EXAM PAPERS PRACTICE

# Particle Model And Pressure

**These practice questions can be used by students and teachers and is**

Suitable for GCSE AQA Physics Topic Question 8463

## Level: GSCE AQA 8463

## Subject: Physics

## Exam Board: GCSE AQA

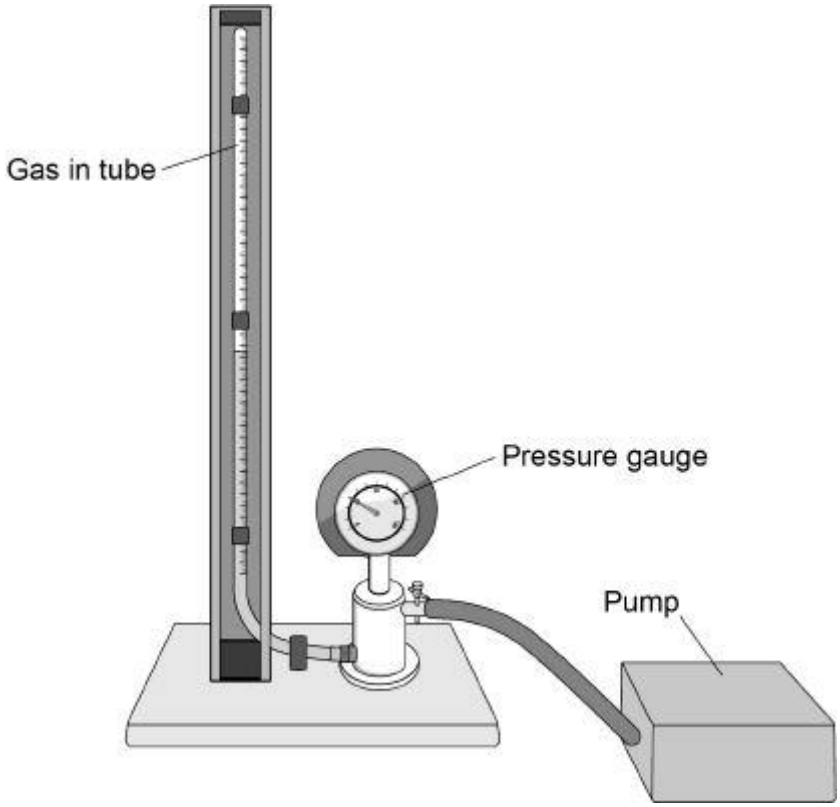
## Topic: Particle Model And Pressure

## Q1.

A student investigated how the pressure exerted by a gas varied with the volume of the gas.

**Figure 1** shows the equipment the student used.

**Figure 1**




A pump was used to compress the gas in a tube. As the volume of the gas 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.

1. _____

_____

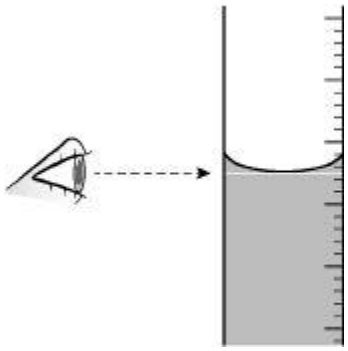
2. _____

_____

**(2)**

(b) **Figure 2** shows the position of the student's eye when taking volume measurements.

**Figure 2**



Explain what type of error would be caused if the student's eye was **not** in line with the level of the liquid in the tube.

_____

_____

_____

_____

**(2)**

(c) If the gas is compressed too quickly the temperature of the gas increases.

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

_____

_____

_____

_____

**(2)**

(d) One of the student's results is given below.

pressure = $1.6 \times 10^5$ Pa
volume = 9.0 $cm^3$

Calculate the volume of the gas when the pressure was $1.8 \times 10^5$ Pa.

The temperature of the gas was constant.

_____

_____

_____

_____

Volume = _____ $cm^3$

**(3)**

(e) **Figure 3** shows a person using a bicycle pump to inflate a tyre.

**Figure 3**

The internal energy of the air increases as the tyre is inflated.

Explain why.

