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)

Wednesday 19 November 2025

Morning (Time: 1 hour 40 minutes)

Paper reference **4WPH2/1P**

Physics (Modular)

UNIT 2: 4WPH2
PAPER: 1P

You must have:
Ruler, calculator, 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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P 8 1 5 6 4 R A 0 1 3 2

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FORMULAE

wave speed = frequency × wavelength $v = f \times \lambda$

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

refractive index = $\dfrac{\sin(\text{angle of incidence})}{\sin(\text{angle of refraction})}$ $n = \dfrac{\sin i}{\sin r}$

$\sin(\text{critical angle}) = \dfrac{1}{\text{refractive index}}$ $\sin c = \dfrac{1}{n}$

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

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

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

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

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

Where necessary, assume the acceleration of free fall, g = 10 m / s^2.

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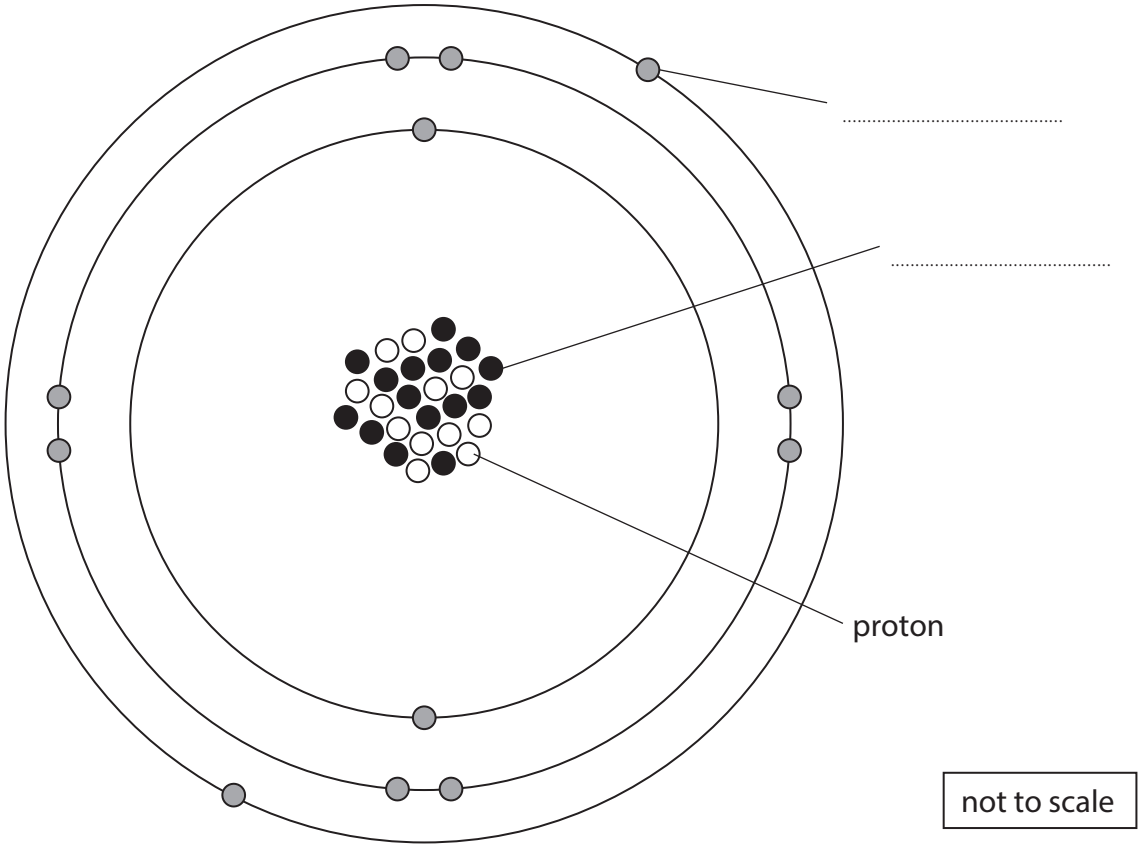
Answer ALL questions.

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) The diagram shows an atom of the element magnesium, Mg.

One of the particles in the atom is labelled.



(i) Complete the diagram by adding the labels for the other particles.

