**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Friday 14 June 2024**

**Afternoon** (Time: 1 hour 45 minutes)

**Paper reference** **1PH0/2H**

**Physics**

**PAPER 2**

**Higher Tier**

**You must have:** Calculator, ruler, Equation Booklet (enclosed)

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **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.*
- 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.

## 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.

## 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.

*Turn over* ▶

Pearson

**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 and electric fields.

(a) Figure 1 shows three charged objects, X, Y and Z.



**Figure 1**

Y has a positive charge and is held stationary.

The charge on Y causes X and Z to move in the directions of the arrows.

Which row of the table is correct for the charges on X and Z?

**(1)**

|  | charge on X | charge on Z |
|---|---|---|
| ⊠ **A** | negative | negative |
| ⊠ **B** | negative | positive |
| ⊠ **C** | positive | negative |
| ⊠ **D** | positive | positive |

(b) Give the meaning of the term **electric field**.

**(1)**

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*P 7 4 4 8 9 A 0 2 3 6*

(c) Figure 2 shows the electric field around a point charge.
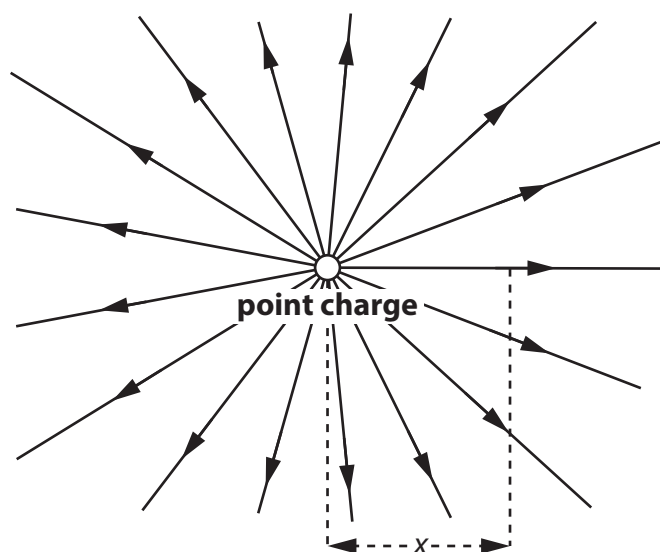


**Figure 2**

(i) State how Figure 2 gives evidence that the point charge is positive.

**(1)**

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(ii) In Figure 2, $x$ is the distance from the point charge.

State how Figure 2 gives evidence that the electric field strength decreases as $x$ increases.

**(1)**

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(iii) Figure 3 shows a graph of electric field strength against distance $x$.
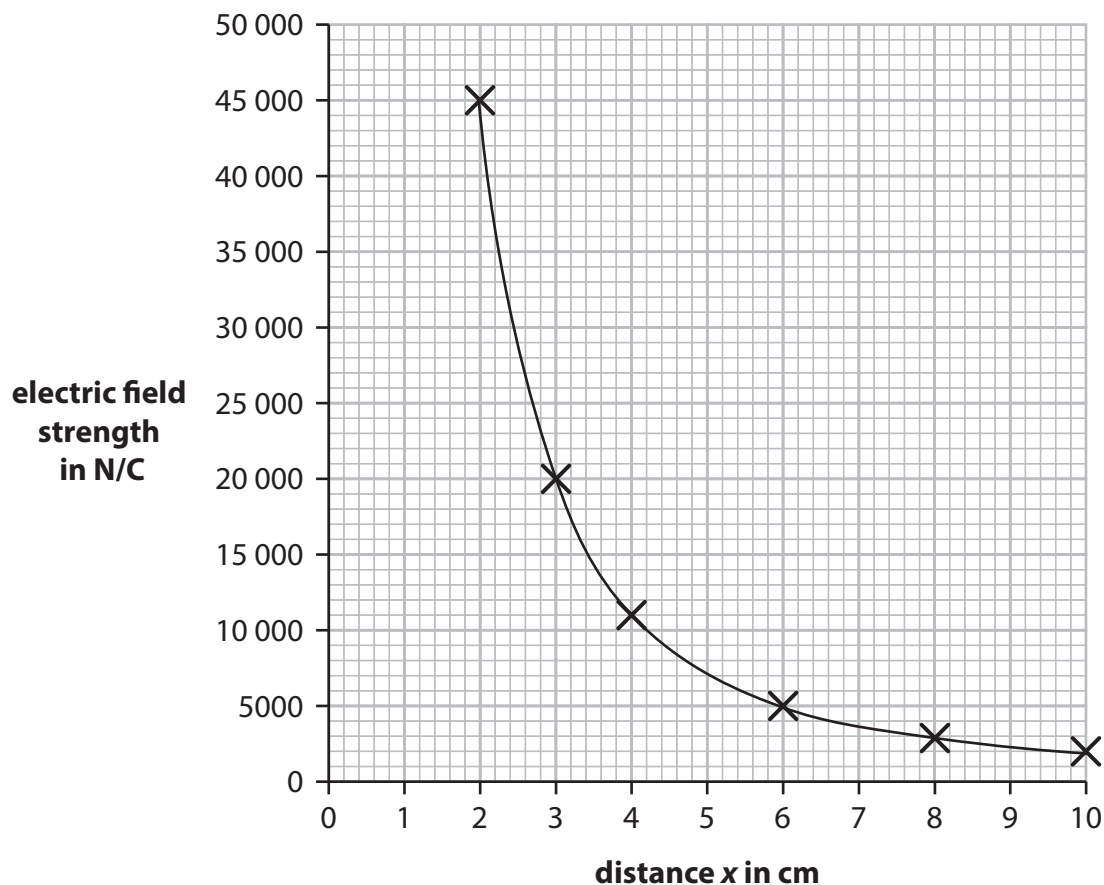


**Figure 3**

The equation relating electric field strength to distance, $x$, is

$$\text{electric field strength} = \frac{A}{x^2}$$

A is a constant.

