

**Paper Reference(s) 1PH0/2H**  
**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Physics**  
**PAPER 2**  
**Higher Tier**

<b>Total Marks</b>
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**Time: 1 hour 45 minutes**

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

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

**YOU MUST HAVE**

**Calculator, ruler, Equation Booklet**

**YOU WILL BE GIVEN**

**Diagram Booklet, Additional  
Equations Insert**

**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.**

**Calculators may be used.**

**Any diagrams may NOT be accurately drawn,  
unless otherwise indicated.**

**You must show all your working out with  
your answer clearly identified at the  
end of your solution.**

**Turn over**

## **INFORMATION**

**The total mark for this paper is 100.**

**The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**

**In questions marked with an **ASTERISK (\*)**, marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.**

**The lists of equations are provided as a separate booklet and as an additional insert.**

**There may be spare copies of some diagrams.**

## **ADVICE**

**Read each question carefully before you start to answer it.**

**Try to answer every question.**

**Check your answers if you have time at the end.**

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**Answer ALL questions. Write your answers in the spaces provided.**

**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 static electricity.**

- (a) Look at Figure 1 for Question 1(a) in the Diagram Booklet. Draw on Figure 1 the shape and direction of the electric field due to the positive point charge.  
(2 marks)**

**(continued on the next page)**

**1 continued.**

**(b) A student rubs a plastic ruler against a woolly jumper.**

**The student tests the ruler and finds it has a positive charge.**

**Explain how the ruler becomes positively charged.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**1 continued.**

**(c) An insecticide sprayer charges droplets of insecticide.**

**Look at Figure 2 for Question 1(c) in the Diagram Booklet. It shows the sprayer being used to spray a leaf.**

**The leaf is connected to the ground (earthed).**

**Explain how charging the droplets helps to make sure that the leaf gets covered with insecticide.**

**You may add to Figure 2, including the sign (+ or –) of any charges, to help your answer.**

**(3 marks)**

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**(continued on the next page)**

**Turn over**

**1 continued.**

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**(Total for Question 1 = 7 marks)**

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**Turn over**

- 2 (a) Look at Figure 3 for Question 2(a) in the Diagram Booklet. It shows a lamp connected to a d.c. power supply.**

**The power supply provides a potential difference (voltage) of 4.5 V.**

**The current in the lamp is 0.30 A.**

**(continued on the next page)**

**2 continued.**

- (i) Calculate the resistance of the lamp.  
(1 mark)**

**Use the equation**

$$R = \frac{V}{I}$$

**resistance = \_\_\_\_\_  $\Omega$**

**(continued on the next page)**

**Turn over**

**2 continued.**

- (ii) Calculate the power supplied to the lamp.  
(2 marks)**

**power = \_\_\_\_\_ W**

**(continued on the next page)**

**Turn over**

**2 continued.**

**(b) Look at Figure 4 for Question 2(b) in the Diagram Booklet. Another IDENTICAL lamp is added to the circuit, as shown in Figure 4.**

**The power supply provides the same potential difference as it provided in the circuit in Figure 3.**

**State and explain the difference between the brightness of the lamp in Figure 3 and the brightness of a lamp in Figure 4.**

**(3 marks)**

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**(continued on the next page)**

**Turn over**

**2 continued.**

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**(continued on the next page)**

**2 continued.**

**(c) A student is given a low voltage power supply and 1 m of resistance wire.**

**The student uses these and other pieces of equipment to measure the resistance of just 50 cm of the resistance wire.**

**On page 15 draw a diagram of the circuit that the student should use.**

**Your circuit diagram should identify the pieces of equipment that the student uses.**

**(3 marks)**

**(continued on the next page)**

**2 continued.**

**(Total for Question 2 = 9 marks)**

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**Turn over**

- 3 (a) When water boils and turns into steam, there are changes in the arrangement of particles and the density.

