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

Physics

Science (Double Award) 4SD0

Paper: 1P

Total Marks

Time: 2 hours plus your additional time allowance

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

Surname						
Other names						
Centre Number						
Candidate Number						

Q67159A

Pearson

YOU MUST HAVE

Calculator, ruler, protractor

YOU WILL BE GIVEN

Diagram Booklet, Formulae Booklet

INSTRUCTIONS

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.

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 ☒.

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.

Good luck with your examination.

Answer ALL questions.

1 (a) (i) Which of these coloured stars has the highest surface temperature?
(1 mark)

☐ A orange

☐ B red

☐ C white

☐ D yellow

(ii) Which of these is a stage in the life cycle of the Sun?
(1 mark)

☐ A black hole

☐ B neutron star

☐ C supernova

☐ D white dwarf

(continued on the next page)

1 continued.

(iii) Which of these is the stage nearest the end of the life cycle of a star with a mass much greater than the Sun?
(1 mark)

☐ A main sequence

☐ B protostar

☐ C supernova

☐ D white dwarf

(b) Look at the diagram for Question 1(b) in the Diagram Booklet. It shows the orbit of a comet around a star.

Draw a labelled arrow to show the force acting on the comet due to the star.
(2 marks)

(Total for Question 1 = 5 marks)

2 A student uses iron filings to investigate the magnetic field pattern around a bar magnet.

(a) Name the apparatus that the student could use to find the direction of the field lines.
(1 mark)

(b) Look at the diagram for Question 2(b) in the Diagram Booklet. The student draws a diagram of the magnetic field pattern of the magnet.

The student makes three mistakes.

Draw a circle around each mistake on the diagram the Diagram Booklet.
(3 marks)

(continued on the next page)

2 continued.

(c) The magnet is made of a magnetically hard material.

Describe what is meant by the term MAGNETICALLY HARD.
(2 marks)

(Total for Question 2 = 6 marks)

3 Look at the diagram for Question 3 in the Diagram Booklet. It shows a model of a chain reaction in a nuclear fission reactor.

A ball falls through the hole and hits a mousetrap.

This mousetrap then releases another ball.

Each released ball hits a different mousetrap.

(a) Each mousetrap represents a uranium-235 nucleus.

(i) Name the particle represented by the balls. (1 mark)

(continued on the next page)

3 continued.

(ii) Describe what is meant by the term NUCLEAR FISSION.
(2 marks)

(continued on the next page)

3 continued.

(iii) Describe what is meant by the term CHAIN REACTION.
(2 marks)

(continued on the next page)

3 continued.

(b) The walls of a real nuclear reactor are not made of plastic.

Give a suitable material for the walls of a real nuclear reactor.
(1 mark)

(continued on the next page)

3 continued.

(c) Look at the list of words for Question 3(c) in the Diagram Booklet. Use words from the list to complete the sentences about the moderator and control rods in a nuclear reactor.
(4 marks)

The moderator in a nuclear reactor can be made of

_____ .

The moderator is designed to _____

neutrons.

The control rods in a nuclear reactor can be made of

_____ .

The control rods are designed to

_____ neutrons.

(Total for Question 3 = 10 marks)

4 Look at the diagram for Question 4(a) in the Diagram Booklet. It shows a velocity-time graph for a car from the time the driver sees an obstacle in the road until the car comes to rest.

(a) (i) Calculate the acceleration of the car between 1·8 and 8·0 seconds.
(3 marks)

acceleration = _____ m/s^2

(ii) Calculate the braking distance of the car.
(3 marks)

braking distance = _____ m

(continued on the next page)

4 continued.

(iii) Explain the effect, if any, of increased driver tiredness on the thinking distance and on the braking distance of the car.
(4 marks)

thinking distance _____

braking distance _____

(continued on the next page)

4 continued.

(b) Look at the graphs for Question 4(b) in the Diagram Booklet. Which of these graphs represents the distance-time graph for the car? (1 mark)

☐ A Graph A

☐ B Graph B

☐ C Graph C

☐ D Graph D

(Total for Question 4 = 11 marks)

5 Look at the diagram for Question 5(a) in the Diagram Booklet. It shows a circuit used to investigate the relationship between current and voltage for a light-emitting diode (LED).

(a) Draw meters on the diagram to measure the voltage of the LED and the current in the LED. (3 marks)

(continued on the next page)

5 continued.

(b) The table shows the results of the investigation.

Voltage in V	Current in mA
0·00	0·0
0·30	0·5
0·35	2·5
0·40	1·5
0·45	2·0
0·50	4·5
0·55	9·0
0·60	15·0

(i) Look at the grid for Question 5(b) in the Diagram Booklet. Plot the results on the grid in the Diagram Booklet.
(3 marks)

(ii) One of the results is anomalous.

On the graph, draw a circle around the anomalous result.
(1 mark)

(iii) Draw a curve of best fit.
(1 mark)

(continued on the next page)

5 continued.

(iv) Give a reason why a line graph is the best way of showing these results.
(1 mark)

(v) State the formula linking voltage, current and resistance.
(1 mark)

(continued on the next page)

5 continued.

(vi) Any current larger than 15 mA will permanently damage the LED.

The resistor in the circuit has a resistance of 270 Ω.

Use the results from the investigation to determine the maximum voltage of the power supply without damaging the LED.
(4 marks)

maximum voltage = _____ V

(Total for Question 5 = 14 marks)

6 Look at the diagram for Question 6(a) in the Diagram Booklet. It shows a container of water.

The container has a heater in the bottom corner, a temperature sensor and a lid.