Using data from the graph in Figure 3, calculate the value of A when $x = 3$ cm.

(2)

A = ........................................................ N cm$^2$/C

**(Total for Question 1 = 6 marks)**

**2** (a) Figure 4 is a circuit diagram.
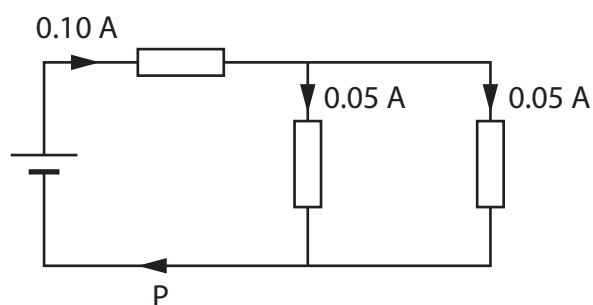


**Figure 4**

The current at P is

(1)

☒ **A** 0.05 A

☒ **B** 0.10 A

☒ **C** 0.15 A

☒ **D** 0.20 A

P 7 4 4 8 9 A 0 5 3 6

(b) Some students investigate resistors in parallel.

The students set up a circuit containing **four** identical resistors.
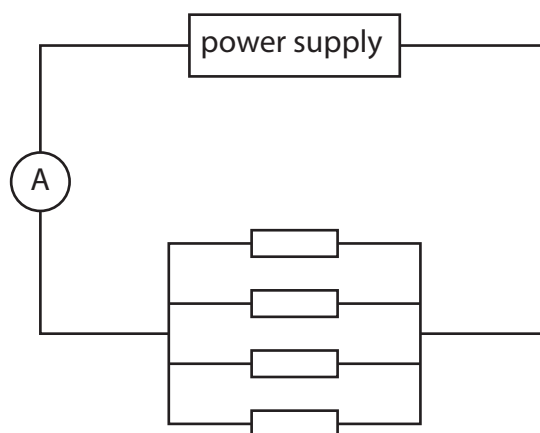
The circuit used is shown in Figure 5.



**Figure 5**

The students measure the current from the power supply and the voltage (p.d.) across the resistors.

(i) On Figure 5, draw a voltmeter connected to measure the voltage (p.d.) across the resistors.

(1)

The students remove one resistor and measure the current and voltage again with only 3 resistors in the circuit.

They repeat the measurements of current and voltage with only 2 resistors in the circuit and then with only 1 resistor in the circuit.

Figure 6 is a table of their results.

| number of resistors | current in mA | voltage in V |
|---|---|---|
| 4 | | 6.00 |
| 3 | 27.3 | 6.00 |
| 2 | 18.2 | 6.00 |
| 1 | 9.1 | 6.00 |

**Figure 6**

(ii) Using data from the table in Figure 6, predict the current from the power supply when there are 4 resistors in the circuit.

**(1)**

current = .......................................................... mA

(iii) Using data from the table in Figure 6, calculate the resistance of **only 1** resistor.

**(3)**

resistance = .......................................................... Ω

(iv) Using data from the table in Figure 6, explain what happens to the **total resistance of the circuit** as the number of resistors in parallel decreases.

**(3)**

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

**3** (a) A coil of copper wire has a mass of 14.1 g.

The density, $\rho$, of copper is 8.96 g/cm³.

Calculate the volume of the copper wire.

Use the equation

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

**(3)**

volume = ............................................................ cm³

(b) Figure 7 gives information about the density of aluminium.

| | density in g/cm$^3$ |
|---|---|
| solid aluminium | 2.70 |
| liquid aluminium | 2.38 |

**Figure 7**

Explain the difference between the density of solid aluminium and the density of liquid aluminium in terms of the arrangement of particles.

**(2)**

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(c) A student boils some water.

Calculate the amount of thermal energy needed to change 60.0 g of water to steam at its boiling point.

The specific latent heat of vaporisation of water, $L$, is $2.26 \times 10^6$ J/kg.

Use the equation

$$Q = m \times L$$

**(2)**

amount of thermal energy = ........................................................ J

(d) Some students measure the volume of a lump of modelling clay using a measuring jug, as shown in Figure 8.



