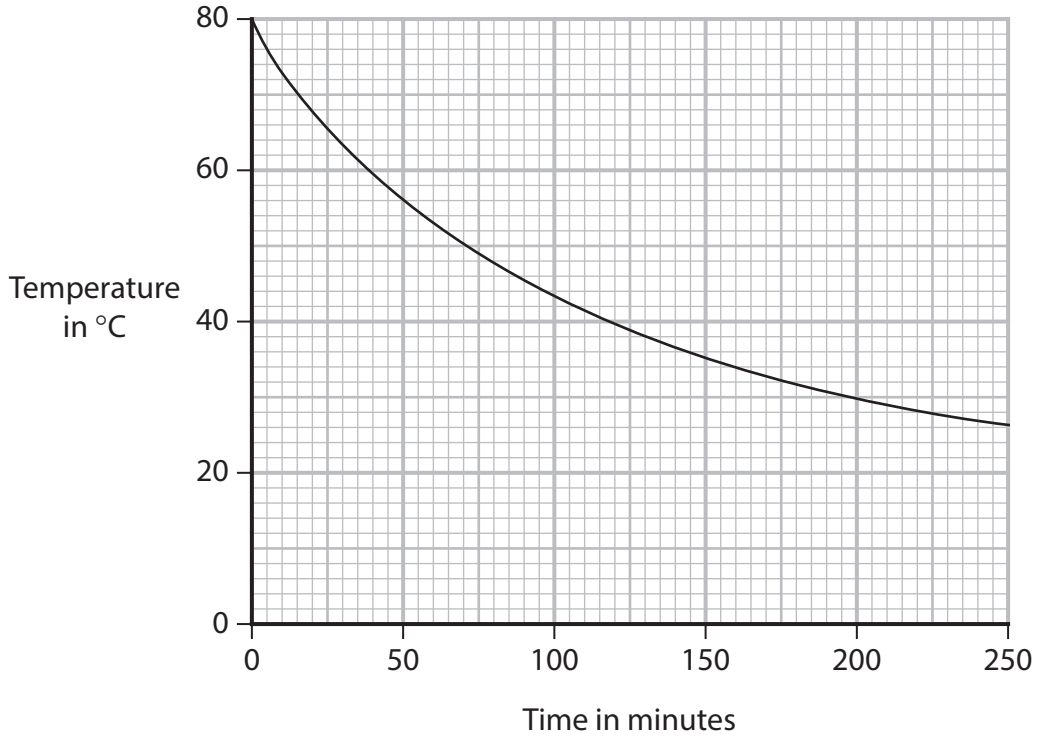
(2)

(c) A student investigates how the temperature of a drink in the cup varies with time.

This is the student's method.

- pour some hot water into the cup and place the lid on the cup
- wait for the water to cool to 80 °C and then start a stopwatch
- measure the temperature of the water in the cup every 10 minutes

The graph shows the student's results.



(i) On the graph, draw a tangent to the curve when the temperature is 40 °C.

(1)

(ii) Calculate the gradient of the tangent to find the rate of temperature change of the water when the temperature is 40 °C.

Give your answer in °C / minute.

(3)

rate of temperature change = ... °C / minute

(iii) The student is working in a laboratory with a room temperature of 20 °C.

Draw a line on the graph to show how the temperature of the water in the cup would change if there was no lid on the cup.

(2)

(Total for Question 7 = 10 marks)

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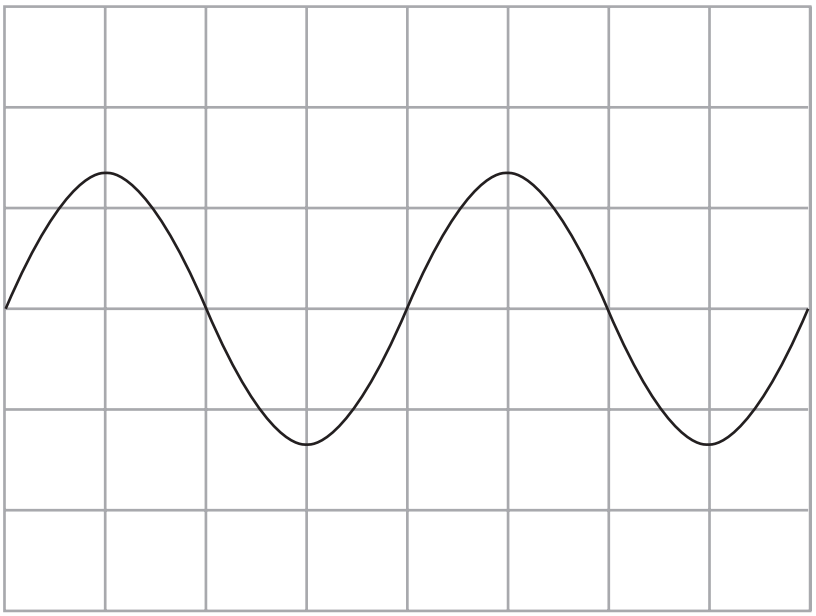
8 A high-frequency sound wave is detected by a microphone and displayed on an oscilloscope.

The diagram shows the oscilloscope screen when the sound wave is detected. It also shows the oscilloscope settings.



oscilloscope settings:

x direction: 1 square = 20×10^{-6} s
y direction: 1 square = 10 mV

(a) Give the maximum frequency of sound that can be heard by humans.

(1)

.....

(b) Determine if the sound wave displayed on the oscilloscope could be heard by humans.

(4)

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.....

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(c) A student changes the settings of the oscilloscope to alter the displayed wave in these two ways.

- increase the amplitude of the wave
- only display one time period of the wave on the screen

The table shows some possible settings for the oscilloscope.

Which row of the table gives the student's new oscilloscope settings?

(1)

	x direction setting / seconds per square	y direction setting / mV per square
☒ **A**	10×10^{-6}	5
☒ **B**	10×10^{-6}	20
☒ **C**	40×10^{-6}	5
☒ **D**	40×10^{-6}	20

(Total for Question 8 = 6 marks)

TOTAL FOR PAPER = 70 MARKS

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Pearson Edexcel International GCSE (9–1)

Monday 16 June 2025

Paper reference **4PH1/2PR**

Physics

UNIT: 4PH1
PAPER: 2PR

Equation Booklet

Do not return this Booklet with the question paper.

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Y:1/1/1/1/

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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