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 40 minutes)

Paper reference **4WPH2/1PR**

Physics (Modular)

UNIT 2: 4WPH2

PAPER: 1PR

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 the calculations and state the units where required.

Information

- The total mark for this paper is 90.
- 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

Unit 2

5. Waves	
wave speed = frequency × wavelength	$v = f \times \lambda$
frequency = $\dfrac{1}{\text{time period}}$	$f = \dfrac{1}{T}$
refractive index = $\dfrac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$	$n = \dfrac{\sin i}{\sin r}$
$\sin(\text{critical angle}) = \dfrac{1}{\text{refractive index}}$	$\sin c = \dfrac{1}{n}$
6. Solids, liquids and gases: Part 2	
$\dfrac{\text{pressure}}{\text{temperature}}$ = constant	$\dfrac{p_1}{T_1} = \dfrac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
7. 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
9. Astrophysics	
orbital speed = $\dfrac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$	$v = \dfrac{2 \times \pi \times r}{T}$
$\dfrac{\text{change in wavelength}}{\text{reference wavelength}} = \dfrac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\dfrac{\lambda - \lambda_0}{\lambda_0} = \dfrac{\Delta\lambda}{\lambda_0} = \dfrac{v}{c}$

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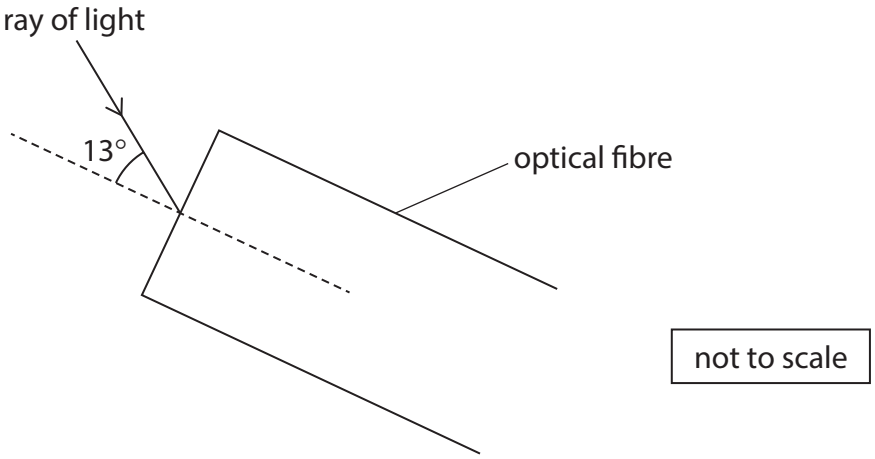
Answer ALL questions.

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 The diagram shows a ray of light travelling from air into an optical fibre.



The ray of light is at an angle of 13° to the normal.

The glass of the fibre has a refractive index of 1.6

(a) (i) State the relationship between refractive index, angle of incidence and angle of refraction.

(1)

(ii) Calculate the angle of refraction of the ray.

(4)

angle of refraction = ... degrees

(b) Inside the fibre, total internal reflection occurs.

Describe the conditions needed for total internal reflection to occur.

(2)

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(c) Describe the role of total internal reflection in transmitting information along optical fibres.

(2)

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(Total for Question 1 = 9 marks)

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2 This question is about waves.

(a) Explain what is meant by the term **wave**.

(2)