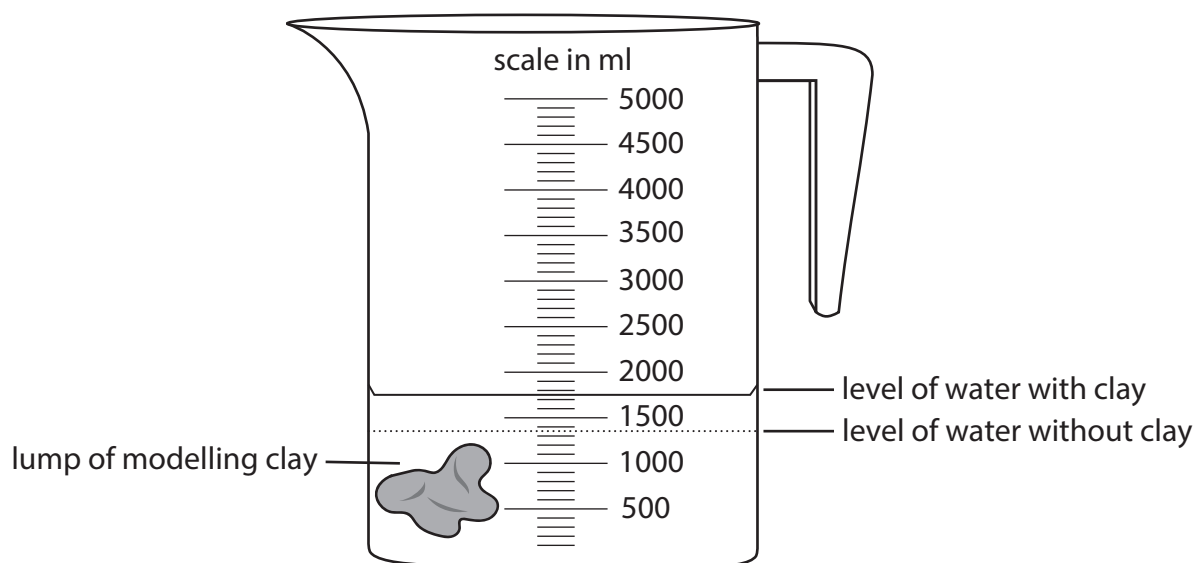**Figure 8**

Using Figure 8, estimate the volume of the modelling clay in cm$^3$.

You may assume that 1 litre = 1000 cm$^3$.

(2)

volume = ....................................................... cm$^3$

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

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**4** (a) Figure 9 shows an object at the bottom of a beaker of water.
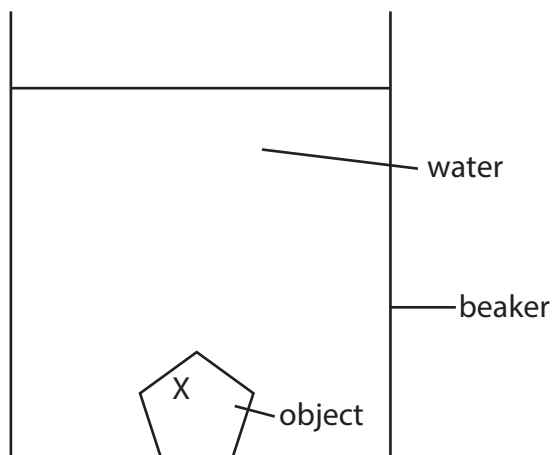


**Figure 9**

Which diagram shows the direction of the force exerted by the water on the object at point X?

(1)

☒ **A**



☒ **B**



☒ **C**



☒ **D**

(b)  Figure 10 shows an ice skater standing on one skate.
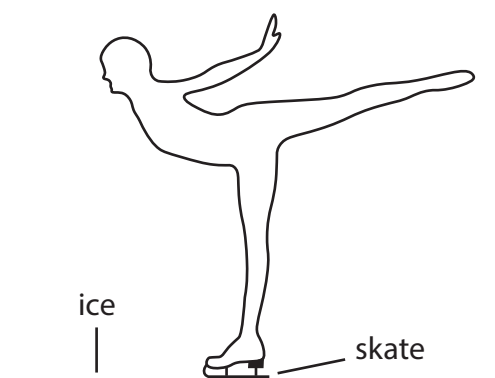


**Figure 10**

Calculate the force the skate exerts on the ice

pressure of skate on ice = 4.8 $\times$ 10$^7$ Pa

area of blade in contact with ice = 1.2 $\times$ 10$^{-5}$ m$^2$

Use the equation

force = pressure $\times$ area

Give your answer to 2 significant figures.

**(3)**

force = ...................................................................................... N

*Turn over* ▶

(c) Figure 11 shows how atmospheric pressure changes with height above sea level.
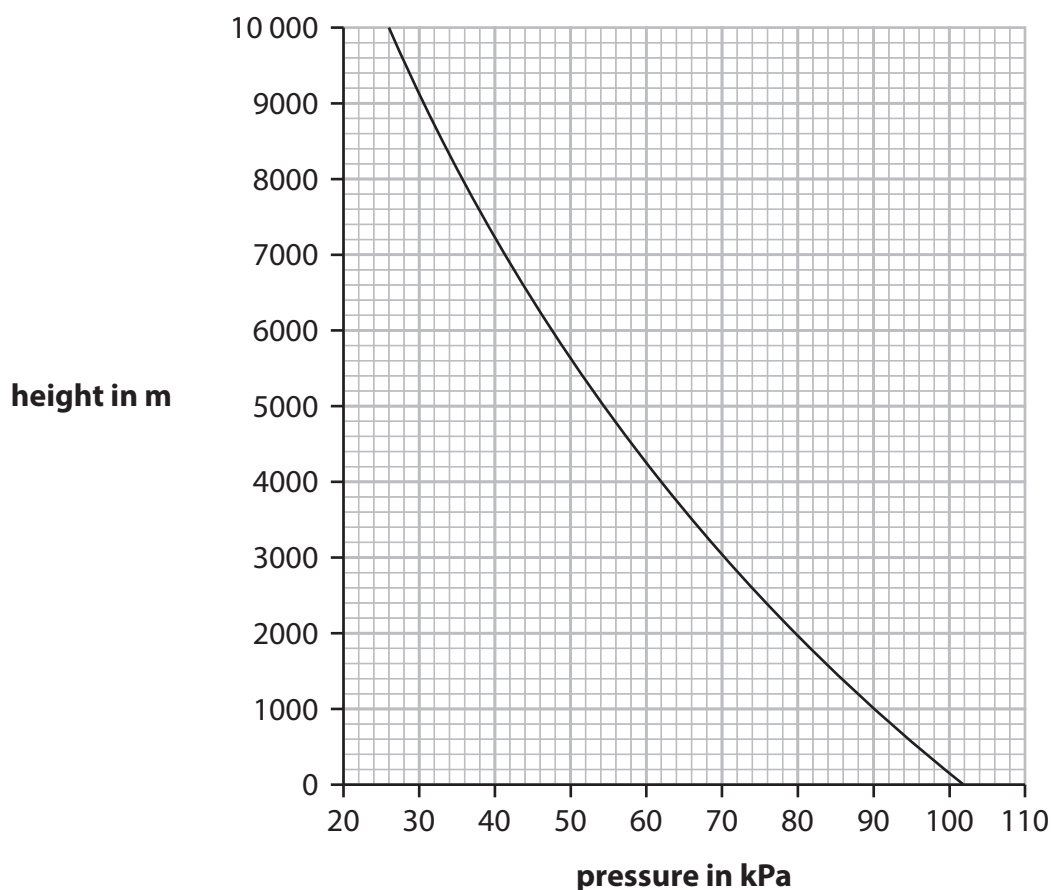


