Paper Reference(s) 4PH1/1PR 4SD0/1PR
Pearson Edexcel International GCSE (9–1)

Total Marks

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

Time: 2 hours

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

Y70952A

Pearson

YOU MUST HAVE

Ruler, protractor, calculator, Equation Booklet

YOU WILL BE GIVEN

Diagram Booklet, Formulae Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – 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.

There may be spare copies of some diagrams.

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.

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 This question is about astrophysics.

(a) Which of these do planets orbit? (1 mark)

☐ **A an artificial satellite**

☐ **B a comet**

☐ **C a moon**

☐ **D a star**

(continued on the next page)

1 continued.

(b) Which of these has the largest diameter?
(1 mark)

☐ A a galaxy

☐ B the Solar System

☐ C the Sun

☐ D the universe

(continued on the next page)

1 continued.

(c) Which of these has the smallest diameter?
(1 mark)

☐ A a galaxy

☐ B the Moon

☐ C a star

☐ D the Solar System

(continued on the next page)

1 continued.

(d) At the surface of the Earth, the gravitational field strength is 10 N / kg.

At the surface of the Moon, the gravitational field strength is 1·7 N / kg.

Give a reason for the difference in gravitational field strength.
(1 mark)

(Total for Question 1 = 4 marks)

2 This question is about electromagnetic waves.

(a) Look at the diagram for Question 2(a) in the Diagram Booklet. Draw a straight line from each electromagnetic wave to its correct use.

One has been done for you.
(4 marks)

(b) State a hazard to humans of excessive exposure to infrared waves.
(1 mark)

(continued on the next page)

2 continued.

(c) State a precaution that would reduce a person's risk of exposure to ultraviolet waves.
(1 mark)

(Total for Question 2 = 6 marks)

3 Look at the diagram for Question 3 in the Diagram Booklet. It shows an electric circuit containing component X and a lamp connected in series.

(a) (i) Add another component to the diagram to measure the voltage of component X.
(1 mark)

(ii) Give the name of component X.
(1 mark)

_____

_____

(continued on the next page)

3 continued.

(b) Look at the graph for Question 3(b) in the Diagram Booklet. It shows how the resistance of component X changes with light intensity.

(i) Use the graph to determine the resistance of component X when the light intensity is 4·0 arbitrary units.
(2 marks)

resistance = _____ Ω

(continued on the next page)

3 continued.

(ii) The current in the circuit is 0·0018 A.

Calculate the voltage across component X at a light intensity of 4·0 arbitrary units.
(3 marks)

voltage = _____ V

(continued on the next page)

3 continued.

(iii) Explain what happens to the brightness of the lamp when component X is covered with a dark sheet of paper.
(2 marks)

(Total for Question 3 = 9 marks)

4 Look at Diagram 1 for Question 4(a) in the Diagram Booklet. It shows an ice cube floating at rest in a beaker of water.

(a) State the value of the resultant force on the ice cube.
(1 mark)

resultant force = _____ N

(continued on the next page)

4 continued.

(b) Look at Diagram 2 for Question 4(b) in the Diagram Booklet. It shows the ice cube pushed down into the water by force X.

The ice cube is at rest in this new position.

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

(continued on the next page)

4 continued.

(ii) The bottom of the ice cube is 0·041 m below the surface of the water.

The density of water is 1000 kg / m^3.

Show that the pressure difference between the bottom of the ice cube and the surface of the water is about 400 Pa.
(2 marks)

(continued on the next page)

4 continued.

(iii) State the formula linking pressure, force and area. (1 mark)

(continued on the next page)

4 continued.

(iv) The area of the base of the ice cube is $0{\cdot}0017\,m^2$.

Calculate the upward force on the bottom of the cube from the water due to the pressure difference.
(2 marks)

upward force = _____ N

(continued on the next page)

4 continued.

(v) Explain why the ice cube will accelerate upwards when force X is removed.
(2 marks)

(Total for Question 4 = 9 marks)

5 Table 1 shows the colour of some stars.

TABLE 1

Star	Colour
Sun	yellow
Rigel	blue
Betelgeuse	red
Arcturus	orange
Sirius	white

(a) Look at table 2 for Question 5(a) in the Diagram Booklet. Complete table 2 by giving the stars in order of increasing surface temperature.