(2)

(ii) Which of these describes the atom shown in the diagram?

(1)

☒ **A** $^{15}_{12}Mg$

☒ **B** $^{27}_{12}Mg$

☒ **C** $^{15}_{3}Mg$

☒ **D** $^{12}_{15}Mg$

(b) Nuclei of atoms in a different element decay by the emission of alpha particles.

Describe the nature of alpha particles.

(2)

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(c) Another type of nuclear decay is by the emission of beta particles.

Nucleus X decays by the emission of a beta particle to form nucleus Z.

The equation shows this decay.

(2)

$$^{114}_{46}X \longrightarrow \boxed{}Z + {}^{0}_{-1}\beta^{-}$$

Complete the equation by adding numbers to the boxes.

(Total for Question 1 = 7 marks)

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2 This question is about magnetic fields.

(a) Diagram 1 shows magnetic field patterns between four pairs of bar magnets.

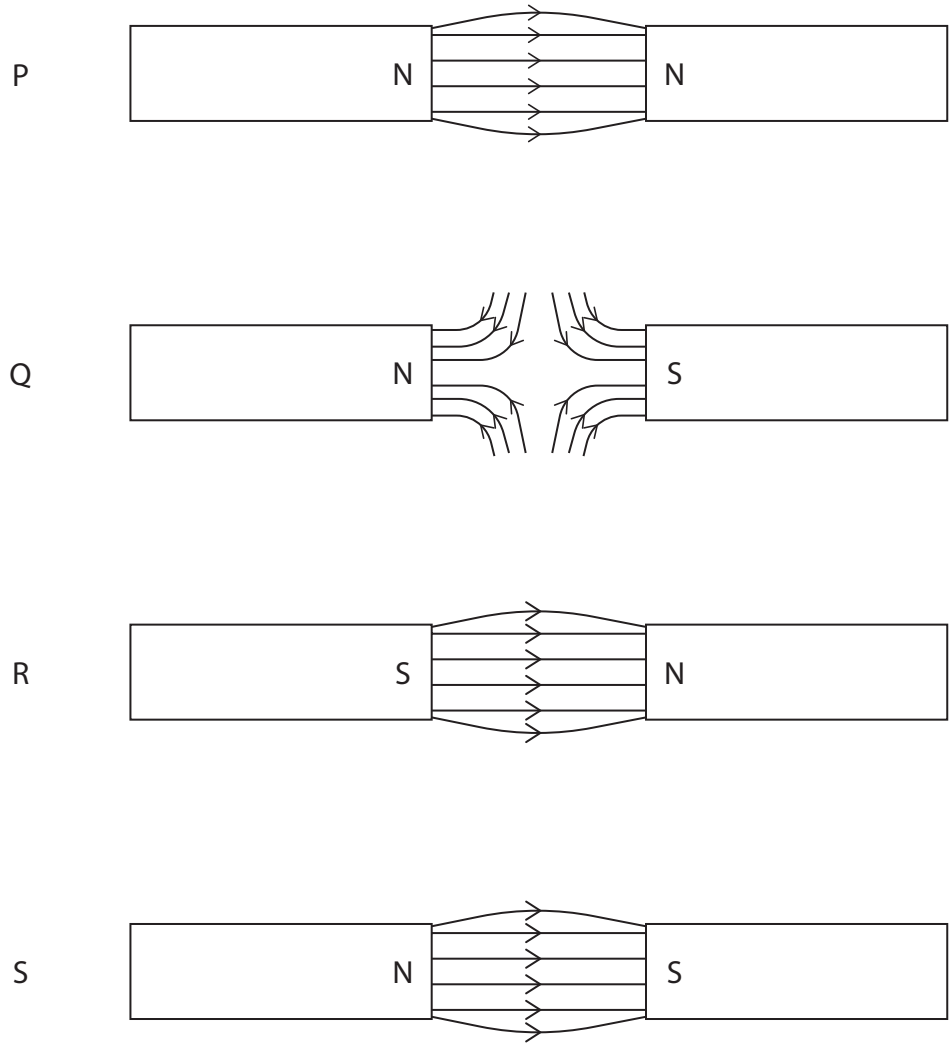

Diagram 1

Which pair of bar magnets shows the correct magnetic field pattern between the poles?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

(b) Diagram 2 shows a uniform magnetic field between two bar magnets.

