Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Physics (1PH0) Foundation

Resource Set Topic H – Test 1: Particle model, Forces and Matter

Questions

(Public release version)

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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

2 (a) Figure 1 shows a fixed mass of gas inside a cylinder with a movable piston.

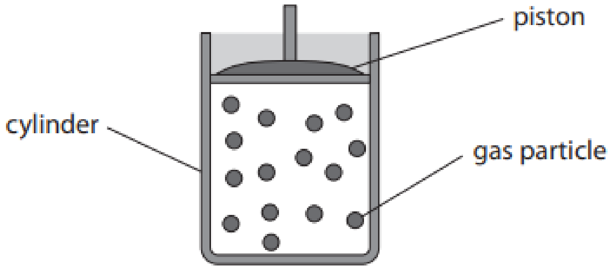


Figure 1

(i) Describe, in terms of **gas particles**, how the gas exerts a pressure on the cylinder.

(3)

Gas particles are in continuous motion inside the cylinder and they collide with the walls on the cylinder. The forces that the particles exert per unit area gives rise to pressure.

(ii) Figure 2 shows the same gas squashed into a smaller volume.

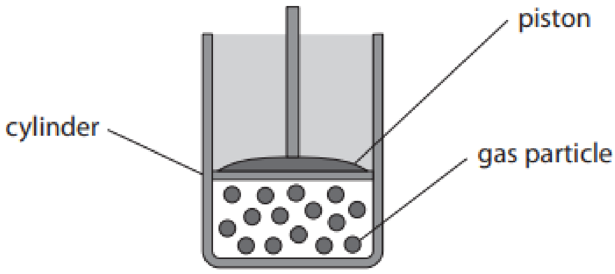


Figure 2

State what happens to the pressure the gas exerts on the cylinder when the volume of gas is reduced, as in Figure 2.

(1)

Pressure increases

(iii) State what happens to the gas particles when the volume of the gas is reduced, as in Figure 2.

(1)

They get closer to each other.

2

(b) Figure 3 shows an oxygen cylinder.

Figure 3

The volume of the gas in the cylinder is 2100 cm^3.

When the gas is released into the atmosphere the volume of the gas is 8600 cm^3.

The pressure of the atmosphere is 98 kPa.

Calculate the pressure of the gas when it is in the cylinder.

Use the equation

$$P_1 = \frac{P_2 \times V_2}{V_1}$$

(2)

$$= \frac{98 \times 8600}{2100}$$

$$= 401.3$$

$$\approx 400$$

pressure of the gas in the cylinder = 400 kPa

8 (a) A student uses the apparatus in Figure 17 to determine the specific heat capacity of water.

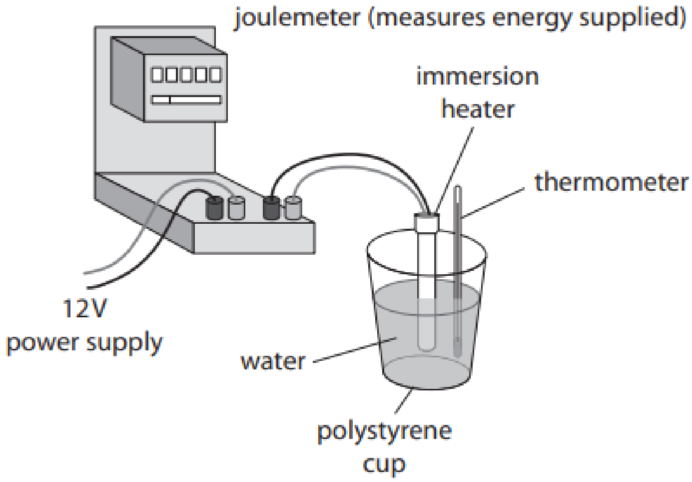


Figure 17

(i) State the measurements needed to calculate the specific heat capacity of water.

(4)

Energy supplied

Mass of the water

Temperature of water before heat was applied

Temperature of water after heat was applied

(ii) State **two** ways that the apparatus could be adapted to improve the procedure.

(2)

1 Cover the polystyrene cup with a lid to minimize the heat loss to the surrounding

2 Use a stirrer and constantly stir the water to distribute heat across the water

(b) The student decides to measure the temperature of the water every minute while it is being heated.

Figure 18 shows a graph of the student's results.

