3.3 Particle Model & Pressure

Question Paper

Course	AQA GCSE Physics
Section	3. Particle Model of Matter
Topic	3.3 Particle Model & Pressure
Difficulty	Medium

Time allowed: 60

Score: /43

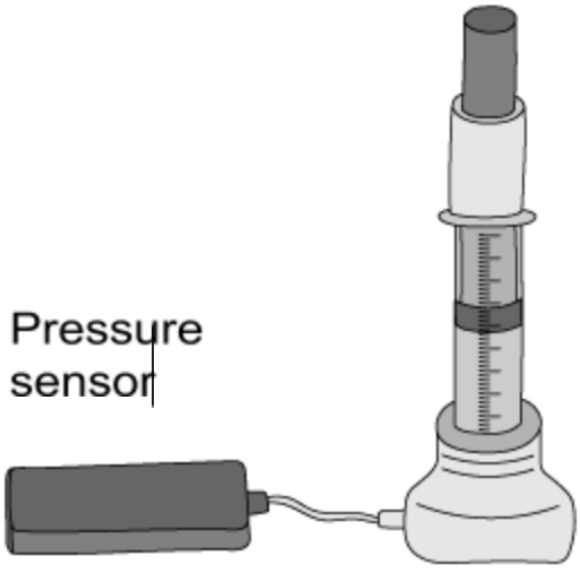
Percentage: /100

Question 1a

A student carried out an investigation to see how the pressure of a gas varied with its volume.

Figure 1 shows the apparatus used.

Figure 1



The student presses down on the syringe.

As the volume of the gas in the syringe decreases, the pressure of the gas increases.

(a) The student only recorded one set of results.

Give **two** reasons why taking repeat readings could provide more accurate data.

[2 marks]

[2 marks]

Question 1b

(b) If the student pushes the plunger too quickly, the temperature of the gas increases.

Explain how the increased temperature would affect the pressure exerted by the gas.

[2 marks]

[2 marks]

Question 1c

(c) The student records the following results:

- volume = 20 cm^3
- pressure = 1.2×10^5 Pa

The student then expands the gas at a constant temperature by raising the plunger slowly.

Calculate the pressure when the volume of the gas is 50 cm^3.

[3 marks]

[3 marks]

Question 1d

(d) A car tyre is inflated using a foot pump.

Explain why the internal energy of the air in the tyre increases as it is inflated.

[2 marks]

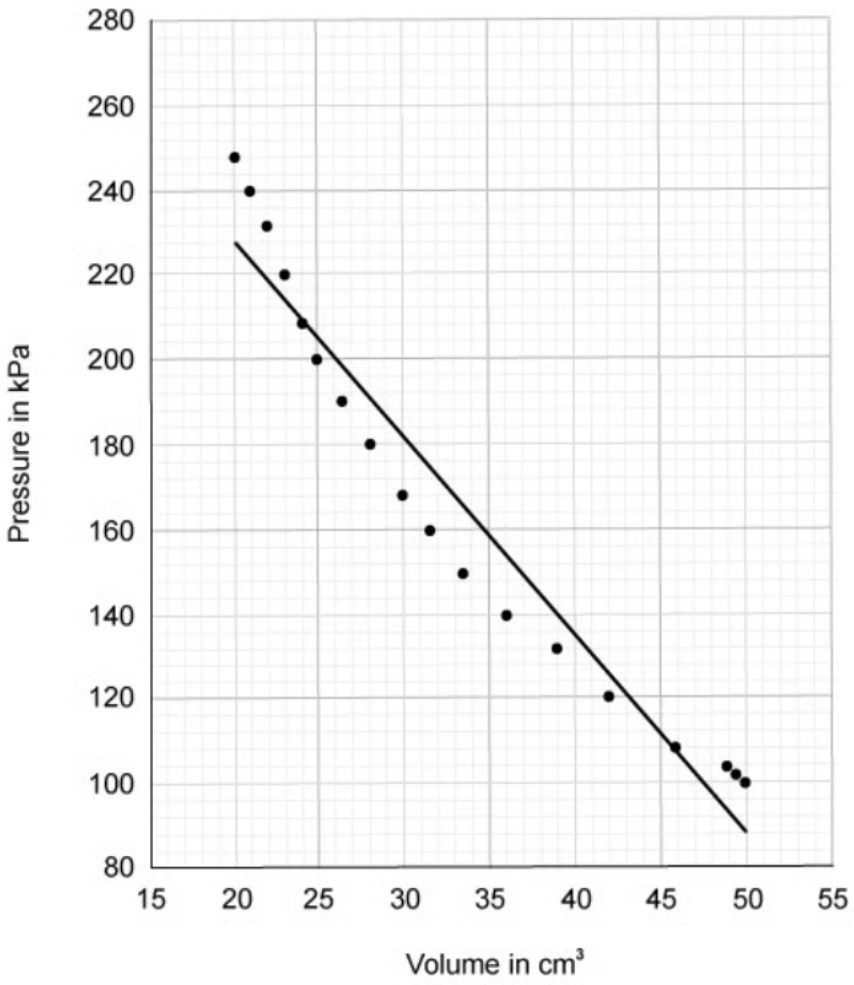
[2 marks]

Question 2a

A student carries out an investigation to measure how the pressure of a gas changes as its volume changes.

Her results are shown in **Figure 2** below.

Figure 2



(a) What conclusion can be drawn from the data in the graph?

Use data from the graph in your answer.

Give the reason for your answer.

[3 marks]

[3 marks]

Question 2b

(b) Explain, in terms of particles, why the pressure in the gas increases as its volume decreases.

[4 marks]

[4 marks]

Question 3a

(a) Using ideas about particles, explain how air inside a container exerts pressure.

