

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

Physics  
PAPER 2  
Higher Tier

Total Marks
-------------

Friday 16 June 2023 – Morning

Time: 1 hour 45 minutes

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

Surname					
Other names					
Centre Number					
Candidate Number					

**YOU MUST HAVE**

**Calculator, ruler, Equation Booklet (enclosed)**

**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.**

**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.**

**A list of equations is provided as a separate booklet.**

**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.**

**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 (a) Look at Figure 1 for Question 1(a) in the Diagram Booklet. It shows a prize that is made from a metal star on a plastic base.**

**A person starts to clean the prize by rubbing the plastic base with a dry cloth.**

**The plastic base becomes positively charged and the cloth becomes negatively charged.**

**(continued on the next page)**

**Turn over**

**1(a) continued.**

**(i) The plastic base has  
(1 mark)**

☐ **A gained electrons**

☐ **B gained protons**

☐ **C lost electrons**

☐ **D lost protons**

**(continued on the next page)**

**1(a) continued.**

- (ii) Explain why the cloth has become negatively charged.  
(2 marks)**

---

---

---

---

---

---

**(continued on the next page)**

**1 continued.**

**(b) The person then holds the metal star and rubs it with the charged cloth.**

**The cloth loses its charge.**

**Explain why the cloth loses its charge.  
(2 marks)**

---

---

---

---

---

---

**(continued on the next page)**

**Turn over**

**1 continued.**

**(c) The charged plastic base attracts some dust from the air.**

**Look at Figure 2 for Question 1(c) in the Diagram Booklet. It shows a magnified view of part of the surface of the plastic base and a dust particle.**

**Some of the charges on the plastic base are shown but the charges induced on the dust particle are not shown.**

**Draw the charges induced on the dust particle in Figure 2.  
(2 marks)**

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

---



- 2 (a) Look at Figure 3 for Question 2(a) in the Diagram Booklet. It shows some of the apparatus that students use to determine the resistance of a piece of iron wire.**

**Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 3 so that the students can determine the resistance of the piece of iron wire.  
(2 marks)**

- (b) The students extend the investigation to determine how the resistance of the iron wire changes with its length.**

- (i) Give the name of ONE additional piece of apparatus the students would need.  
(1 mark)**
- 
-

**2(b) continued.**

- (ii) Look at Figure 4 for Question 2(b) in the Diagram Booklet. It shows a graph of the results.**

**Draw a straight line of best fit on Figure 4.  
(1 mark)**

- (iii) Use Figure 4 to estimate the resistance of a 100 cm length of the iron wire.  
(1 mark)**

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

**(continued on the next page)**

**2(b) continued.**

**(iv) The variable resistor shown in Figure 3 is used to prevent the iron wire from becoming too hot.**

**Explain how the variable resistor is used to prevent the iron wire from becoming too hot.  
(2 marks)**

---

---

---

---

---

---

**(continued on the next page)**

**Turn over**

**2 continued.**

**(c) The potential difference (voltage) across another piece of wire is 1.56 V.**

**The current in the wire is 0.45 A.**

**Calculate the resistance of this piece of wire.  
(2 marks)**

**Use the equation**

$$V = I \times R$$

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

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

---

**Turn over**

- 3 (a) Which of these means changing state from solid directly to gas?  
(1 mark)

☐ A condensing

☐ B freezing

☐ C melting

☐ D sublimating

- (b) An object has a mass of  $7.22 \times 10^{-2} \text{ kg}$  and a volume of  $2.69 \times 10^{-5} \text{ m}^3$ .

Calculate the density,  $\rho$ , of the object.  
(3 marks)

Use the equation

$$\rho = \frac{m}{v}$$

State the unit.

Answer space continues on the next page.