Which of these shows the changes?  
(1 mark)

	<b>space between particles in steam</b>	<b>density of steam</b>
<input type="checkbox"/> A	<b>bigger than in water</b>	<b>greater than water</b>
<input type="checkbox"/> B	<b>bigger than in water</b>	<b>less than water</b>
<input type="checkbox"/> C	<b>smaller than in water</b>	<b>greater than water</b>
<input type="checkbox"/> D	<b>smaller than in water</b>	<b>less than water</b>

(continued on the next page)

**3 continued.**

**(b) Look at Figure 5 for Question 3(b) in the Diagram Booklet. It shows some water in a measuring cylinder and a lump of iron.**

**The lump of iron is lowered fully into the water.**

**The water level in the measuring cylinder rises to  $530 \text{ cm}^3$ .**

**The density of iron is  $7.9 \text{ g/cm}^3$ .**

**On page 18 calculate the mass of the lump of iron.**

**Use the equation**

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

**Give your answer to  
2 significant figures.  
(4 marks)**

**(continued on the next page)**

**Turn over**

**3 continued.**

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

**mass = \_\_\_\_\_ g**

**(continued on the next page)**

**Turn over**

**3 continued.**

**(c) A piece of wood has a similar shape and volume to the lump of iron.**

**The density of the wood is  $0.82 \text{ g/cm}^3$ .**

**The density of water is  $1.00 \text{ g/cm}^3$**

**Explain why the method used in part (b) cannot be used to determine the mass of the piece of wood.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**3 continued.**

**(d) Describe what happens when a substance experiences sublimation.  
(2 marks)**

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**(Total for Question 3 = 9 marks)**

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4 (a) A donkey has a weight of 2500 N.

The area of each hoof is  $0.022 \text{ m}^2$ .

(i) Calculate the average pressure that the donkey exerts on the ground.  
(2 marks)

Use the equation

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

average pressure = \_\_\_\_\_ Pa

**4 continued.**

- (ii) Look at Figure 7 for Question 4(a)(ii) in the Diagram Booklet. It shows how the shape of a camel's hoof is different from the shape of a donkey's hoof.**

**The camel and the donkey have the same mass.**

**Explain how a camel's hoof is a more suitable shape than a donkey's hoof for walking on soft ground.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**4 continued.**

- (b) A student carries out an investigation to show how pressure varies with depth in water.**

**A pressure sensor is attached to a rule.**

**Look at Figure 8 for Question 4(b) in the Diagram Booklet. The rule and pressure sensor are lowered into the water in a tank, as shown in Figure 8.**

**The depth of the pressure sensor below the surface of the water is read from the scale on the rule.**

**The pressure is displayed on the student's mobile phone which receives a signal from the pressure sensor.**

**(continued on the next page)**

**4 continued.**

**Figure 9 gives some of the readings.**

**FIGURE 9**

<b>depth in m</b>	<b>pressure in kPa</b>
<b>0·050</b>	<b>99·15</b>
<b>0·100</b>	<b>99·70</b>
<b>0·150</b>	<b>100·15</b>
<b>0·200</b>	<b>100·70</b>
<b>0·250</b>	<b>101·15</b>
<b>0·300</b>	<b>101·70</b>

**(continued on the next page)**

**Turn over**

**4 continued.**

**Look at Figure 10 for Question 4(b) in the Diagram Booklet. It shows a graph with some of the results plotted, but two of the points are missing.**

- (i) Plot the two missing points on the graph.  
(2 marks)**
- (ii) Draw a line of best fit through the points on the graph.  
(1 mark)**

**(continued on the next page)**

**4 continued.**

**(iii) Which of the following equations represents the variation of pressure with depth of water below the surface?  
(1 mark)**

☐ **A**  $y = ax^2 + b$

☐ **B**  $y = mx$

☐ **C**  $Y = mc - x$

☐ **D**  $y = mx + c$

**(continued on the next page)**

**4 continued.**

- (iv) Use the graph in Figure 10 to predict the pressure at the surface of the water.  
(1 mark)**