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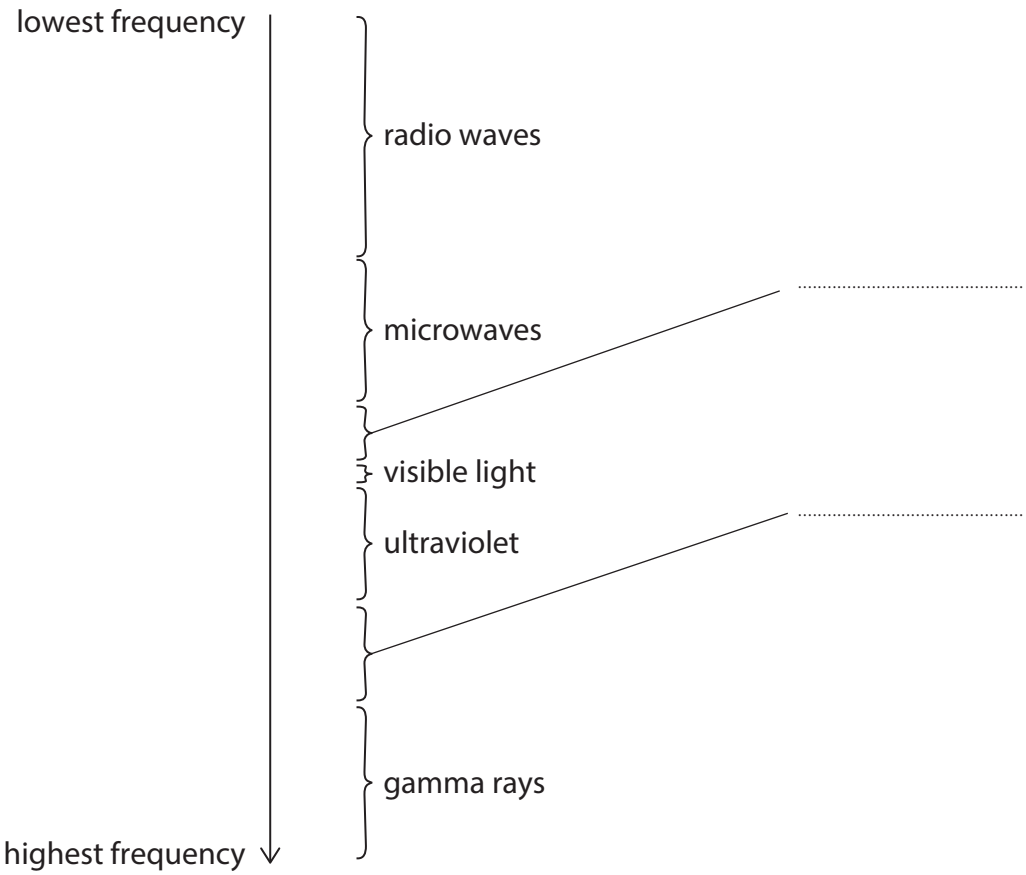
(b) The diagram shows the parts of the electromagnetic spectrum in order of increasing frequency.



Complete the diagram by naming the missing parts.

(2)

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(c) Microwave radiation can be used for cooking.

The image shows a microwave oven.

(Source: © Rashevskyi Viacheslav/Shutterstock)

(i) Explain how microwave radiation cooks food.

(2)

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(ii) Microwave radiation can be dangerous.

Suggest one way that the design of the oven reduces the danger of the microwave radiation.

(1)

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(Total for Question 2 = 7 marks)

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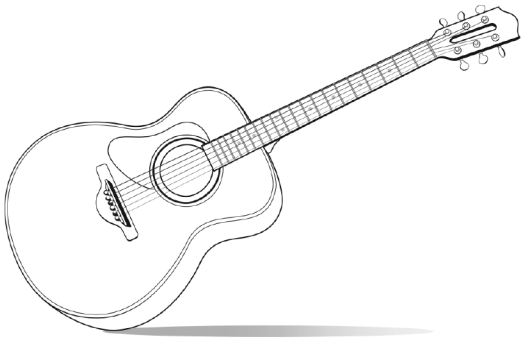
3 The diagram shows an image of a guitar.



(Source: © addinia/Shutterstock)

The strings on a guitar have different thicknesses.

Each string produces a sound when it vibrates.

A student investigates the relationship between the thickness of the string and the frequency of the sound the string produces.

This is the student's method.

- make each string the same length
- use the same force to tighten each string
- place a microphone next to the string
- connect the microphone to an oscilloscope
- make the string vibrate
- measure the time period from the oscilloscope trace

The student repeats the method four times for each string.

(a) Table 1 lists some variables in the student's investigation.

Complete table 1 by placing a tick (✓) in each row to identify the type of variable.