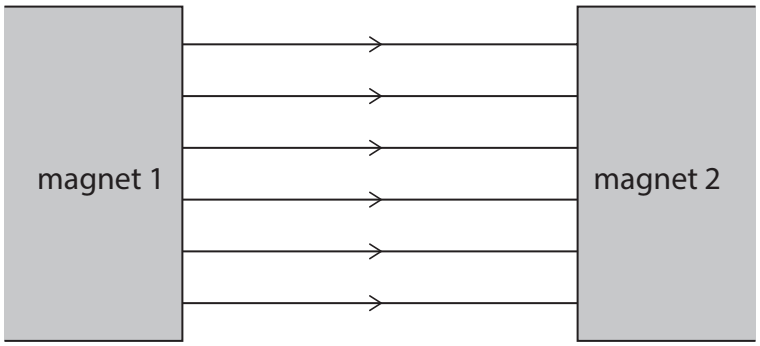

Diagram 2

Explain how Diagram 2 shows that the magnetic field is uniform.

(2)

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(c) Diagram 3 shows a magnet and an iron ring.

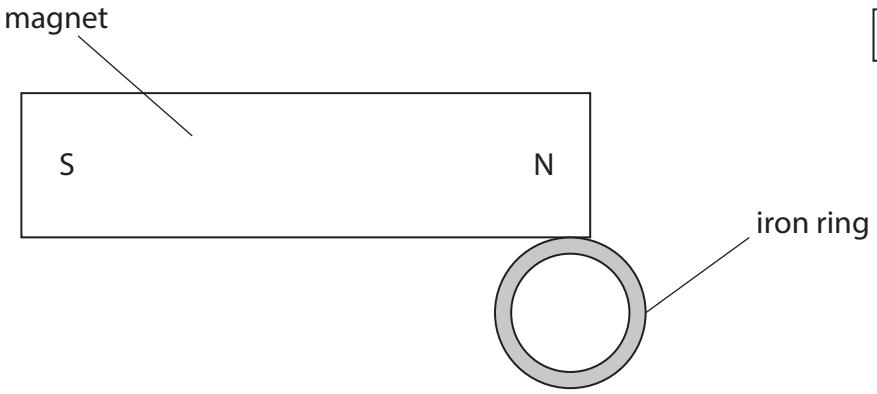

Diagram 3

The iron ring is attracted to the magnet.

Explain why the iron ring is attracted to the magnet.

(3)

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(Total for Question 2 = 6 marks)

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3 This question is about sound.

(a) Sound is a type of wave.

Name this type of wave.

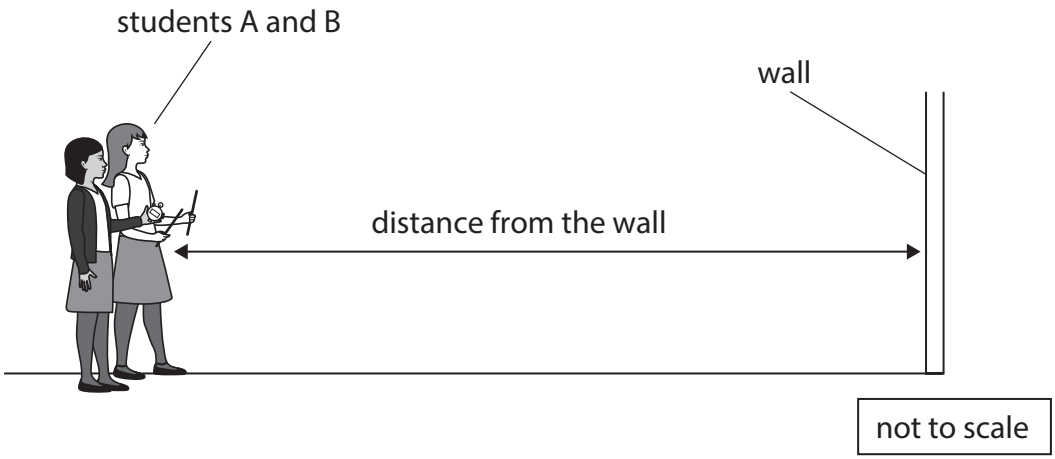
(1)

.....