**Figure 11**

(i) Using the graph, describe how atmospheric pressure changes with height above sea level.

**(2)**

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(ii) The top of Mount Everest is 8850 m above sea level.
Using the graph, estimate the atmospheric pressure at the top of Mount Everest.

**(1)**

pressure = ........................................................ kPa

(iii) On a different day, the pressure at sea level is 104 kPa and the pressure at a height of 2500 m is 74 kPa.

Calculate the percentage change in pressure from sea level to the height of 2500 m.

**(2)**

percentage change = ............................................................ %

(d) Figure 12 is a model representing molecules of the Earth's atmosphere.

top of atmosphere
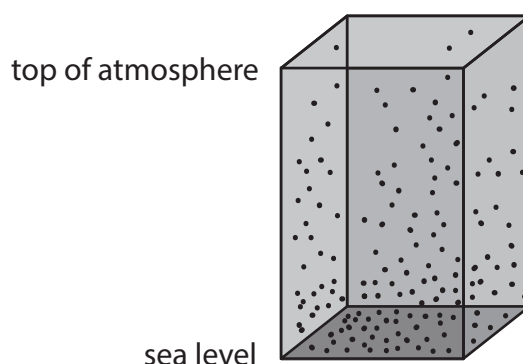
sea level

**Figure 12**

Use Figure 12 to explain how the density of the air varies with height above sea level.

**(2)**

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

**5** (a) Figure 13 represents the Earth.

Figure 13 shows **two** magnetic compass needles placed near to the Earth's surface, at points Q and T.

Each magnetic compass needle can rotate about its central dot.

compass needle

Q        R        Earth's surface

P        not to scale

T
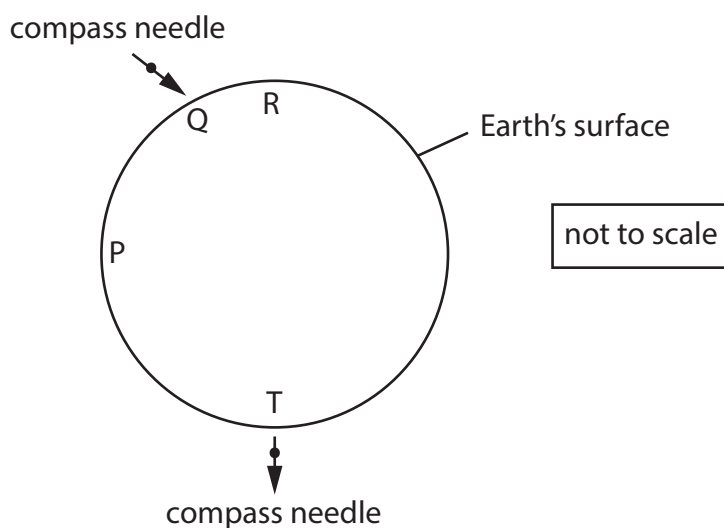
compass needle

**Figure 13**

(i) A compass needle is placed at point P and another at point R, near to the Earth's surface.

On Figure 13, draw an arrow at point P and an arrow at point R to show the direction of the compass needle at each point.

(2)

(ii) Explain why the arrows point in the directions you have drawn in part (i).

You may draw on Figure 13 to help your answer.

(3)

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(b) Figure 14 shows a wire placed between the poles of a U-shaped magnet.

The wire is connected to a resistor and a battery.

The wire carries a current in the direction shown.