The hottest star, Rigel, has been done for you.
(3 marks)

(continued on the next page)

5 continued.

(b) A star has a much larger mass than the Sun.

Describe the evolution of this star after it has left the main sequence. (3 marks)

(continued on the next page)

5 continued.

(continued on the next page)

5 continued.

(c) Look at the graph for Question 5(c) in the Diagram Booklet. It shows the relationship between the peak wavelength of light emitted by a star and the surface temperature of the star.

A scientist suggests that the two variables are linked by this formula.

peak wavelength × surface temperature = constant

Use data from the graph to justify this formula.
(4 marks)

(continued on the next page)

5 continued.

(Total for Question 5 = 10 marks)

6 Look at Diagram 1 for Question 6(a) in the Diagram Booklet. It shows a simple loudspeaker.

The coil is connected to an alternating current (a.c.) supply.

(a) Describe how the loudspeaker produces sound.
(4 marks)

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(b) Look at Diagram 2 for Question 6(b) in the Diagram Booklet. It shows two loudspeakers connected in series with a variable resistor.

The variable resistor is set to 5·0 Ω.

(continued on the next page)

6 continued.

(i) The total voltage across the two loudspeakers is 0·75V and the current in the circuit is 0·15A.

Show that the total power of the two loudspeakers is about 0·1W.

[power = current × voltage]
(2 marks)

(continued on the next page)

6 continued.

(ii) A student varies the resistance of the variable resistor.

The table shows the power of the loudspeakers for different resistance values of the variable resistor.

Resistance of variable resistor in Ω	Power of loudspeakers in W
0·0	0·000
2·5	0·100
5·0	0·113
7·5	0·108
10·0	0·100
12·5	0·092
15·0	0·084

(continued on the next page)

6 continued.

Look at the grid for Question 6(b)(ii) in the Diagram Booklet. Plot the student's results on the grid.
(3 marks)

(iii) Draw a curve of best fit.
(2 marks)

(continued on the next page)

6 continued.

(c) Look at Diagram 3 for Question 6(c) in the Diagram Booklet. It shows the loudspeakers connected in series to a cell.

Look at Diagram 4 for Question 6(c) in the Diagram Booklet. It shows the loudspeakers connected in parallel to the same cell.

Comment on how the total resistance of the loudspeakers in diagram 3 compares with the total resistance of the loudspeakers in diagram 4.
(4 marks)

(continued on the next page)

6 continued.

(Total for Question 6 = 15 marks)

7 Radon is a radioactive gas that contributes to background radiation.

(a) Describe what is meant by the term BACKGROUND RADIATION.
(2 marks)

(continued on the next page)

7 continued.

(b) Look at the graph for Question 7(b) in the Diagram Booklet. It shows the activity of a sample of radon-222.

(i) State what is meant by the term HALF-LIFE.
(2 marks)

(continued on the next page)

7 continued.

(ii) Use the graph to determine the half-life of radon-222.
(2 marks)

half-life = _____ days

(c) Radon-222 is formed by multiple alpha decays of uranium-234.

Complete the nuclear equation by giving the missing information.
(3 marks)

$$^{234}_{92}U \longrightarrow {}^{222}_{\square}Rn + 3\,{}^{\square}_{\square}\alpha$$

(continued on the next page)

7 continued.

(d) Radon-222 also emits alpha radiation.

Explain the hazard to humans of breathing in air contaminated with radon-222.
(2 marks)

(Total for Question 7 = 11 marks)

8 Hailstones are small pieces of ice that sometimes fall to the ground during storms.

(a) (i) Describe how to determine the density of a hailstone.

Assume that hailstones are spherical.
(4 marks)

(continued on the next page)

8 continued.

(continued on the next page)

8 continued.

(ii) The mean volume of a hailstone is $1{\cdot}1\,cm^3$.

The mean mass of a hailstone is $0{\cdot}94\,g$.

Calculate the mean density of a hailstone.

Give the unit.
(3 marks)

density = _____

unit _____

(continued on the next page)

8 continued.

(b) Hailstones can be lifted to the top of clouds.

Look at the diagram for Question 8(b) in the Diagram Booklet. It shows the movement of some hailstones in a cloud.

Suggest how hailstones are lifted to the top of the cloud by convection. (2 marks)

(continued on the next page)

8 continued.