Turn over

**3(b) continued.**

**density = \_\_\_\_\_**

**unit \_\_\_\_\_**

**(c) Aluminium has a melting point of 660 °C.**

**The absolute zero of temperature is –273 °C.**

**(i) Calculate the melting point of aluminium in kelvin.  
(1 mark)**

**Answer space continues on the next page.**

**Turn over**

**3(c)(i) continued.**

**melting point of aluminium =**

**\_\_\_\_\_ K**

**(continued on the next page)**

**3(c) continued.**

**(ii) Describe the motion of particles in liquid aluminium (above 660 °C). (2 marks)**

---

---

---

---

---

**(continued on the next page)**



**3 continued.**

**(d) A student determines the volume of a piece of metal by measuring the volume of water that it displaces.**

**The student wrote the following in his notebook.**

**I put some water into a measuring cylinder.**

**I put the piece of metal into the water in the measuring cylinder.**

**I took the reading of the new water level in the measuring cylinder.**

**This was the volume of the piece of metal.**

**(continued on the next page)**

**Turn over**

**3(d) continued.**

**The student's description  
is incomplete.**

**Suggest TWO sentences that the  
student could have included to  
provide a more complete description  
of the correct procedure.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

**Turn over**

**4 This question is about pressure.**

**(a) Look at Figure 5 for Question 4(a) in the Diagram Booklet. It shows windows in an aeroplane.**

**The aeroplane is high above the Earth's surface.**

**The atmospheric pressure outside the aeroplane is 23 000 Pa.**

**The air pressure inside the aeroplane is 80 000 Pa.**

**(i) Calculate the pressure difference between inside and outside of the aeroplane.  
(1 mark)**

**pressure difference =  
\_\_\_\_\_ Pa**

**(continued on the next page)**

**Turn over**

**4(a) continued.**

- (ii) The surface area of the window is  $0.094 \text{ m}^2$**

**Calculate the size of the force on the window due to the cabin air pressure of  $80\,000 \text{ Pa}$ .  
(2 marks)**

**Use the equation**

$$P = \frac{F}{A}$$

**Answer space continues on the next page.**

**4(a)(ii) continued.**

**force = \_\_\_\_\_ N**

**(iii) On the same aeroplane, a different window has a smaller surface area.**

**Explain how the force due to the air pressure inside the cabin on the small window differs from the force on the larger window.  
(2 marks)**

**Answer space continues on the next page.**

---

---

---

**Turn over**

**4(a)(iii) continued.**

---

---

---

**(continued on the next page)**

**4(a) continued.**

**(iv) Look at Figure 6 for Question 4(a)(iv) in the Diagram Booklet. It shows a cross-section through the aeroplane including one window.**

**Draw an arrow on Figure 6 to show the direction of the resultant force due to the air pressure inside the cabin on the window at point X.  
(2 marks)**

**(continued on the next page)**

**4 continued.**

**(b) Look at Figure 7 in the Diagram Booklet. It shows the atmospheric pressure at different heights above the Earth's surface.**

**(i) Describe how the atmospheric pressure changes with height above the Earth's surface.**

**Use data from Figure 7 to support your answer.  
(3 marks)**

**Answer space continues on the next page.**

---

---

---

---

**Turn over**



**4(b)(i) continued.**

---

---

---

---

---

**(ii) Suggest ONE reason why the atmospheric pressure changes with height above the Earth's surface.  
(1 mark)**

---

---

---

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

**Turn over**

- 5 (a) Look at Figure 8 for Question 5(a) in the Diagram Booklet. It shows two magnets with their N poles facing each other.**

**On Figure 8, draw the shape and direction of the magnetic field between the two magnets.  
(2 marks)**

- (b) Look at Figure 9 for Question 5(b) in the Diagram Booklet. It shows a toy that has a plastic cylinder, a plastic base and two similar magnets. Each of the two magnets is in the shape of a ring.**

**The upper magnet seems to float in the air above the lower magnet.**

**Describe the forces acting on the upper magnet.**

**Use the idea of magnetic fields in your answer.  
(3 marks)**

**Answer space continues on the next page.**

**Turn over**

**5(b) continued.**

---

---

---

---

---

---

---

---

---

---

**(continued on the next page)**

**5 continued.**

**(c) Look at Figure 10 for Question 5(c) in the Diagram Booklet. It shows a current-carrying wire between the poles of a magnet.**