The wire is perpendicular to the magnetic field of the magnet.
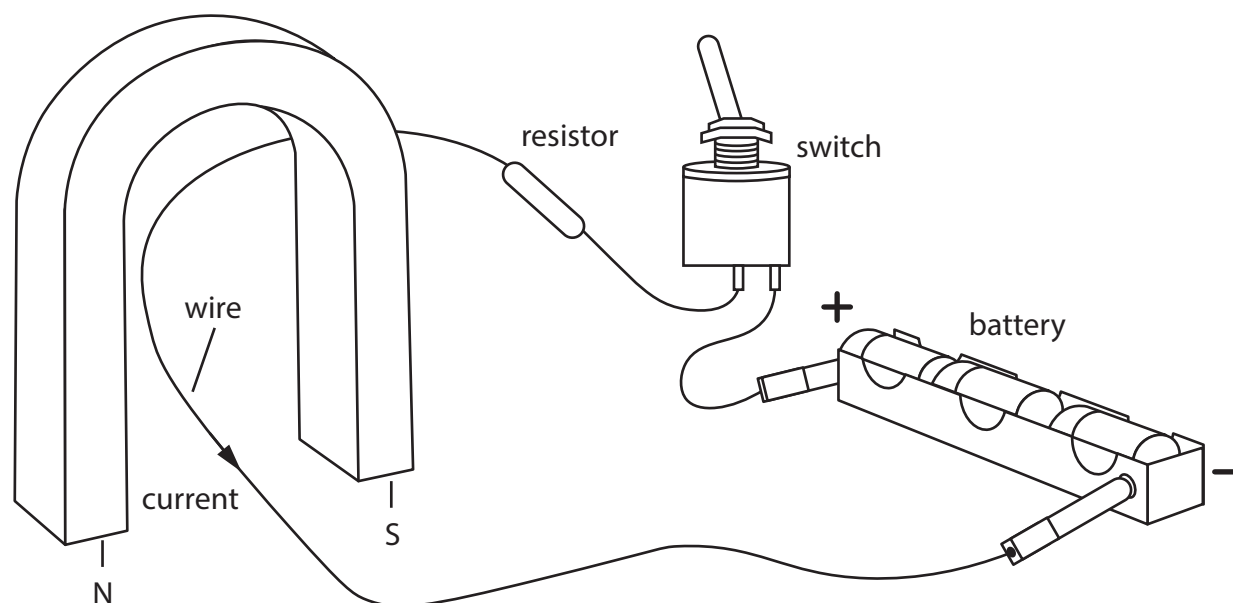


**Figure 14**

 (i) Draw an arrow on Figure 14 to show the direction of the force, F, acting on the wire.

Label this arrow 'F'.

**(1)**

 (ii) State **one** practical way of reversing the direction of force F.

**(1)**

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(iii) In Figure 14

- current in the wire = 3.2 A

- length of wire in the magnetic field = 0.042 m

- magnitude of the force on the wire = 0.078 N

Calculate the magnitude of the magnetic flux density between the two poles of the magnet.

**(2)**

magnetic flux density = .............................................................. T

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

*P74489A01836*

**6** (a) Which of these is a unit for the moment of a force?

**(1)**

⊠ **A** $N/m^2$

⊠ **B** $N/m$

⊠ **C** $N\ m$

⊠ **D** $N\ m^2$

(b) Figure 15 shows a claw hammer about to remove a nail from a piece of wood.
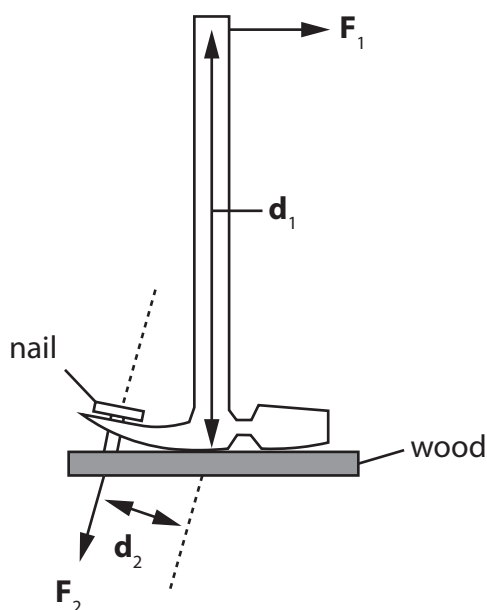


**Figure 15**

(i) State the principle of moments.

**(2)**

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(ii) Calculate the force $F_2$ shown in Figure 15.

Use the following data

- $F_1$ = 11.4 N

- $d_1$ = 24.5 cm

- $d_2$ = 3.7 cm

**(3)**

$F_2$ = ............................................................ N

(c) Figure 16 shows a system of gears used in a clock.

20 teeth



60 teeth

Q

P
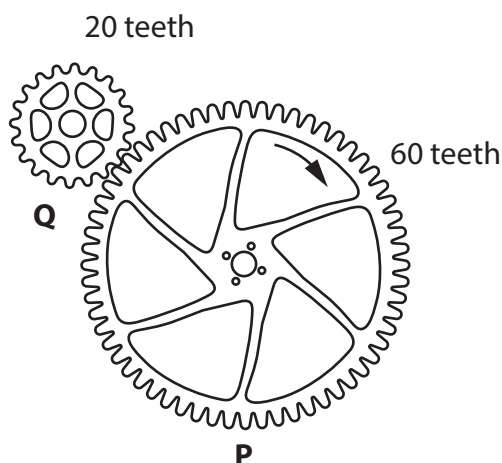
**Figure 16**

(i) Gear wheel **P** rotates clockwise at a rate of 1.0 revolution per **minute**.

Calculate the rotation rate of gear wheel **Q** in revolutions per **hour**.

**(2)**

rotation rate of **Q** = ............................................................ revolutions per hour

(ii) Describe how a gear wheel could be added to the system to give a clockwise rotation with **double** the rotation rate of gear wheel **Q**.

Your answer should refer to

• the position of the gear wheel

• the number of teeth in the gear wheel.