(b) Two students, A and B, use this method to investigate the speed of sound.

- both students stand together in front of a wall
- the students measure their distance from the wall
- student A has two wooden sticks and student B has a timer
- student A hits the two sticks together to make a sound
- student B starts the timer as they hear this sound
- student B stops the timer when they hear the sound again
- student B records the time given by the timer

The diagram shows the arrangement for this investigation.



The students repeat their investigation at five different distances.

They obtain three measurements of time for each distance.

The table shows their results.

Distance from wall in metres	Time in seconds			Mean time in seconds
100	0.61	0.65	0.64	0.63
150	0.96	0.94	0.91	0.94
200	1.98	1.24	1.26	1.25
250	1.59	1.54	1.55	1.56
300	2.08	1.93	1.72	

One of the results is anomalous.

(i) Draw a circle around the anomalous result.

(1)

(ii) Calculate the mean time when the distance from the wall is 300 m.

(2)

mean time = ... s

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(iii) The students attempt to calculate the speed of sound using the **first** row of their table.

This is their working.

speed = distance ÷ time

speed = 100 ÷ 0.63

speed = 159 m/s

The value that the students have calculated is **not** correct.

Explain the mistake that the students have made.

(2)

(iv) Describe how the students could process their results to obtain a more accurate value for the speed of sound.

(2)

(Total for Question 3 = 8 marks)

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4 A student investigates the refractive index of glass using a semi-circular glass block.

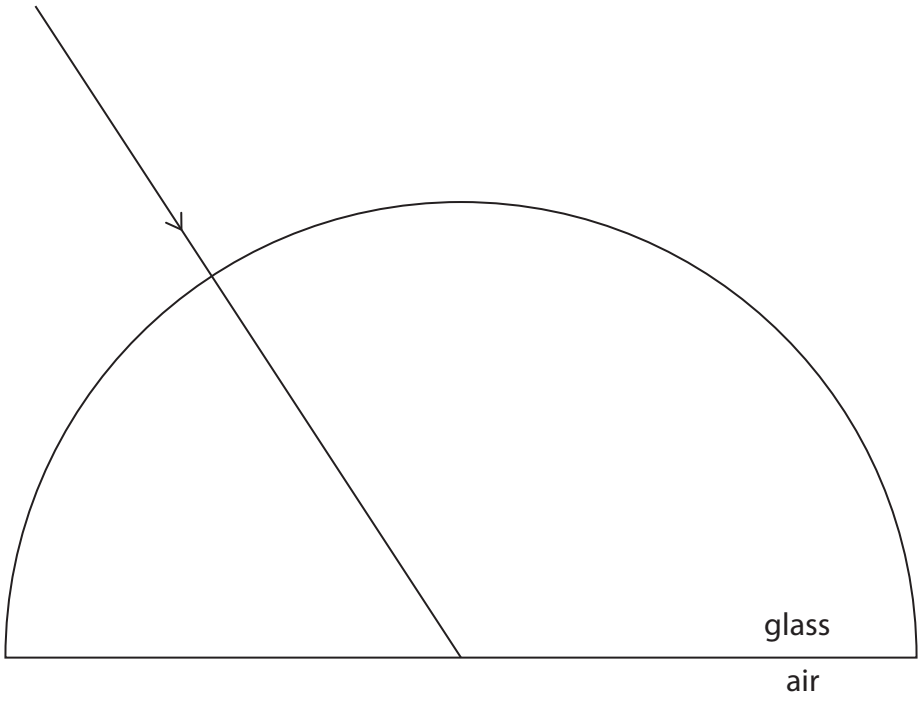
(a) The diagram shows the glass block and an incident ray of light.

The ray of light is incident at the glass-air boundary at an angle lower than the critical angle for the glass.

Complete the ray diagram to show the path of the ray as it passes out of the block.

You should include a suitable normal.

(3)



(b) The student shines the ray of light into a rectangular block of a different material.

The light is shone at different angles of incidence and the student measures the angle of refraction each time.