**(i) The magnet and the wire each experience a force when there is a current in the wire.  
(2 marks)**

**1 State the direction of the force on the wire.**

---

---

**2 State the direction of the force on the magnet.**

---

---

**5(c) continued.**

**(ii) The force on the wire is 0.15 N.**

**The current in the wire is 2.7 A.**

**The magnet produces a field with  
a magnetic flux density of 0.50 T.**

**Calculate the length of the wire in  
the magnetic field.**

**Use an equation selected from  
the list of equations given in the  
Equation Booklet.  
(2 marks)**

**length of the wire in the  
magnetic field =**

**\_\_\_\_\_ m**

**(Total for Question 5 = 9 marks)**

---

**Turn over**

- 6 (a) Look at Figure 11 for Question 6(a) in the Diagram Booklet. It shows a person doing a push-up exercise.**

**An upward force is used to cause rotation about a pivot.**

**Which row of the table is correct for this rotation?  
(1 mark)**

	<b>provide the upward force</b>	<b>act as a pivot</b>
<input type="checkbox"/> <b>A</b>	<b>arms</b>	<b>hands</b>
<input type="checkbox"/> <b>B</b>	<b>arms</b>	<b>feet</b>
<input type="checkbox"/> <b>C</b>	<b>legs</b>	<b>hands</b>
<input type="checkbox"/> <b>D</b>	<b>legs</b>	<b>feet</b>

**(continued on the next page)**

**Turn over**

**6 continued.**

**(b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. It shows some of the bones and muscles in an arm.**

**The arrows show the forces on the forearm when the arm is bent.**

**The hand is empty.**

**The biceps muscle provides a force to balance the weight of the forearm.**

**The weight of the forearm can be represented as a single force.**

**(continued on the next page)**

**6(b) continued.**

**Look at Figure 13 for Question 6(b)(i) in the Diagram Booklet. It shows a diagram representing the forces and distances involved.**

- (i) Use the principle of moments to show that the system shown in Figure 13 is in equilibrium.  
(2 marks)**

---

---

---

---

---

---

---

**(continued on the next page)**

**Turn over**



**6(b) continued.**

- (ii) The person then holds a ball weighing 15 N in their hand.**

**Look at Figure 14 for Question 6(b)(ii) in the Diagram Booklet. It shows the forces on the forearm and their distances from the elbow joint.**

**Calculate the force from the muscle that is needed to keep the system in Figure 14 in equilibrium.**

**(3 marks)**

**force = \_\_\_\_\_ N**

**(continued on the next page)**

**Turn over**

**6 continued.**

**(c) Look at Figure 15 for Question 6(c) in the Diagram Booklet. It shows a ball floating in seawater and the same ball floating in fresh water.**

**(i) Compare the upthrust on the ball in seawater with the upthrust on the same ball in fresh water.  
(1 mark)**

---

---

---

**(continued on the next page)**

**Turn over**

**6(c) continued.**

- (ii) Explain why there is less of the ball below the surface of the seawater than below the surface of the fresh water.  
(3 marks)**

---

---

---

---

---

---

---

---

---

---

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

**Turn over**

- 7 (a) Look at Figure 16 for Question 7(a)(i) in the Diagram Booklet. It shows part of the inside of a pen.**

**The pen contains a spring that can be compressed.**

**The spring constant of the spring is  $260 \text{ N/m}$ .**

- (i) Calculate the force needed to compress the spring by the amount shown in Figure 16.**

**Give your answer to an appropriate number of significant figures.  
(3 marks)**

**force = \_\_\_\_\_ N**

**(continued on the next page)**

**Turn over**

**7(a) continued.**

- (ii) A student removes the spring from the pen and investigates the compression of the spring.**

**Look at Figure 17 for Question 7(a)(ii) in the Diagram Booklet. It shows the equipment and the procedure that the student uses.**

**The student presses down on the spring to change its length.**

**The electronic balance measures the force applied to the spring.**

**Describe how the student can determine the change in length of the spring. You may add to Figure 17 to help your answer.**