(2)

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

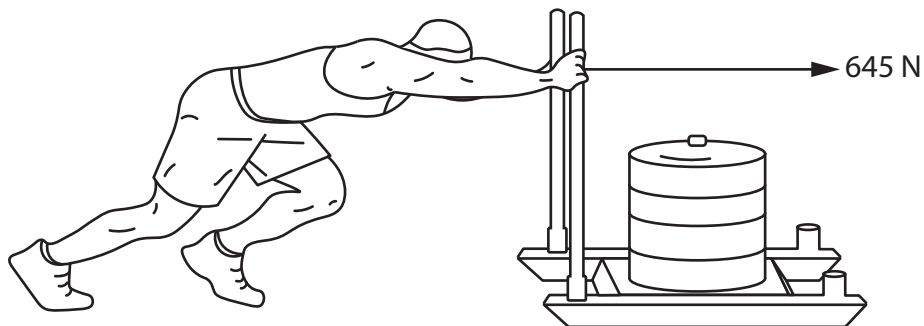**7** (a) Figure 17 shows an athlete training with a push sled.

→ 645 N

**Figure 17**

The athlete pushes the sled with a force of 645 N.

Calculate the distance the sled moves when the force of 645 N does 7440 J of work on the sled.

Give your answer to an appropriate number of significant figures.

**(3)**

distance moved = .............................................................. m

(b) Figure 18 shows an electric motor lifting a set of masses.

to power supply — motor

string
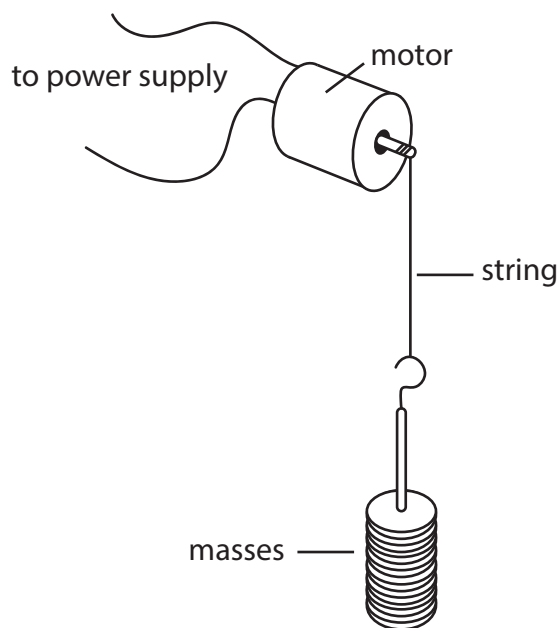
masses

**Figure 18**

(i) Describe an experiment, using the apparatus in Figure 18, to determine the gravitational potential energy gained by the masses as they are lifted.

Your description should include any measuring devices to be used.

You may add to the diagram in Figure 18 if it helps your answer.

**(4)**

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(ii) In one experiment, the change in gravitational potential energy of the masses was 5.8 J.

The total mass lifted was 320 g.

Calculate the vertical height the masses travelled through.

Use g = 10 N/kg.

(2)

height = ........................................................ m

(iii) The efficiency of the motor was 59%.

State **one** reason why the motor was not 100% efficient.

(1)

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**(Total for Question 7 = 10 marks)**

**8** (a) A student investigates how current varies with potential difference across a filament lamp.

The student uses a power supply, a variable resistor, the filament lamp and two meters.

Part of the circuit diagram is shown in Figure 19.

Complete the circuit diagram needed for this investigation.

**(3)**



**Figure 19**

*P 7 4 4 8 9 A 0 2 5 3 6*

(b) Another student repeats the investigation in part (a) using a data logger.

The data logger records observations using sensors instead of meters. The sensors are connected to a computer to collect and display the observations.

The data logger collects 555 pairs of data in 2 minutes.