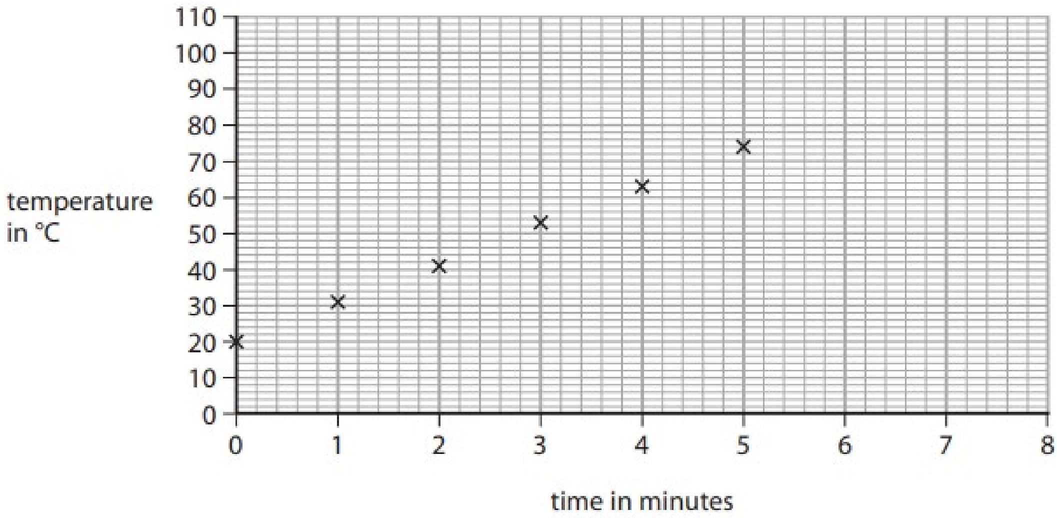


Figure 18

Predict the temperature of the water if the heating continues up to 8 minutes.

(1)

temperature of the water = 100 °C

(c) Another student decides to melt some ice.

The student melts 380 g of ice at 0 °C.

The specific latent heat of fusion of ice is 3.34×10^5 J/kg.

Calculate the thermal energy needed to melt the ice.

Select an equation from the list of equations at the end of this paper.

(2)

$E = mL$

$= \frac{380}{1000} \times 3.34 \times 10^5$

$= 126920$

≈ 127000

thermal energy needed = 1.27×10^5 J

(d) The volume of 380 g of ice is 410 cm³.

Calculate the density of the ice in g/cm³.

(2)

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

$= \frac{380}{410}$

$= 0.9268$

≈ 0.93

density = 0.93 g/cm³

4 (a) The particles of a gas exert a pressure on the walls of a container.

Which row of the table is correct when the pressure of the gas changes?

(1)

	pressure of gas	number of particles colliding with the walls of the container each second
☐ **A**	increases	stays the same
☒ **B**	increases	increases
☐ **C**	decreases	stays the same
☐ **D**	decreases	increases

(b) A digital thermometer gives a temperature reading of 23 °C.

Calculate the value of this temperature in kelvin.

(1)

23+273 = 296 K

(c) A student changes the volume of gas in a container and notes the pressure for different values of the volume.
The results are shown in Figure 6 and plotted on the graph in Figure 7.

volume in ml	pressure in kPa
10	260
12	200
20	140
25	150
30	100
40	75
50	65

Figure 6

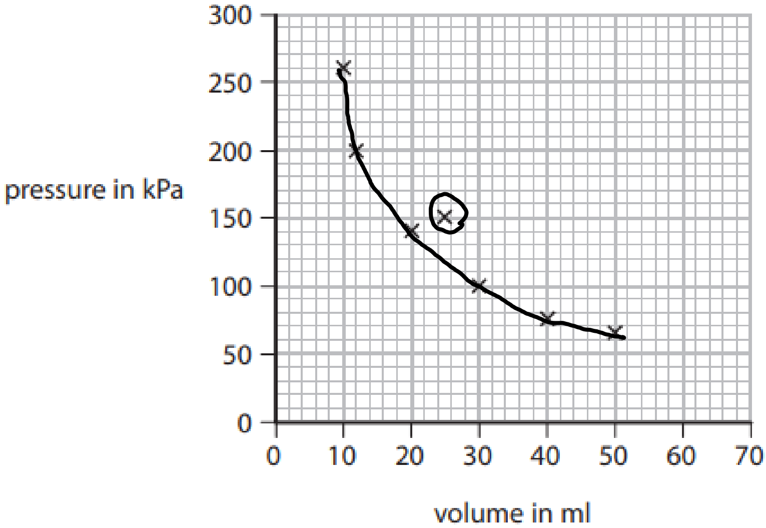


Figure 7

(i) Identify the anomalous result plotted on Figure 7 by drawing a circle on Figure 7 around the anomalous point.