For each pair of angles, the student calculates sin (angle of incidence) and sin (angle of refraction).

The table shows the student's results.

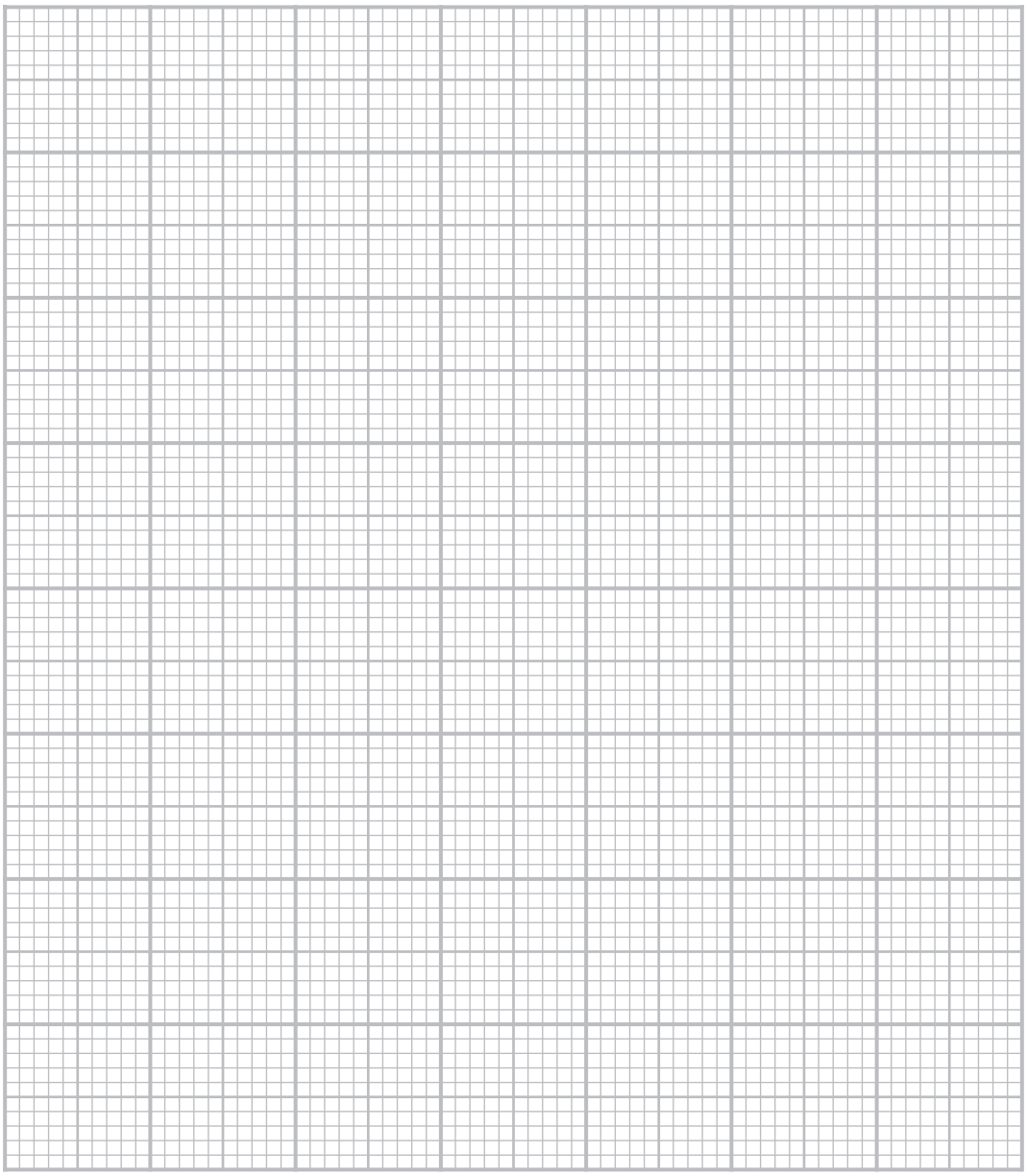
sin (angle of incidence)	sin (angle of refraction)
0.34	0.20
0.50	0.29
0.64	0.37
0.77	0.44
0.87	0.49
0.94	0.53

(i) Plot the student's results on the grid.