The results are shown in Figure 20.
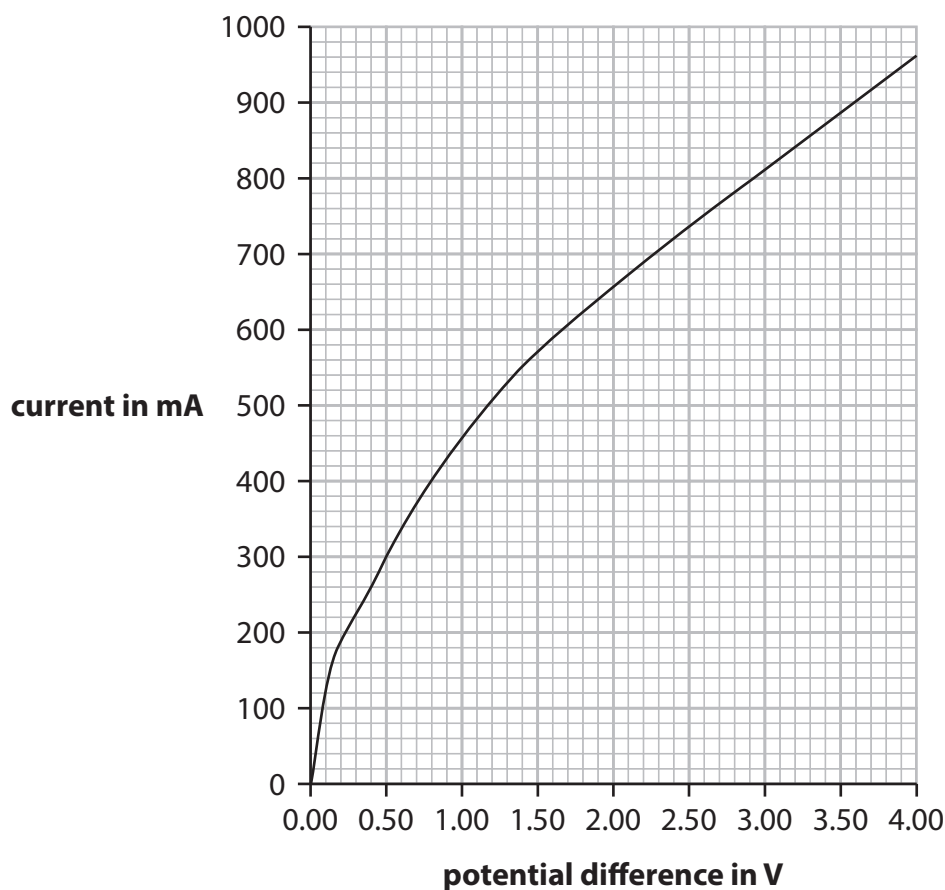


**Figure 20**

(i) Suggest **one** advantage of using a data logger instead of meters in this investigation.

(1)

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(ii) Describe how current varies with potential difference in the graph in Figure 20.

(2)

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(iii) Use data from the graph in Figure 20 to show how the resistance changes with potential difference for the filament lamp.

**(2)**

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(c) Which of these equations is correct?

**(1)**

☒ **A** time $= \dfrac{\text{charge}}{\text{current}}$

☒ **B** time $=$ charge $\times$ current

☒ **C** time $= \dfrac{\text{power}}{\text{energy}}$

☒ **D** time $=$ power $\times$ energy

(d) The unit of work is the joule.

Starting with the meaning of work, we may obtain an equivalent unit of work as Nm.

Using work $= F \times d$

unit of work $=$ unit of force $\times$ unit of distance $=$ Nm

The unit of potential difference is the volt.

Explain how, starting with the meaning of potential difference, we may obtain an equivalent unit of potential difference.

**(2)**

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

**9** (a) Which of these changes of state describes sublimation?

(1)

⊠ **A** from gas to liquid

⊠ **B** from liquid to solid

⊠ **C** from solid to gas

⊠ **D** from solid to liquid

(b) Figure 21 shows a sealed aerosol can.



**Figure 21**

The sealed can is taken from a cold room into a warm room.

If the volume of the can remains the same, which of these does **not** change?

⊠ **A** the pressure inside the can

⊠ **B** the mean speed of the particles inside the can

⊠ **C** the mean distance between the particles inside the can

⊠ **D** the mean size of the momentum of the particles inside the can
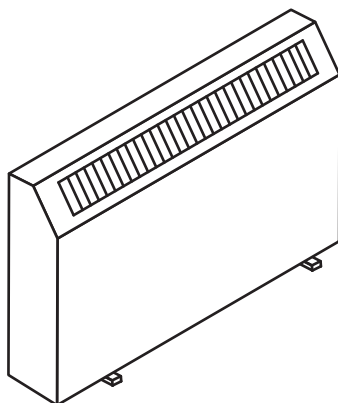
(1)

(c) Figure 22 shows a storage heater.



**Figure 22**

The storage heater contains bricks.

The bricks are heated electrically.

The electrical heater supplies 210 kJ of energy to each brick in the storage heater.

One brick has a mass of 5.8 kg.

The specific heat capacity for the brick is 860 J/kg K.

(i) Use this data to calculate the increase in temperature of the brick.

(2)

temperature increase = ........................................................ °C

(ii) The actual temperature increase will be smaller than you calculated in (i).

Explain why the actual temperature increase will be smaller than the value in (i).

(2)

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*(d) Describe an investigation to determine the value for the specific heat capacity of water.

Your answer should include details of

- the apparatus needed

- the experimental procedure

- how the value may be calculated from the measurements taken.

You may draw a diagram to help your answer.

**(6)**

P 7 4 4 8 9 A 0 3 0 3 6

**(Total for Question 9 = 12 marks)**

**10** (a) Figure 23 shows a magnet being dropped through a coil.

The coil is connected to a sensitive voltmeter.
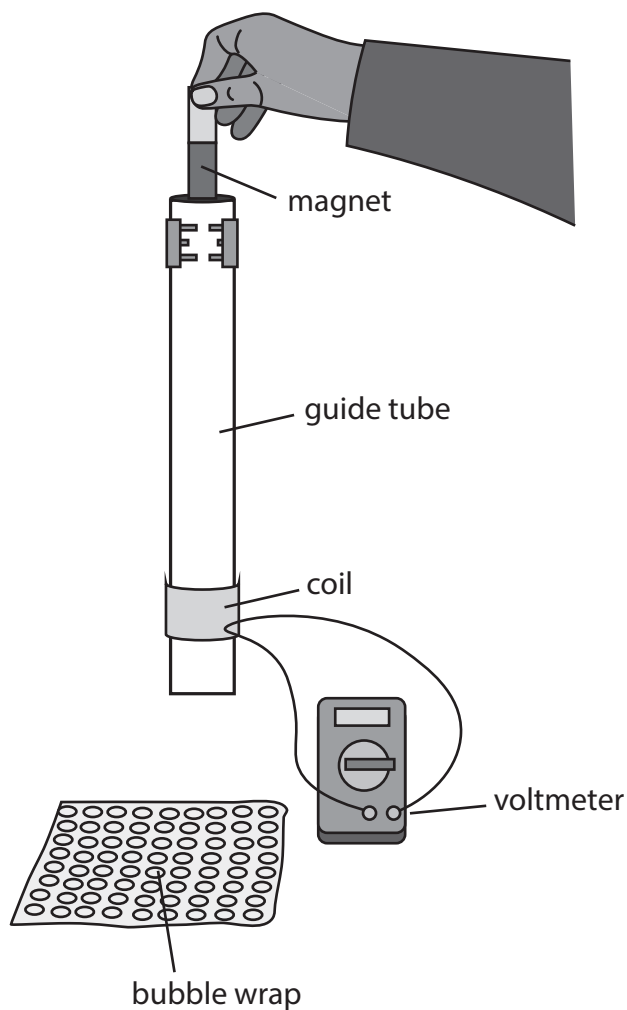