(1)

(ii) Draw the curve of best fit on Figure 7.

(1)

(iii) Describe how the graph in Figure 7 would change if the student repeated the experiment with the same mass of gas, at a higher constant temperature.

(2)

The curve will shift up because the gas has a higher pressure due to the increase in temperature as frequency of the collisions increases.

(d) Figure 8 shows a small container of carbon dioxide at high pressure.

The pressure, P_1, in the container is 8.00 MPa.

The volume, V_1, of the container is 14.5 cm³.

Figure 8

The container is pierced and all of the carbon dioxide goes into a large balloon.

The volume of gas, V_2, in the large balloon is 1160 cm³.

Calculate the pressure, P_2, in the large balloon.

Use the equation

$$P_1V_1 = P_2V_2$$

(3)

$8 \times 14.5 = P_2 \times 1160$

$\frac{8 \times 14.5}{1160} = P_2$

pressure in the large balloon = 0.1 MPa

6 (a) Solid, liquid and gas are states of matter.

Which process describes the change from a solid to a liquid?

(1)

☒ **A** melting

☐ **B** freezing

☐ **C** evaporation

☐ **D** condensation

(b) A student determines the density of a liquid.

The student puts an empty measuring cylinder on a balance (Figure 10a).
The student then adds liquid to the measuring cylinder (Figure 10b).

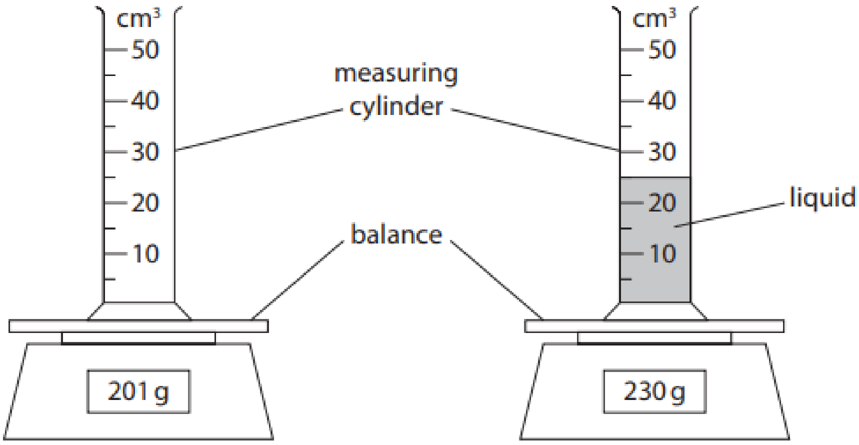


Figure 10a **Figure 10b**

Calculate the mass of liquid added and the volume of liquid added.

Use the information in Figures 10a and 10b.

(i) mass of liquid added = 29 g

(1)

(ii) volume of liquid added = 25 cm^3

(1)

(iii) Which equation should the student use to calculate the density of the liquid?

(1)

☐ **A** density = mass + volume

☐ **B** density = mass − volume

☐ **C** density = mass × volume

☒ **D** density = $\frac{\text{mass}}{\text{volume}}$

(iv) State **two** improvements the student could make to this investigation.

(2)

1 Using different volumes of water and calculating respective densities and obtaining a mean.

2 Repeat the experiment and obtain a mean

(c) (i) Figure 11 shows an electric kettle.

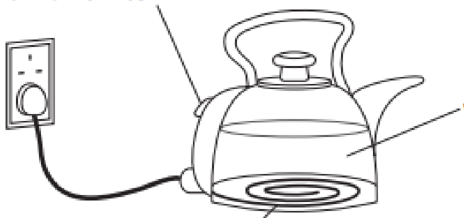


Figure 11

The kettle contains 1.5 kg of water.

The kettle is switched on.

Calculate the energy needed to raise the temperature of the water by 50 °C.

Specific heat capacity of water = 4200 J/kg °C

Use the equation

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

$\Delta Q = 1.5 \times 4200 \times 50$

energy needed = 3.15×10^5 J

(ii) The amount of energy, E, needed to bring the water to boiling point is 670 000 J.