**(3 marks)**

**Answer space continues on the next page.**

**Turn over**

**7(a)(ii) continued.**

---

---

---

---

---

---

---

---

---

**(continued on the next page)**

**7(a) continued.**

**(iii) The student finds it difficult to make an accurate measurement of the change in length of the spring using the equipment as shown.**

**Describe ONE way that the student could improve the procedure.  
(2 marks)**

---

---

---

---

---

**(continued on the next page)**

**Turn over**

**7 continued.**

**(b) Look at Figure 18 for Question 7(b) in the Diagram Booklet. It shows a different spring hanging from a hook fixed to the ceiling.**

**A block hangs from the other end of the spring.**

**The weight of the spring is 1 N.  
The weight of the block is 5 N.**

**The force exerted on the top of the spring by the hook is  
(1 mark)**

☐ **A 4 N down**

☐ **B 4 N up**

☐ **C 6 N down**

☐ **D 6 N up**

**(continued on the next page)**

**Turn over**



**7 continued.**

- (c) Look at Figure 19 for Question 7(c) in the Diagram Booklet. It shows two forces, P and Q, acting at point X.**

**Complete the diagram in Figure 19 to show the size and direction of the resultant force, R, on point X.  
(2 marks)**

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

---

- 8 (a) An electric car is travelling at a speed of  $16.0 \text{ m/s}$ .

The total mass of the car is  $1200 \text{ kg}$ .

- (i) Calculate the kinetic energy, in  $\text{kJ}$ , of the car.  
(2 marks)

kinetic energy =

\_\_\_\_\_  $\text{kJ}$

(continued on the next page)

**8(a) continued.**

- (ii) On a journey, the car transfers energy from the battery at an average rate of 17.5 kW.**

**The battery in the car transfers a total of 126 MJ of energy before it becomes discharged.**

**Calculate the time taken for the battery to become discharged on this journey.**

**Give your answer in hours.  
(2 marks)**

**Answer space continues on the next page.**

**8(a)(ii) continued.**

**time taken = \_\_\_\_\_**  
**hours**

**(continued on the next page)**

**8(a) continued.**

**(iii) Look at Figure 20 for Question 8(a)(iii) in the Diagram Booklet. It shows an electrical device connected to the wheels of an electric car.**

**The electrical device is used as a motor when the car accelerates and as a dynamo when the car decelerates.**

**Explain how using the device can help to increase the time that the car can be driven before the battery becomes discharged.  
(2 marks)**

**Answer space continues on the next page.**

---

---

---

**Turn over**

**8(a)(iii) continued.**

---

---

---

**(continued on the next page)**

**8 continued.**

**(b) The battery can be recharged at a charging point.**

**The charging point provides an average current of 15.0 A to the battery, at a potential difference (voltage) of 400 V.**

**It is claimed that 126 MJ of energy can be transferred to the battery in less than 6 hours.**

**(i) Comment on this claim.**

**Use this equation to support your answer  
(3 marks)**

$$t = \frac{E}{I \times V}$$

**Answer space continues on the next page.**

**Turn over**

**8(b) continued.**

$$t = \frac{E}{I \times V}$$

---

---

---

**(continued on the next page)**



**8(b) continued.**

- (ii) Calculate the total charge that moves into the battery while it is being recharged.  
(2 marks)**

**Use the equation**

$$E = Q \times V$$

**charge = \_\_\_\_\_ C**

**(Total for Question 8 = 11 marks)**

---

- 9 (a) Look at Figure 21 for Question 9(a) in the Diagram Booklet. It shows a pulley system that enables a person to lift a heavy barrel.**

**The person pulls down on the rope to make the barrel rise through 1.2 m.**

**The work done against gravity on the barrel is 1800 J.**

- (i) Calculate the weight of the barrel.  
(2 marks)**

**Use the equation**

**work done = force ×  
distance moved in the direction  
of the force**

**Answer space continues on the next page.**

**9(a) continued.**

**work done = force ×  
distance moved in the direction  
of the force**

**weight of the barrel =**

**\_\_\_\_\_ N**

**(continued on the next page)**

9(a) continued.