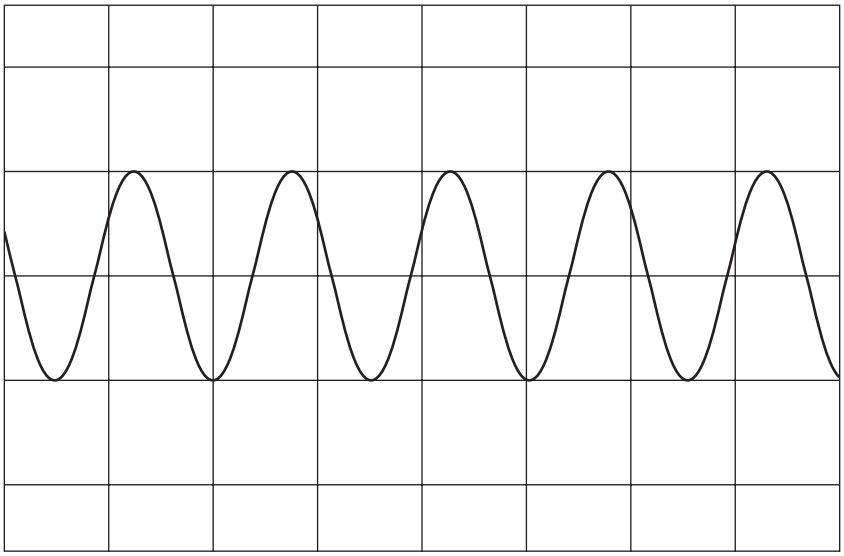
(2)

Variable	Dependent	Independent	Control
thickness of string			
length of string			
force to tighten string			
time period			

Table 1

(b) The image shows an oscilloscope screen from the investigation.

In the x direction, each square equals 1.0 ms.



Determine the time period of the detected sound wave.

(2)

time period = ... ms

(c) Table 2 shows the student's results.

Thickness of string in mm	Frequency of sound in Hz				
	test 1	test 2	test 3	test 4	mean
0.75	222	223	219	217	220
0.50	326	328	329	336	330
0.25	659	656	663	661	

Table 2

(i) Complete table 2 by calculating the mean frequency of sound for the 0.25 mm thickness of string.

(2)

(ii) Describe how the student could show if the relationship between thickness of string and frequency of sound produced by the string is linear or non-linear.

(2)

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(Total for Question 3 = 8 marks)

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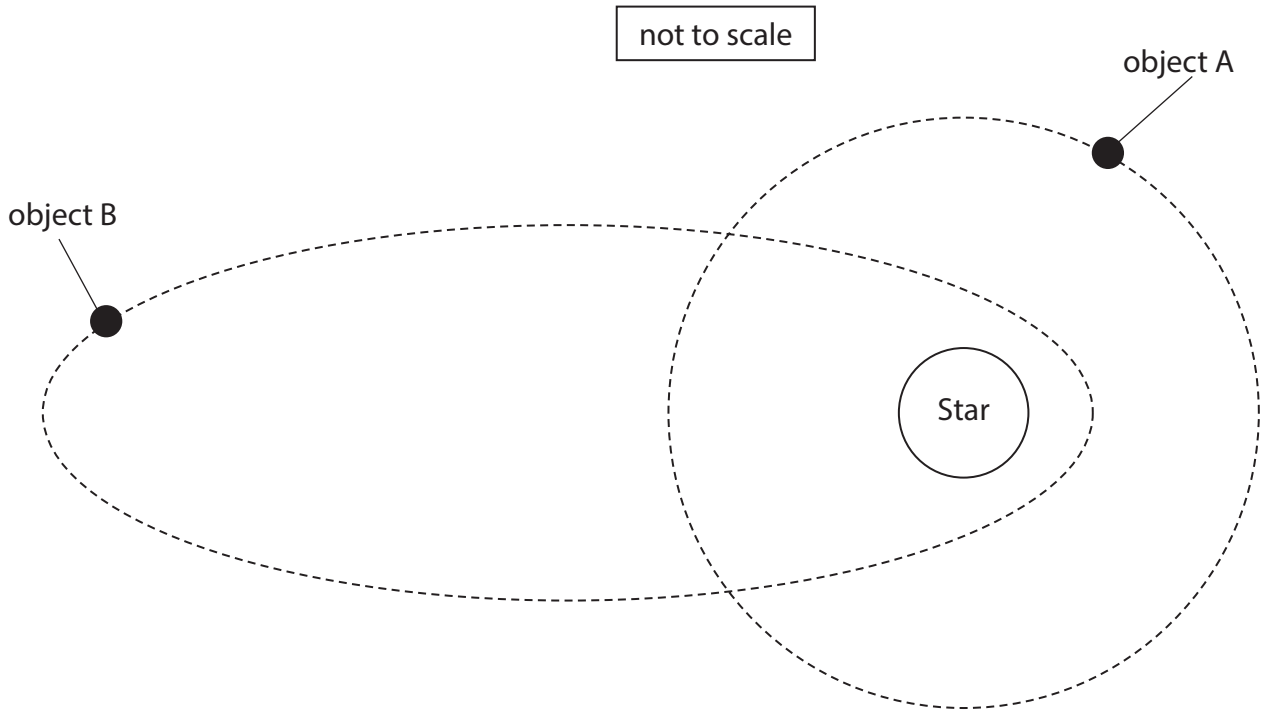
4 The diagram shows two objects, A and B, orbiting a star.