**pressure at the surface of**

**the water = \_\_\_\_\_ kPa**

**(continued on the next page)**

**4 continued.**

- (c) The student repeats the investigation in part (b) using seawater and draws a graph of the results.**

**The seawater is more dense than the water used in part (b).**

**Compare the graph for seawater with the graph in Figure 10.  
(2 marks)**

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**(Total for Question 4 = 11 marks)**

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**Turn over**

- 5 (a) Look at Figure 11 for Question 5(a) in the Diagram Booklet. It shows the shape of the magnetic field near a bar magnet.**
- (i) Draw arrows on the field lines in Figure 11 to show the direction of the magnetic field.  
(1 mark)**
- (ii) Place a letter X on Figure 11 at a place where the magnetic field is strongest.  
(1 mark)**

**(continued on the next page)**

**5 continued.**

- (iii) Describe TWO differences between the magnetic field shown in Figure 11 and a uniform magnetic field.  
(2 marks)**

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**(continued on the next page)**

**5 continued.**

**(b) State how a uniform magnetic field may be obtained in a school laboratory.  
(1 mark)**

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**(continued on the next page)**

**5 continued.**

**(c) Look at Figure 12 for Question 5(c) in the Diagram Booklet. It shows the directions of some plotting compass needles placed at different points near the Earth's surface.**

**(i) Sketch, on Figure 12, the Earth's magnetic field outside and inside the Earth.  
(2 marks)**

**(ii) State which part of the Earth generates its magnetic field.  
(1 mark)**

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**(continued on the next page)**

**Turn over**

**5 continued.**

**(d) A wire is placed at right angles to the Earth's magnetic field.**

**The wire is 0.600 m long and carries a current of 93.1 mA.**

**The force on the wire is  $1.11 \times 10^{-5}$  N.**

**On page 34 calculate the magnetic flux density of the Earth's magnetic field.**

**(2 marks)**

**(continued on the next page)**

**5 continued.**

**Use the equation**

$$F = B \times I \times l$$

**magnetic flux density = \_\_\_\_\_ T**

**(Total for Question 5 = 10 marks)**

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**Turn over**

**6 (a) Which of these is a vector quantity?  
(1 mark)**

☐ **A acceleration**

☐ **B speed**

☐ **C time**

☐ **D distance**

**(continued on the next page)**

**6 continued.**

**(b) Look at Figure 13 for Question 6(b) in the Diagram Booklet. It shows a toy that a student makes for a nursery school.**

**The rod hangs by a string from the ceiling.**

**(continued on the next page)**

**6 continued.**

- (i) The moment of C about point P is 0.60 N m.**

**Calculate the weight of C.  
(2 marks)**

**Use the equation**

$$\text{moment} = F \times d$$

**weight of C \_\_\_\_\_ N**

**(continued on the next page)**

**Turn over**

**6 continued.**

- (ii) Show that the total moment of S and R about P is  $0.70 \text{ N m}$ .  
(2 marks)**

**(continued on the next page)**

**Turn over**

**6 continued.**

- (iii) Using the data in the question and the principle of moments, determine if the toy shown in Figure 13 is in equilibrium.**

**The rod is very light so its weight can be ignored.  
(3 marks)**

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**Turn over**

**6 continued.**

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**6 continued.**

**(c) Look at Figures 14a and 14b for Question 6(c) in the Diagram Booklet. Figure 14a shows a rack and pinion system, used on a mountain railway.**

**Figure 14b shows a close up of the rack and pinion.**

**The teeth on the rack are 8·0 cm apart.**

**(continued on the next page)**

**6 continued.**

**Calculate how far along the rack the train moves when the pinion turns through one complete revolution.  
(2 marks)**

**distance = \_\_\_\_\_ m**

**(Total for Question 6 = 10 marks)**

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**Turn over**

- 7 (a) Look at Figure 15 for Question 7(a) in the Diagram Booklet. It shows a 'Mars rover' descending to the surface of the planet Mars.**
- (i) On page 44 calculate the change in gravitational potential energy of the rover as it descends from position P to position Q.**