(3)

(ii) Draw a line of best fit.

(1)



(iii) Use the graph to determine the refractive index of the rectangular block.

(2)

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.....

(c) Diamond has a very high refractive index of 2.417

Calculate the critical angle for diamond.

Use the formula

$$\sin c = \frac{1}{n}$$

(3)

critical angle = ... degrees

(Total for Question 4 = 12 marks)

5 This question is about gases.

(a) A sample of gas is inside a sealed container.

The volume of the container is then decreased.

The temperature of the gas is kept constant.

Explain why the pressure of the gas changes.

(3)

(b) Explain how the average speed of gas molecules changes as temperature increases.

(2)

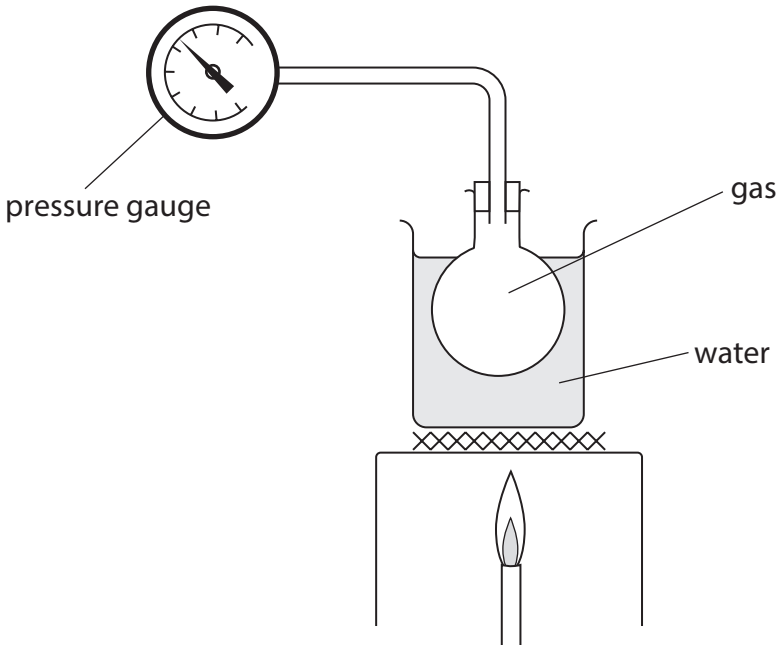
(c) Which of these temperatures is equivalent to 100 °C?

(1)

- ☒ **A** –173 K
- ☒ **B** 100 K
- ☒ **C** 212 K
- ☒ **D** 373 K

(d) A student investigates how temperature affects the pressure of a gas.

The diagram shows some of the equipment the student uses.



(i) Identify the dependent and independent variables in this investigation.

(2)

dependent

.....

.....

independent

.....

.....

(ii) The initial temperature of the gas is 280 K.

The initial pressure of the gas is 1.46×10^5 Pa.

After heating, the new pressure of the gas is 193 kPa.

Calculate the new temperature of the gas.

Give your answer in K.

(4)

temperature = ... K

(Total for Question 5 = 12 marks)

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6 When a current-carrying conductor is placed in a magnetic field, the conductor may experience a force.

(a) A student uses a pair of magnets, a power supply providing a constant current and a current-carrying conductor to set up four experiments, A, B, C and D.

Diagram 1 shows all four experiments seen from above.

The arrow represents the direction of the current in the conductor.