(a) (i) What is object A?

(1)

- ☒ **A** a comet
- ☒ **B** a galaxy
- ☒ **C** a moon
- ☒ **D** a planet

(ii) What is object B?

(1)

- ☒ **A** a comet
- ☒ **B** a galaxy
- ☒ **C** a moon
- ☒ **D** a planet

(iii) Which force causes object A and object B to orbit the star?

(1)

- ☒ **A** electric
- ☒ **B** gravitational
- ☒ **C** magnetic
- ☒ **D** nuclear

(b) Object A has an orbital speed of 6.87 km/s and an orbital radius of 414 000 000 km.

(i) Calculate the time period of the orbit of object A.

Give your answer in standard form.

(4)

time period = ... s

(ii) State the order of magnitude of this time period.

(1)

order of magnitude = ...

(Total for Question 4 = 8 marks)

5 A step-up transformer is used to increase voltage.

The input voltage to the transformer is 25 000 V.

The output voltage from the transformer is 275 000 V.

The number of turns on the primary coil is 265.

(a) (i) State the formula linking input (primary) voltage, output (secondary) voltage and the turns ratio for a transformer.

(1)

(ii) Calculate the number of turns on the secondary coil.

(3)

number of turns = ...

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(b) The secondary current in the transformer is 903 A.

(i) State the formula linking primary current, secondary current, primary voltage and secondary voltage for a transformer.

(1)

(ii) Calculate the primary current in the transformer.

(2)

primary current = ... A

(iii) State an assumption used in this calculation.

(1)

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(c) A student finds this statement online.

A transformer uses electromagnetism to cause electromagnetic induction.

Comment on the statement.

(4)

(Total for Question 5 = 12 marks)

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6 A student investigates the magnetic field between two bar magnets.

(a) Bar magnets are made of magnetically hard materials.

State what is meant by the term **magnetically hard material**.

(1)

(b) Describe a method that the student could use to determine the shape and direction of the magnetic field between two bar magnets.

(3)

(c) The diagram shows two bar magnets.

Draw the magnetic field between the magnets.

You should draw four field lines.

(3)

(d) Describe what is meant by a uniform magnetic field.

(2)

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(Total for Question 6 = 9 marks)

7 A teacher demonstrates radioactive decay.

(a) State the meaning of the term **half-life**.