**Mass of rover = 1100 kg**

**Gravitational field strength on Mars = 3.7 N/kg**

**Give your answer to  
2 significant figures.  
(3 marks)**

**(continued on the next page)**

**7 continued.**

**change in gravitational potential**

**energy = \_\_\_\_\_ J**

**(continued on the next page)**

**Turn over**

**7 continued.**

- (ii) Use data from Figure 15 to calculate the change in kinetic energy of the rover as it descends from position P to position Q.  
(2 marks)**

**change in kinetic energy =  
\_\_\_\_\_ J**

**(continued on the next page)**

**Turn over**

**7 continued.**

- (iii) The rover is slowed down safely using thrusters and a parachute (not shown in Figure 15).**

**The thrusters use jets of gas to control movements and the parachute is designed to be used in the atmosphere of Mars.**

**Describe the energy changes involved in terms of the work done by various forces as the rover descends.**

**(3 marks)**

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**(continued on the next page)**

**Turn over**

**7 continued.**

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**(continued on the next page)**

**7 continued.**

**(b) The rover uses solar panels for its power needs.**

**The solar panels can provide 1200 W of power.**

**(i) Show that the solar panels can provide 2·16 MJ of energy in 30 minutes.  
(1 mark)**

**(continued on the next page)**

**Turn over**

**7 continued.**

- (ii) The solar panels convert 27% of the energy they receive from the Sun into electricity.**

**Calculate the solar energy received by the panels that provides the 2.16 MJ of energy.  
(2 marks)**

**energy received = \_\_\_\_\_ J**

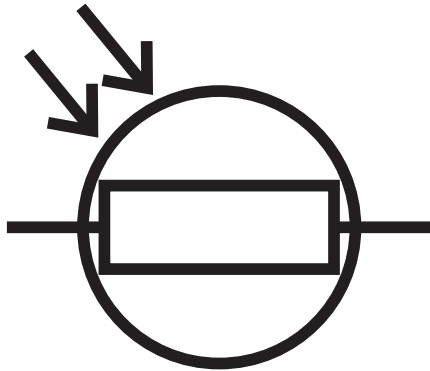
**(Total for Question 7 = 11 marks)**

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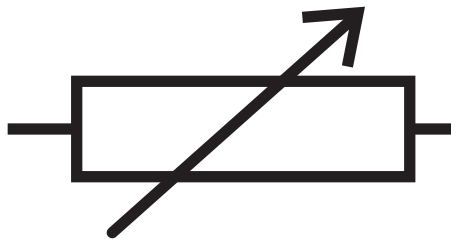
**Turn over**

- 8 (a) Which of these shows the correct circuit symbol for a thermistor?  
(1 mark)

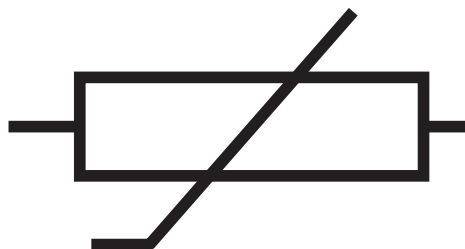
☐ A



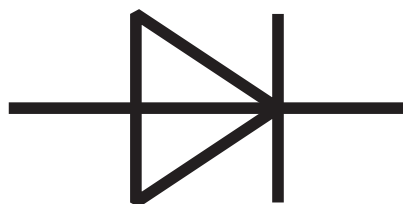
☐ B



☐ C



☐ D



**8 continued.**

**(b) A student investigates how the resistance of a thermistor varies with temperature.**

**Look at Figure 16 for Question 8(b) in the Diagram Booklet. It shows a graph of the results of this investigation.**

**(i) Describe how the resistance of this thermistor varies with temperature.  
(2 marks)**

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**(continued on the next page)**