[3 marks]

[3 marks]

Question 3b

(b) A car tyre exerts a pressure of 203 kPa on the ground.

The contact area between the tyre and the ground is 0.021 m^2.

Calculate the force that the tyre exerts on the ground.

[3 marks]

[3 marks]

Question 3c

(c) The air in the tyre heats up when the car is driven.

Explain how this affects the contact between the tyre and the ground.

You should assume that the volume of the air remains constant.

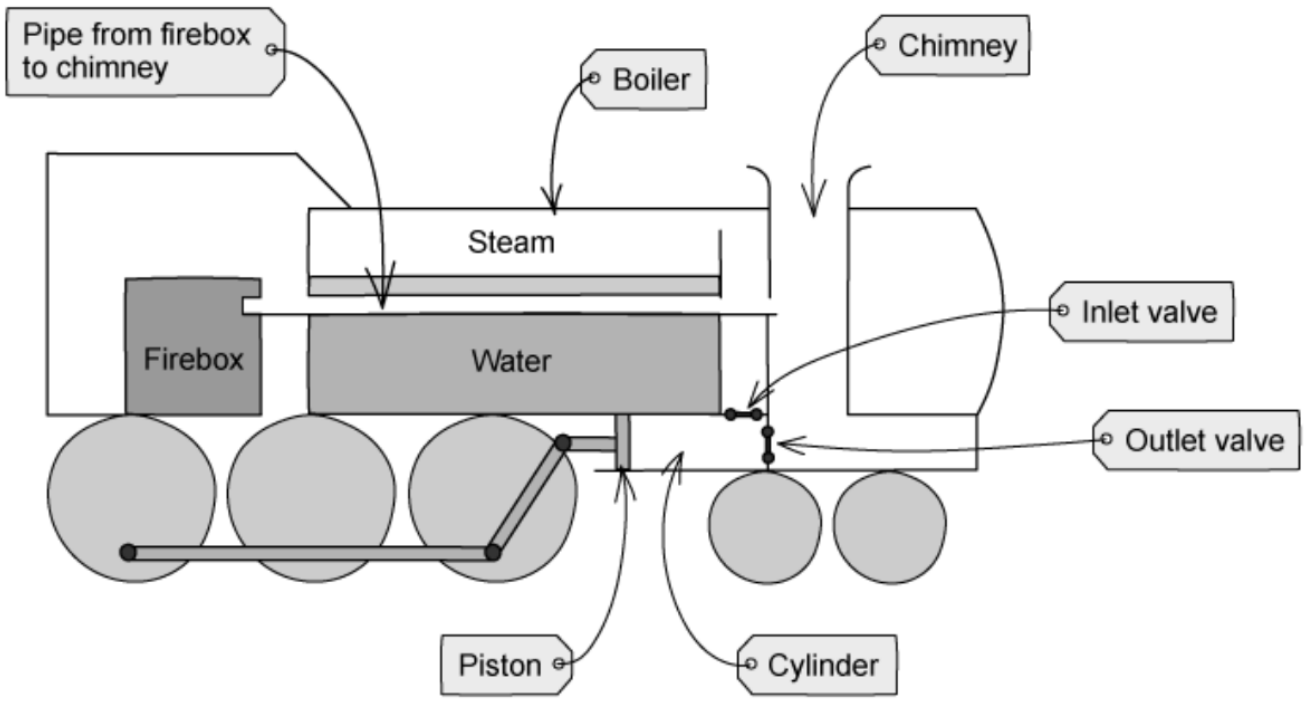
[3 marks]

[3 marks]

Question 4a

Figure 3 below shows the basic details of the steam engine used in a steam locomotive.

Figure 3



(a) The following is a description of how the steam engine works:

- Hot air from the firebox passes through a pipe to the chimney
- Water is heated as the pipe passes through the boiler
- The water boils to form steam
- The steam is trapped by the closed inlet valve and continues to be heated.

Explain why the pressure of the steam increases as its temperature increases.

[3 marks]

[3 marks]

Question 4b

(b) When the inlet valve is opened, the steam moves into the cylinder.

The pressure of the steam is 1.53 MPa.

The area of the piston is 0.0285 m^2.

Calculate the force exerted by the steam on the piston.

[3 marks]

[3 marks]

Question 4c

(c) When the steam flows through the outlet valve, its pressure changes from 1.53 MPa to 101 kPa.

The volume of steam in the cylinder is 0.022 m^3

Calculate the volume of the steam after it has passed through the outlet valve.

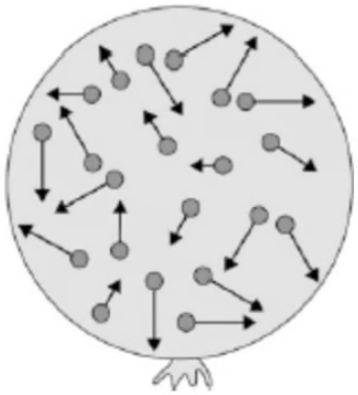
[3 marks]

[3 marks]

Question 5a

Figure 4 shows the particles of helium inside a balloon.

Figure 4



(a) Describe the motion of particles inside the helium balloon

[2 marks]

[2 marks]

Question 5b

(b) A small canister of pressurised helium is used to fill some balloons.

Using ideas about particles, explain why the pressure in the canister decreases as the helium is used to fill the balloons.

[3 marks]

[3 marks]

Question 5c

(c) The cannister supplies 20 000 cm^3 of helium at a pressure of 2400 kPa.

The volume of each balloon is 1200 cm^3.

The pressure inside a balloon is atmospheric pressure, 100 kPa.

Calculate how many balloons can be filled using the helium from the canister.

You should assume the temperature of the helium remains constant.

[4 marks]

[4 marks]