(Total for Question 8 = 9 marks)

9 Look at the diagram for Question 9 in the Diagram Booklet. It shows an empty metal container that has a hole in the top.

(a) Describe how the air molecules in the container exert a pressure on its inner walls.
(3 marks)

(continued on the next page)

9 continued.

(continued on the next page)

9 continued.

(b) The container is heated for a long time.

Explain what happens to the number of air molecules in the container.
(2 marks)

(continued on the next page)

9 continued.

(c) Look at the diagram for Question 9(c) in the Diagram Booklet. A lid is placed on the hot container.

The lid seals the hole and the container is allowed to cool.

As the container cools, it collapses.

Explain why the container collapses. (2 marks)

(continued on the next page)

9 continued.

(Total for Question 9 = 7 marks)

10 Look at Diagram 1 for Question 10 in the Diagram Booklet. It shows a trolley seen from above.

A copper rod is attached to the front of the trolley.

The rod is connected to a voltmeter fixed to the trolley.

(a) Look at Diagram 2 for Question 10(a) in the Diagram Booklet. It shows the path of the trolley, backwards and forwards through a very strong magnetic field directed into the page.

The shaded area shows the magnetic field.

(continued on the next page)

10 continued.

(i) A voltage is induced in the copper rod as the trolley moves through the magnetic field.

Explain why the sign of the voltmeter reading changes as the trolley moves backwards and forwards.
(3 marks)

(continued on the next page)

10 continued.

(continued on the next page)

10 continued.

(ii) Give a reason why the magnitude of the induced voltage might change.
(1 mark)

(continued on the next page)

10 continued.

(b) The voltmeter is replaced by a resistor.

A charge of $1{\cdot}4 \times 10^{-4}$ C flows in the resistor during a time of 0·78 s.

(i) Calculate the mean current in the resistor.
(3 marks)

mean current = _____ A

(continued on the next page)

10 continued.

(ii) The thermal energy store of the resistor increases by $2{\cdot}3 \times 10^{-6}$ J as energy is transferred to it electrically.

Calculate the mean voltage across the resistor when a charge of $1{\cdot}4 \times 10^{-4}$ C transfers this energy.
(3 marks)

mean voltage = _____ V

(Total for Question 10 = 10 marks)

11 (a) Look at Diagram 1 for Question 11(a) in the Diagram Booklet. It shows water waves just before they reflect off the side of a stationary boat.

(i) Draw the normal at the point where the direction of travel of the waves meets the side of the boat.
(1 mark)

(ii) Measure the angle of incidence of the water waves.
(1 mark)

angle of incidence =

_____ degrees

(continued on the next page)

11 continued.

(iii) Complete the diagram to show the wavefronts after they reflect off the side of the boat.
(3 marks)

(continued on the next page)

11 continued.

(b) The boat starts to move, creating its own waves on the surface of the water.

(i) Surface water waves are transverse.

Describe the difference between transverse waves and longitudinal waves.
(2 marks)

(continued on the next page)

11 continued.

(ii) Look at Diagram 2 for Question 11(b)(ii) in the Diagram Booklet. It shows the boat moving towards an observer.

Explain why the frequency of the water waves measured by the observer is larger than the frequency of the water waves created by the boat.
(3 marks)

(continued on the next page)

11 continued.

(Total for Question 11 = 10 marks)

12 This question is about a parachutist.

(a) A parachutist leaves a helicopter that is hovering above the ground.

The parachutist is initially at rest and falls vertically downwards.

Calculate the speed of the parachutist after they have fallen through a distance of 1300 m.

Ignore the effect of air resistance.
(4 marks)

speed = _____ m/s

(continued on the next page)

12 continued.

(b) When the parachutist is much nearer to the ground, they open their parachute.

The parachutist slows down.

(i) Explain the change in speed of the parachutist.

Use ideas about forces in your answer.
(3 marks)

(continued on the next page)

12 continued.

(continued on the next page)

12 continued.

(ii) It is observed that from when the parachute opens to just before the parachutist touches the ground, the GPE store and the KE store of the parachutist both decrease, yet energy is still conserved.

Justify these observations.
(3 marks)

(continued on the next page)

12 continued.

(Total for Question 12 = 10 marks)

TOTAL FOR PAPER = 110 MARKS
END OF PAPER