**Turn over**

**8 continued.**

- (ii) Draw the tangent to the curve on Figure 16 at a temperature of  $30^{\circ}\text{C}$ , to find the rate of change of resistance with temperature at  $30^{\circ}\text{C}$ .**

**State the unit.  
(3 marks)**

**rate of change of resistance with temperature  
at  $30^{\circ}\text{C}$  = \_\_\_\_\_ unit \_\_\_\_\_**

**(continued on the next page)**

**Turn over**

**8 continued.**

**(c) Look at Figure 17 for Question 8(c)(i) in the Diagram Booklet. It shows the apparatus used for this investigation.**

**(i) Explain ONE improvement in measurement that the student could make in the investigation. (2 marks)**

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**Turn over**

**8 continued.**

**In this investigation, the resistance can be measured in two ways.**

**Method 1 – use an ohmmeter.**

**Method 2 – use an ammeter and a voltmeter.**

**Look at Figure 18 for Question 8(c)(ii) in the Diagram Booklet.**

**(continued on the next page)**

**8 continued.**

- (ii) Explain why method 2 gives more precise results than method 1.  
(2 marks)**

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**(Total for Question 8 = 10 marks)**

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- 9 (a) Explain the difference between the term 'specific heat capacity' and the term 'specific latent heat' when applied to heating substances.  
(2 marks)

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(continued on the next page)

**9 continued.**

**(b) Look at Figure 19 for Question 9(b) in the Diagram Booklet. It shows some apparatus that may be used to determine the specific heat capacity of water.**

**A student measures the initial temperature of the water.**

**The power supply is switched on for 10 minutes and then switched off.**

**Explain how the student should then obtain an accurate reading for the final temperature of the water, to be used in the calculation of the specific heat capacity.**

**(3 marks)**

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**9 continued.**

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**(continued on the next page)**

**9 continued.**

**\*(c) A container of gas is at room temperature.**

**The gas is then heated.**

**The volume of the container remains the same.**

**By considering changes in velocities of the gas particles, explain how the temperature increase affects**

- the average kinetic energy of the particles**
- the pressure the particles exert on the walls of the container.**

**(6 marks)**

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**Turn over**

**9 continued.**

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**Turn over**

**9 continued.**

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**(Total for Question 9 = 11 marks)**

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**Turn over**

- 10 (a) Look at Figure 20 for Question 10(a) in the Diagram Booklet. It shows a magnet and a coil.**

**The coil is connected to a sensitive centre-zero ammeter.**

**Explain what will be observed on the meter when the magnet is pushed in and pulled out of the coil, repeatedly.  
(3 marks)**

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**(continued on the next page)**

**Turn over**

**10 continued.**

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**(continued on the next page)**

**10 continued.**

**(b) This question is about a transformer.**

**Look at Figure 21 for Question 10(b) in the Diagram Booklet. It shows a transformer. It is 100% efficient. Calculate the current in the primary coil.**

**Use the information given in Figure 21 and equations selected from the list of equations provided in the Additional Equations Insert.**

**The transformer is 100% efficient.  
(3 marks)**

**(continue your answer on the next page)**

**Turn over**

**10 continued.**

**current in the primary coil =**

**\_\_\_\_\_ A**

**(continued on the next page)**

**Turn over**

**10 continued.**

- \*(c) Look at Figure 22 for Question 10(c) in the Diagram Booklet. It shows how electricity is delivered efficiently from a power station (P) to homes (T).**

**Using Figure 22, explain the stages in the process of delivering electricity efficiently from P to T.**

**Your answer should include details of the effects that Q, R and S have on efficiency.  
(6 marks)**

**(continue your answer on the next page)**

**Turn over**

**10 continued.**

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**Turn over**

**10 continued.**

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**10 continued.**

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**(Total for Question 10 = 12 marks)**

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**TOTAL FOR PAPER = 100 MARKS**  
**END OF PAPER**