(a) Explain how a convection current is formed in the container.

You may add to the diagram or draw your own diagram to support your answer.
(4 marks)

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(b) Look at the graph for Question 6(b) in the Diagram Booklet. It shows how the temperature sensor reading changes with time.

It shows the change in temperature when the container is full of water and when the container is empty.

(i) Describe the relationship between temperature and time when the container is full of water. (2 marks)

(continued on the next page)

6 continued.

(ii) Explain the differences between the two curves on the graph.
(3 marks)

(Total for Question 6 = 9 marks)

7 (a) Look at the diagram for Question 7(a) in the Diagram Booklet. It shows tracks produced by radiation in a device called a cloud chamber.

The tracks are formed when particles ionise the material in the cloud chamber.

Alpha particles produce the shorter, thicker tracks.

Beta particles produce the longer, thinner tracks.

Explain why alpha particles produce the shorter, thicker tracks.
(2 marks)

(continued on the next page)

7 continued.

(b) Uranium-235 is an isotope of uranium that can decay by emitting an alpha particle.

(i) Describe what is meant by the term ISOTOPE.
(2 marks)

(ii) Look at the equation for Question 7(b)(ii) in the Diagram Booklet. Complete the equation for the decay of uranium-235
(2 marks)

(continued on the next page)

7 continued.

(iii) Uranium-235 decays to thorium-231 with a half-life of 700 million years.

When a rock was formed, it contained 6400 million uranium-235 nuclei and no thorium-231 nuclei.

Show that after 2100 million years there are seven times more thorium nuclei than uranium nuclei in the rock.
(5 marks)

(Total for Question 7 = 11 marks)

8 (a) Describe how two magnets can be arranged to produce a uniform magnetic field.

You may draw a diagram to support your answer.
(2 marks)

(continued on the next page)

8 continued.

(b) Look at the diagram for Question 8(b) in the Diagram Booklet. It shows a wire in a uniform magnetic field.

(i) The wire is moved up and down repeatedly in the magnetic field.

Explain the effect that this movement has on the ammeter reading.
(3 marks)

(continued on the next page)

8 continued.

(ii) Explain the effects on the ammeter reading of moving the wire with the same amplitude but at a higher frequency.
(4 marks)

(continued on the next page)

8 continued.

(Total for Question 8 = 9 marks)

9 Look at the image for Question 9(a) in the Diagram Booklet. It shows a whale jumping out of the surface of the sea.

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2·2 m from the top of the jump to the surface of the sea.

Calculate the velocity of the whale when it hits the surface of the sea.
(4 marks)

velocity = _____ m/s

(continued on the next page)

9 continued.

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Look at the image for Question Q9(b)(i) in the Diagram Booklet. Draw an arrow on the image to show this resultant force.
(1 mark)

(ii) The resultant force acting on the whale is 18 000 N.

The mass of the whale is 4100 kg.

Calculate the acceleration of the whale.
(3 marks)

acceleration = _____ m/s^2

(Total for Question 9 = 8 marks)

10 Look at the diagram for Question 10 in the Diagram Booklet. It shows a device called a hydraulic lift.

The hydraulic lift consists of a tube of oil with a piston at each end.

(a) Calculate the pressure difference between the bottom of piston X and the bottom of the oil. (3 marks)

[density of oil = 820 kg/m^3]

pressure difference = _____ Pa

(continued on the next page)

10 continued.

(b) A 24 kg mass is placed on piston X.

(i) Calculate the weight of the 24 kg mass.

Give the unit.
(3 marks)

weight = _____ unit _____

(ii) Calculate the extra pressure on the oil due to the mass.
(2 marks)

extra pressure = _____ Pa

(continued on the next page)

10 continued.

(iii) The oil transfers the same extra pressure to piston Y.

Calculate the force acting upwards on piston Y due to the extra pressure.
(3 marks)

force = _____ N

(continued on the next page)

10 continued.

(c) Piston Y starts at rest, rises slowly and then comes to rest.

State how the following energy stores have changed from before the motion to after the motion is complete.
(4 marks)

Energy store	Change
gravitational potential energy of piston X	
gravitational potential energy of piston Y	
chemical energy of piston Y	
kinetic energy of piston Y	

(Total for Question 10 = 15 marks)

11 Look at Diagram 1 for Question 11 in the Diagram Booklet. It shows what happens when light is incident on a piece of transparent material.

(a) When very bright light shines on this transparent material, a small amount of light is reflected at point X.

(i) On Diagram 2 for Question 11(a)(i) in the Diagram Booklet draw the reflected ray from point X.
(2 marks)

(ii) Measure the angle of REFRACTION at point X on diagram 2.
(1 mark)

angle = _____ degrees

(iii) State the formula linking refractive index, angle of incidence and angle of refraction.
(1 mark)

(continued on the next page)

11 continued.

(iv) Show that the refractive index of the transparent material is about 1·7
(2 marks)

(v) State the formula linking refractive index and critical angle.
(1 mark)

(continued on the next page)

11 continued.

(vi) Calculate the critical angle for the transparent material.
(2 marks)

critical angle = _____ degrees

(continued on the next page)

11 continued.

(b) Look at the diagram for Question 11(b) in the Diagram Booklet. Explain the behaviour of the light at points Y and Z.
(3 marks)

(Total for Question 11 = 12 marks)

TOTAL FOR PAPER = 110 MARKS
END