The kettle has a power of 3500 W.

Calculate the time, t, it takes to bring the water to boiling point.

Use the equation

$$P = \frac{E}{t}$$

(3)

$$3500 = \frac{670000}{t}$$

$$t = \frac{670000}{3500}$$

$$= 191.43 \approx 191$$

time to bring the water to boiling point = 191 s

7 Figure 16 shows a metal container with a movable piston.

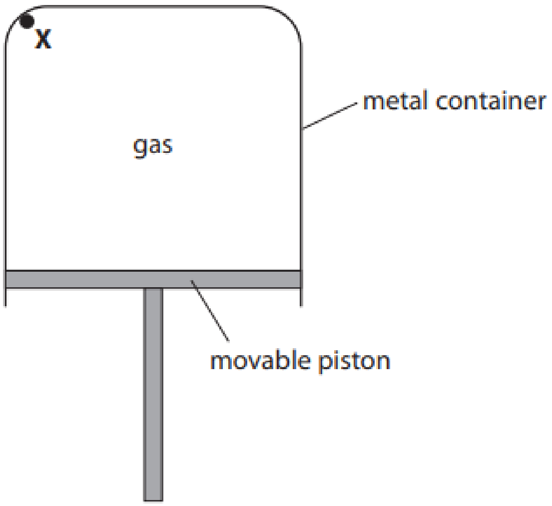


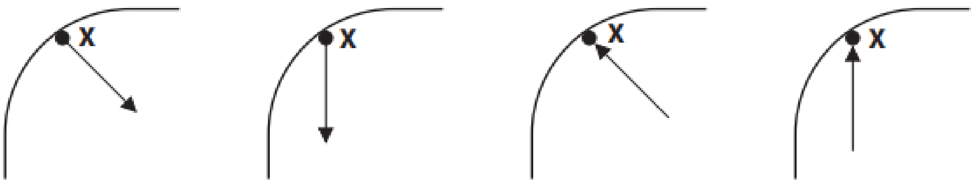
Figure 16

Point X is on the inner surface of the container.

The gas in the container is at a higher pressure than the air outside the container.

(a) Which of these shows the direction of the force, due to the gas, on the container at point X?

(1)



☐ **A** ☐ **B** ☒ **C** ☐ **D**

(b) The pressure of the gas in Figure 16 (P_1) is 120 kPa.

The volume of the gas in Figure 16 (V_1) is 2500 cm³.

The piston is pushed up slowly so that the temperature of the gas does not change.

The new volume of the gas (V_2) is 1600 cm³.

Calculate the new pressure of the gas, P_2.

Use the equation

$$P_2 = \frac{P_1 \times V_1}{V_2}$$

(2)

$= \frac{120 \times 2500}{1600}$

$= 187.5$

≈ 188

new pressure, P_2 = 188 kPa

(c) Figure 17 shows a bicycle pump with a closed end.

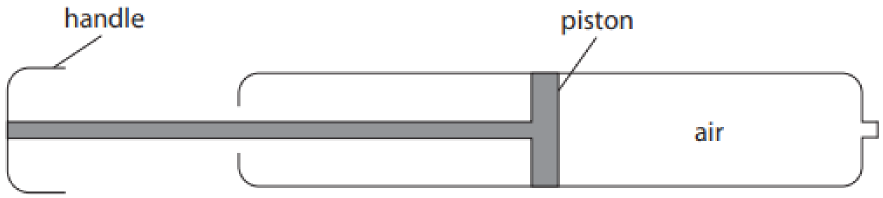


Figure 17

The area of the piston is $2\,cm^2$.

A force of 28 N is applied to the piston.

Calculate the pressure, in N/cm^2, of the piston on the air in the bicycle pump.

(3)

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

$$= \frac{28}{2} = 14$$

pressure = 14 N/cm^2

*(d) A container is sealed so that the mass of the gas inside cannot change.

The volume of the gas is changed and the pressure is measured at different volumes.

The temperature of the gas does not change.

Figure 18 is a graph of the results.