(ii) The efficiency of the system is 64%.

Calculate the total work done by the person.  
(2 marks)

Use the equation

$$\text{efficiency} = \frac{(\text{work done against gravity on the barrel})}{(\text{total work done by the person})} \times 100\%$$

work done =

\_\_\_\_\_ J

(continued on the next page)

Turn over

**9(a) continued.**

**(iii) Some energy is wasted due to friction.**

**Suggest ANOTHER reason why some energy is wasted in using this pulley system.  
(1 mark)**

---

---

---

**(continued on the next page)**

**9 continued.**

**\*(b) Look at Figure 22 for Question 9(b) in the Diagram Booklet. A student has the equipment shown in Figure 22.**

**Devise an experiment to investigate how the efficiency of the pulley system varies with the weight of metal being lifted.**

**Your answer should include how you will use your measurements.  
(6 marks)**

**Answer space continues on the next page.**

---

---

---

---

**Turn over**

**9(b) continued.**

[illegible]

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

**Turn over**

- 10 (a) Look at Figure 23 for Question 10 in the Diagram Booklet. It shows a model dynamo.**

**The dynamo contains a coil of wire that can spin inside a permanent magnet.**

**The dynamo produces a D.C. output.**

**A teacher connects a voltmeter to the terminals of the dynamo.**

**The teacher rotates the handle to make the coil spin inside the magnet.**

**Look at Figure 24(a) for Question 10(a) in the Diagram Booklet. It shows the reading on the voltmeter.**

**The teacher then rotates the handle differently.**

**Look at Figure 24(b) for Question 10(a) in the Diagram Booklet. It shows the new reading on the voltmeter.**



**10(a) continued.**

- (i) Which row of the table shows how the rotation of the handle has changed between (a) and (b)? (1 mark)**

	<b>speed of rotation</b>	<b>direction of rotation</b>
<input type="checkbox"/> <b>A</b>	<b>(a) faster than (b)</b>	<b>(a) opposite to (b)</b>
<input type="checkbox"/> <b>B</b>	<b>(a) faster than (b)</b>	<b>(a) same as (b)</b>
<input type="checkbox"/> <b>C</b>	<b>(a) slower than (b)</b>	<b>(a) opposite to (b)</b>
<input type="checkbox"/> <b>D</b>	<b>(a) slower than (b)</b>	<b>(a) same as (b)</b>

**(continued on the next page)**

**10(a) continued.**

**(ii) The teacher connects the dynamo to a lamp.**

**It is now more difficult for the teacher to rotate the handle.**

**Explain why it is more difficult to turn the dynamo when it is connected to a lamp.  
(2 marks)**

---

---

---

---

---

---

**(continued on the next page)**

**Turn over**

**10 continued.**

**(b) Look at Figure 25 for Question 10(b) in the Diagram Booklet. It shows a transformer.**

**The number of turns on the primary coil,  
 $N_p = 800$**

**The potential difference across the primary coil,  
 $V_p = 230 \text{ V}$**

**The number of turns on the secondary coil,  
 $N_s = 18$**

**Calculate the potential difference across the secondary coil.**

**Use an equation selected from the list of equations in the Equation Booklet.  
(3 marks)**

**Answer space continues on the next page.**

**Turn over**

**10(b) continued.**

**potential difference across the  
secondary coil =**

**\_\_\_\_\_ V**

**(continued on the next page)**

**10 continued.**

- \*(c) Look at Figure 26 for Question 10(c) in the Diagram Booklet. It shows a picture of an electrical device and a simplified drawing of the important parts.**

**The device can be used as a loudspeaker or it can be used as a microphone.**

**Compare how the device operates when used as a loudspeaker with how the device operates when used as a microphone.  
(6 marks)**

**Answer space continues on the next page.**

---

---

---

**Turn over**

**10(c) continued.**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**Turn over**

**10(c) continued.**

---

---

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

---

---

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