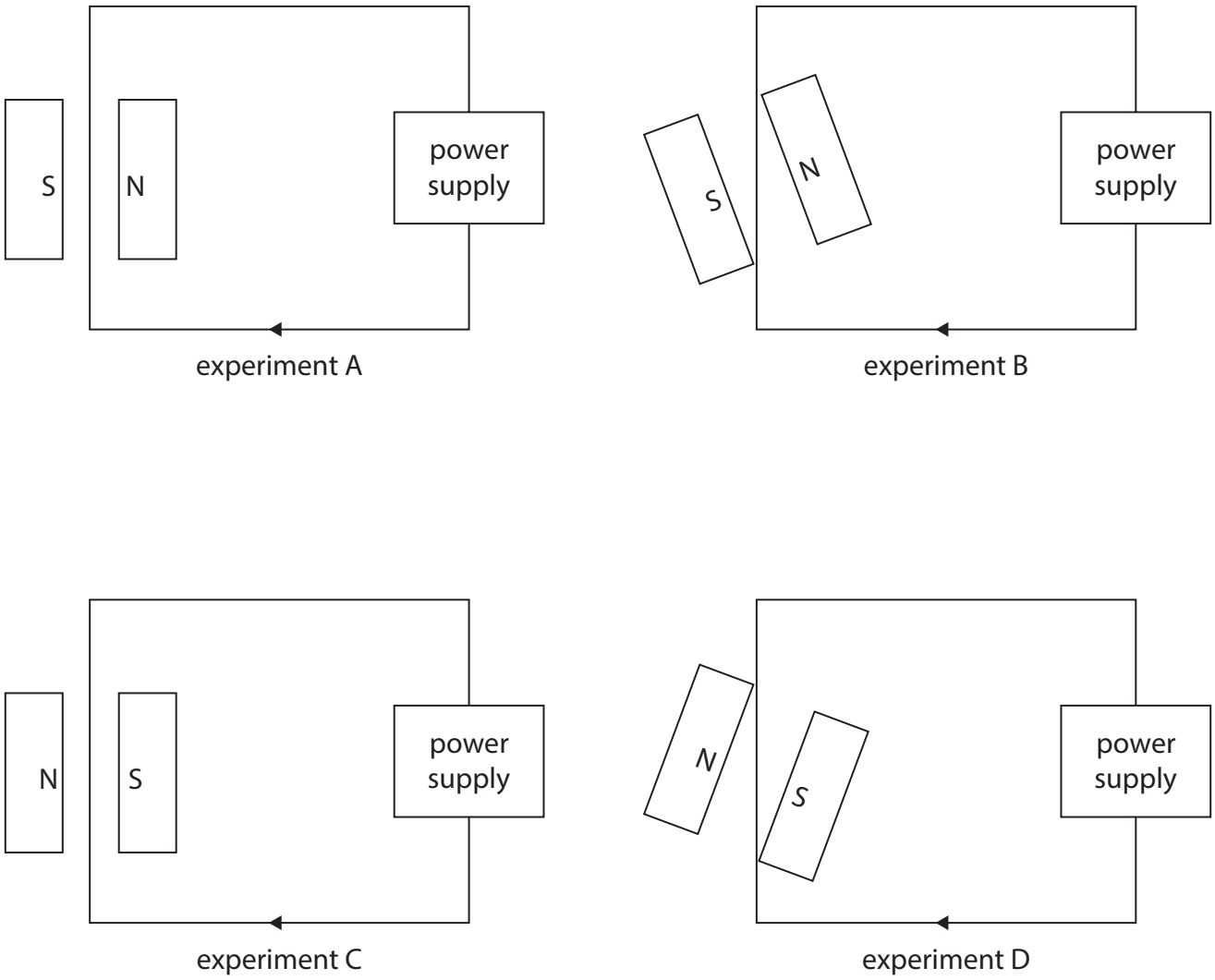

Diagram 1

Which of these produces the largest force out of the page on the conductor?

(1)

- ☒ **A** experiment A
- ☒ **B** experiment B
- ☒ **C** experiment C
- ☒ **D** experiment D

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(b) Diagram 2 shows a simple microphone.