**Figure 23**

(i) Explain why the voltmeter shows a reading as the magnet passes through the coil.

**(3)**

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(ii) A student develops this investigation to find out how the reading on the voltmeter depends on the height the magnet is dropped from.

Describe how the student could use the arrangement in Figure 23 to do this investigation.

(4)

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*(b)  A transformer converts a voltage of 11 000 V to 230 V.

Explain how the design of this transformer enables the voltage to be converted from 11 000 V to 230 V.

Your answer should include

- details of the structure of a transformer

- how a transformer works, using ideas of electromagnetic induction

- how the design of this transformer enables this exact voltage of 230 V to be obtained.

You may draw a diagram to help your answer.

(6)

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**(Total for Question 10 = 13 marks)**

**TOTAL FOR PAPER = 100 MARKS**

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# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

## Friday 14 June 2024

# Physics
## PAPER 2

**Higher Tier**

**Equation Booklet**
Do not return this Booklet with the question paper.

P 7 4 4 8 9 A

Pearson

If you're taking **GCSE (9–1) Combined Science** or **GCSE (9–1) Physics**, you will need these equations:

**HT** = higher tier

| | | |
|---|---|---|
| | distance travelled = average speed × time | |
| | acceleration = change in velocity ÷ time taken | $a = \dfrac{(v-u)}{t}$ |
| | force = mass × acceleration | $F = m \times a$ |
| | weight = mass × gravitational field strength | $W = m \times g$ |
| **HT** | **momentum = mass × velocity** | $\boldsymbol{p = m \times v}$ |
| | change in gravitational potential energy = mass × gravitational field strength × change in vertical height | $\Delta GPE = m \times g \times \Delta h$ |
| | kinetic energy = 1/2 × mass × (speed)$^2$ | $KE = \dfrac{1}{2} \times m \times v^2$ |
| | efficiency = $\dfrac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$ | |
| | wave speed = frequency × wavelength | $v = f \times \lambda$ |
| | wave speed = distance ÷ time | $v = \dfrac{x}{t}$ |
| | work done = force × distance moved in the direction of the force | $E = F \times d$ |
| | power = work done ÷ time taken | $P = \dfrac{E}{t}$ |
| | energy transferred = charge moved × potential difference | $E = Q \times V$ |
| | charge = current × time | $Q = I \times t$ |
| | potential difference = current × resistance | $V = I \times R$ |
| | power = energy transferred ÷ time taken | $P = \dfrac{E}{t}$ |
| | electrical power = current × potential difference | $P = I \times V$ |
| | electrical power = (current)$^2$ × resistance | $P = I^2 \times R$ |
| | density = mass ÷ volume | $\rho = \dfrac{m}{V}$ |

| | | |
|---|---|---|
| | force exerted on a spring = spring constant $\times$ extension | $F = k \times x$ |
| | (final velocity)$^2$ – (initial velocity)$^2$ = 2 $\times$ acceleration $\times$ distance | $v^2 - u^2 = 2 \times a \times x$ |
| **HT** | **force = change in momentum ÷ time** | $F = \dfrac{(mv - mu)}{t}$ |
| | energy transferred = current $\times$ potential difference $\times$ time | $E = I \times V \times t$ |
| **HT** | **force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density $\times$ current $\times$ length** | $F = B \times I \times l$ |
| | For transformers with 100% efficiency, potential difference across primary coil $\times$ current in primary coil = potential difference across secondary coil $\times$ current in secondary coil | $V_P \times I_P = V_S \times I_S$ |
| | change in thermal energy = mass $\times$ specific heat capacity $\times$ change in temperature | $\Delta Q = m \times c \times \Delta\theta$ |
| | thermal energy for a change of state = mass $\times$ specific latent heat | $Q = m \times L$ |
| | energy transferred in stretching = 0.5 $\times$ spring constant $\times$ (extension)$^2$ | $E = \dfrac{1}{2} \times k \times x^2$ |

If you're taking **GCSE (9–1) Physics**, you also need these extra equations:

| | | |
|---|---|---|
| | moment of a force = force $\times$ distance normal to the direction of the force | |
| | pressure = force normal to surface ÷ area of surface | $P = \dfrac{F}{A}$ |
| **HT** | $\dfrac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \dfrac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}$ | $\dfrac{V_p}{V_S} = \dfrac{N_p}{N_S}$ |
| | to calculate pressure or volume for gases of fixed mass at constant temperature | $P_1 \times V_1 = P_2 \times V_2$ |
| **HT** | **pressure due to a column of liquid = height of column $\times$ density of liquid $\times$ gravitational field strength** | $P = h \times \rho \times g$ |

**END OF EQUATION LIST**

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