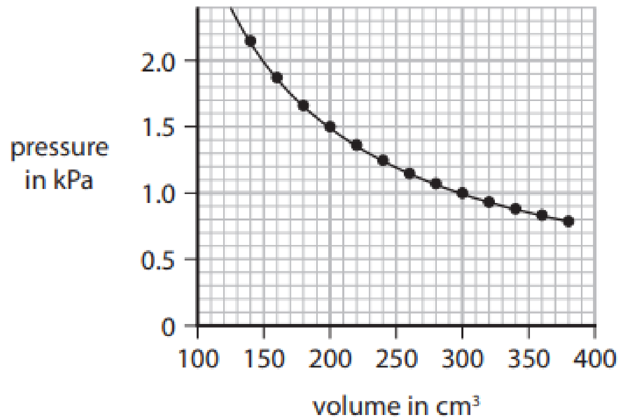


Figure 18

Explain, in terms of the movement of particles, why there is a pressure on the container and why the pressure changes as shown in Figure 18.

(6)

The Gas particles are in continuous motion inside the cylinder and they collide with the walls on the cylinder. The forces that the particles exert per unit area gives rise to pressure. As the volume of the container increases the distance between the particles increases. There is more surface area and since the force is the same, the pressure decreases.

8 (a) Figure 19 shows a small piece of copper about 3 cm high.

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Figure 19

A student wants to determine the density of copper.

The student uses a balance to measure the mass of the piece of copper.

(i) Explain how the student could measure the volume of the piece of copper.

(3)

Measure the initial volume of water in a large measuring cylinder. Add the piece of copper into the measuring cylinder and measure the volume reading. The difference between the reading and the initial reading is the volume of the copper.

(ii) The mass of the piece of copper is 0.058 kg.

The volume of the piece of copper is 6.5×10^{-6} m^3.

Calculate the density of copper.

(2)

$$d = \frac{m}{v} = \frac{0.058}{6.5 \times 10^{-6}}$$

$$= 8923 \approx 8920$$

density of copper = 8920 kg/m^3

(b) A student wants to determine the specific heat capacity of copper.

Figure 20 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

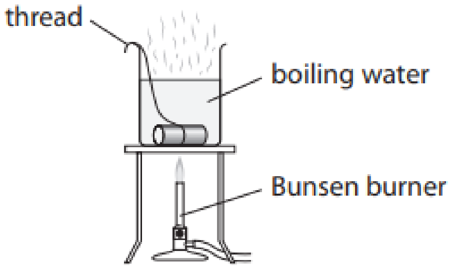

Figure 20

The student leaves the piece of copper in the boiling water so that the copper reaches a temperature of 100 °C.

The student uses the thread to take the piece of copper out of the boiling water.

The student puts the hot piece of copper into a different beaker of cold water at 20 °C.

The apparatus is shown in Figure 21.

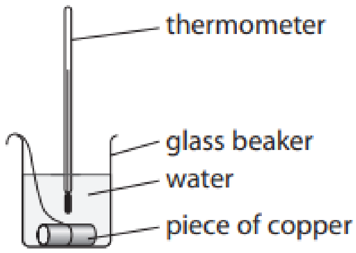

Figure 21

The student assumes that the thermal energy gained by the water equals the thermal energy lost by the piece of copper.

The water and copper both reach a temperature of 22 °C.

The cold water gains 1050 J of energy.

The mass of the piece of copper is 0.058 kg.

(i) Calculate a value for the specific heat capacity of copper, using these results.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

$1050 = 0.058 \times c \times (100 - 22)$

$c = \frac{1050}{0.058 \times 78} = 232$

specific heat capacity of copper from these results = 232 J/kg °C

(ii) The value for the specific heat capacity of copper obtained from the student's results is lower than the correct value.

State **two** ways that the experiment could be improved to give a value that is closer to the correct value.

(2)

1 Cover the cold water beaker with a lid during the cooling to reduce heat gain from the surrounding

2 When the copper is suspended, ensure it is not in direct contact with the bottom of the beaker.

(c) A long piece of wire is made into a coil as shown in Figure 22.

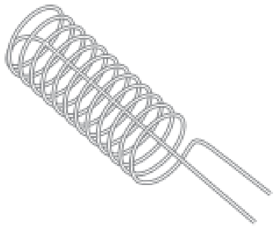

Figure 22

The coil is connected to a low voltage power supply.

Describe how this coil could be used instead of the Bunsen burner in Figure 20.

(2)

Electrons that flow through the metal coil collide with neighboring particles provide resistance and heating up. When kept under the beaker it produces the required heat expected from the Bunsen burner.

TOTAL FOR PAPER IS 61 MARKS