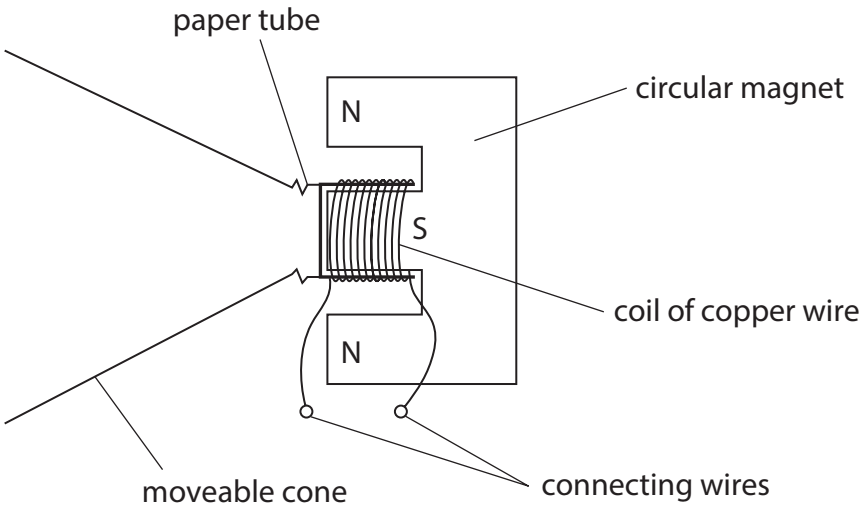

Diagram 2

Sounds in the air exert a force on the moveable cone.

This causes electricity to be generated in the coiled copper wire.

Explain how the microphone causes electricity to be generated.

(4)

(c) A sound wave has a frequency of 110 Hz.

Calculate the time period for this sound wave.

Give your answer to 4 decimal places.

(3)

time period = ... s

(Total for Question 6 = 8 marks)

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7 (a) A transformer consists of two solenoids and an iron core.

This is the label on the transformer.

Number of turns on primary coil: 180
Number of turns on secondary coil: 345
Output voltage: 230 V
Output power = 320 W

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

(1)

(ii) Calculate the input voltage of this transformer.

(3)

input voltage = ... V

(iii) Give the name of this type of transformer.

(1)

.....

(iv) The output current of the transformer is 1.4 A.

Calculate the input current to the transformer.

Assume the transformer is 100% efficient.

(2)

input current = ... A

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(b) Transformers are used in the large-scale generation and transmission of electrical energy.

Describe the structure of a transformer.

Include details of the materials used.

You may draw a diagram to help your answer.

(4)

(Total for Question 7 = 11 marks)

8 Betelgeuse is a star that has a much larger mass than the Sun.

Betelgeuse is red in colour.

The Sun is yellow in colour.

(a) Explain why the two stars have different colours.

(2)

(b) Describe the evolution of a star that has a much larger mass than the Sun.

You should include a description of every stage of the star's evolution.

(6)

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(c) Kepler-1690 is another star.

A planet moves in a circular orbit around Kepler-1690.

The planet has an orbital speed of 3.3×10^4 m/s.

The planet has an orbital radius of 1.07×10^{11} m.

Calculate the orbital time period of the planet.

Give your answer to two significant figures.

(4)

orbital time period = ... s

(Total for Question 8 = 12 marks)

9 (a) Galaxies A, B and C are different distances from the Earth.

Galaxy A is moving away from the Earth with a velocity of 1.7×10^4 km/s.

(i) The reference wavelength for light arriving at the Earth from galaxy A is 506 nm.

Calculate the observed wavelength for the light arriving from galaxy A.

[speed of light = 3.0×10^5 km/s]

(3)

wavelength = ... nm

(ii) Galaxy B is moving away from Earth at a faster speed than galaxy A.

Suggest an explanation for this difference in speed.

(2)

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(b) The universe started with an event called the Big Bang.

(i) State what is meant by the term **universe**.

(1)

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(ii) Explain how evidence from cosmic microwave background radiation shows how the temperature of the universe has changed since the Big Bang.

(2)

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(Total for Question 9 = 8 marks)

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10 Some nuclear power stations use the nuclear fission of uranium-235 to generate electricity.

Stars use nuclear fusion as an energy source.

(a) Explain the difference between nuclear fission and nuclear fusion.

(4)

(b) Nuclear reactors are often surrounded by several metres of thick concrete.

Explain the purpose of this concrete.

(2)

(Total for Question 10 = 6 marks)

TOTAL FOR PAPER = 90 MARKS

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Pearson Edexcel International GCSE (9–1)

Wednesday 19 November 2025

Morning (Time: 1 hour 40 minutes)

Paper reference **4WPH2/1P**

Physics (Modular)

UNIT 2: 4WPH2

PAPER: 1P

Equation Booklet

Do not return this Booklet with the question paper.

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P 8 1 5 6 4 R A

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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