(2)

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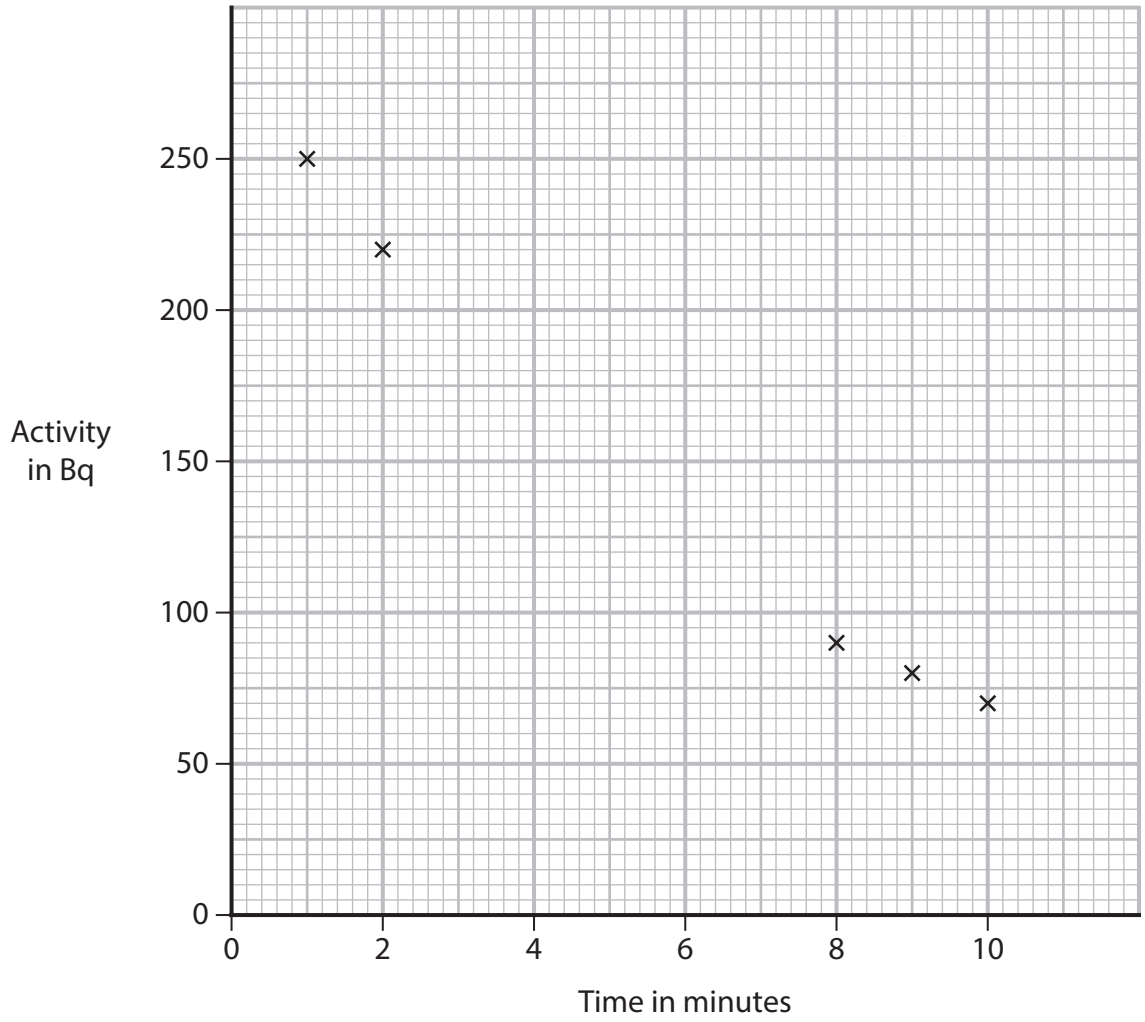
(b) The teacher demonstrates how the activity of a radioactive sample varies over a period of 10 minutes.

The table shows the teacher's results.

Time in minutes	Activity in Bq
1	250
2	220
3	180
4	165
5	140
6	120
7	110
8	90
9	80
10	70

A student has started to plot the results on the grid.



(i) Plot the missing results on the grid.

(1)

(ii) Draw a curve of best fit.

(1)

(iii) Estimate the half-life of the sample using these results.

(2)

half-life = ... minutes

(iv) The student writes these conclusions.

> As time increases, activity decreases
>
> so
>
> activity × time = constant

Evaluate the student's conclusions.

(4)

(Total for Question 7 = 10 marks)

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8 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 8 = 10 marks)

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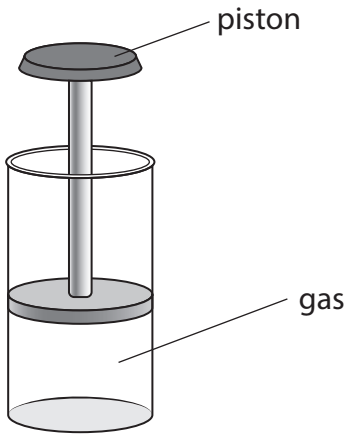
9 A student investigates the relationship between the pressure and the volume of a gas in a container.

The student uses the apparatus shown.



The student applies a force to the piston to decrease the volume of the gas in the container.

The student keeps the gas at the same temperature throughout the experiment.

(a) Explain why the pressure of the gas increases when the volume of the gas decreases.

Refer to gas molecules in your answer.

(3)

(b) The initial volume of the gas in the container is 35 cm^3.

The initial pressure of the gas in the container is 103 kPa.

When the student applies a force to the piston, the pressure of the gas increases by 25%.

Calculate the new volume of the gas in the container.

(3)

new volume = ... cm^3

(c) Explain what happens to the gas molecules in the container if the temperature of the gas increases.

(2)

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(Total for Question 9 = 8 marks)

10 This question is about radioactivity.

(a) The radioactive isotope of the element yttrium, $^{90}_{39}Y$, is sometimes used to treat cancer.

$^{90}_{39}Y$ decays by beta (β^-) radiation to form an isotope of zirconium, Zr.

(i) Give the equation to show this decay of $^{90}_{39}Y$

(3)

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(ii) During cancer treatment, part of the patient is irradiated using yttrium.

Explain how irradiation differs from contamination.

(2)

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(b) Explain one source of background radiation from Earth.

(2)

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(c) Nuclear power stations produce radioactive waste.

Explain how one risk from radioactive waste can be reduced.

(2)

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(Total for Question 10 = 9 marks)

TOTAL FOR PAPER = 90 MARKS

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Pearson Edexcel International GCSE (9–1)

Monday 16 June 2025

Morning (Time: 1 hour 40 minutes)

Paper reference **4WPH2/1PR**

Physics (Modular)

UNIT 2: 4WPH2

PAPER: 1PR

Equation Booklet

Do not return this Booklet with the question paper.

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These equations may be required for International GCSE Physics modular (4WPH2) papers.

Unit 1

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	$W = m \times g$
momentum = mass × velocity	$p = m \times v$
force = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{(mv - mu)}{t}$
moment = force × perpendicular distance from the pivot	
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. 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 = ½ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
4. Solids, liquids and gases: Part 1	
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	$p = h \times \rho \times g$
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$

Unit 2

5. Waves	
wave speed = frequency × wavelength	$v = f \times \lambda$
frequency = $\frac{1}{\text{time period}}$	$f = \frac{1}{T}$
refractive index = $\frac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$	$n = \frac{\sin i}{\sin r}$
$\sin(\text{critical angle}) = \frac{1}{\text{refractive index}}$	$\sin c = \frac{1}{n}$
6. Solids, liquids and gases: Part 2	
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$

7. Magnetism and electromagnetism	
relationship between input and output voltages for a transformer	$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$
input power = output power	$V_p I_p = V_s I_s$ for 100% efficiency

9. Astrophysics	
orbital speed = $\frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$	$v = \frac{2 \times \pi \times r}{T}$
$\frac{\text{change in wavelength}}{\text{reference wavelength}} = \frac{\text{velocity of a galaxy}}{\text{speed of light}}$	$\frac{\lambda - \lambda_0}{\lambda_0} = \frac{\Delta\lambda}{\lambda_0} = \frac{v}{c}$

END OF EQUATION LIST