_____

_____

_____

_____

**(2)**

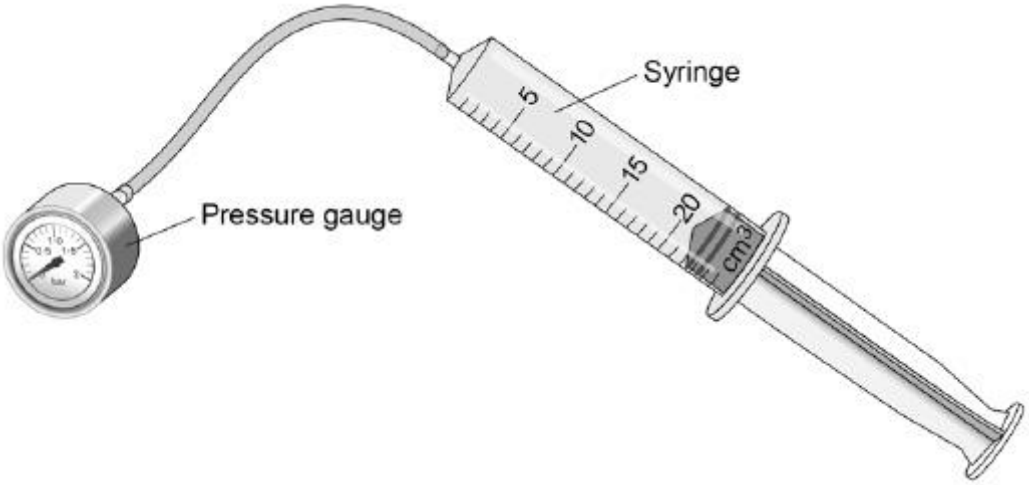
**(Total 11 marks)**

## Q2.

A student investigated how the pressure of a gas varied with the volume of the gas.

The mass and temperature of the gas were constant.

The diagram shows the equipment the student used.




(a) What is the range of the syringe?

Tick **one** box.

- 0 to 1 $cm^3$ ☐
- 0 to 5 $cm^3$ ☐
- 0 to 20 $cm^3$ ☐
- 0 to 25 $cm^3$ ☐

**(1)**

(b) What type of variable was the mass of gas?

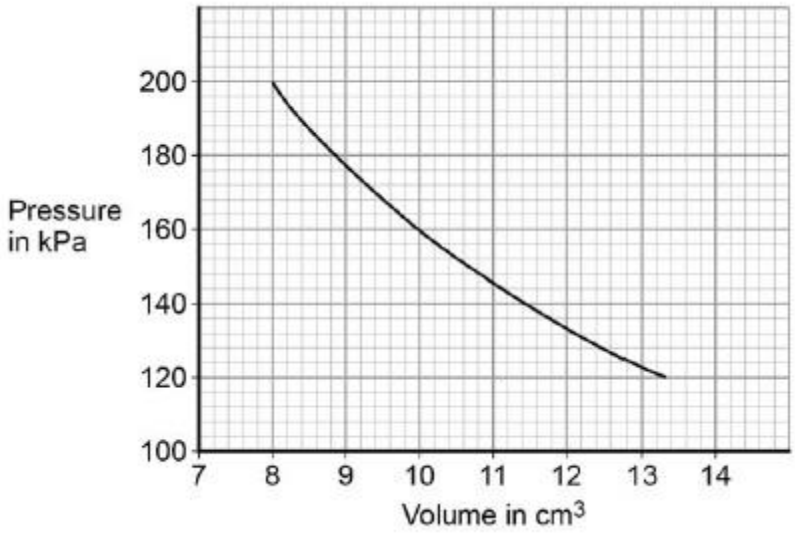
Tick **one** box.

- Control ☐
- Dependent ☐
- Independent ☐

**(1)**

The student compressed the gas in the syringe and read the pressure from the pressure gauge.

The graph shows the student's results.




(c) The student concluded that when the pressure was multiplied by the corresponding volume the answer was the same.

Use data from the graph to show that the student's conclusion was correct.

_____

_____

_____

_____

_____

_____

**(2)**

(d) Complete the sentences.

Choose the answers from the box.

Each answer may be used once, more than once or not at all.

| | | |
|---|---|---|
| **decreases** | **increases** | **remains the same** |

When the gas is compressed, the volume of gas in the syringe _____ .

So the number of collisions each second between the gas particles inside the syringe and the inside surface of the syringe _____ .

This means the force exerted on the inside surface of the container walls _____ .

**(3)**

**(Total 7 marks)**

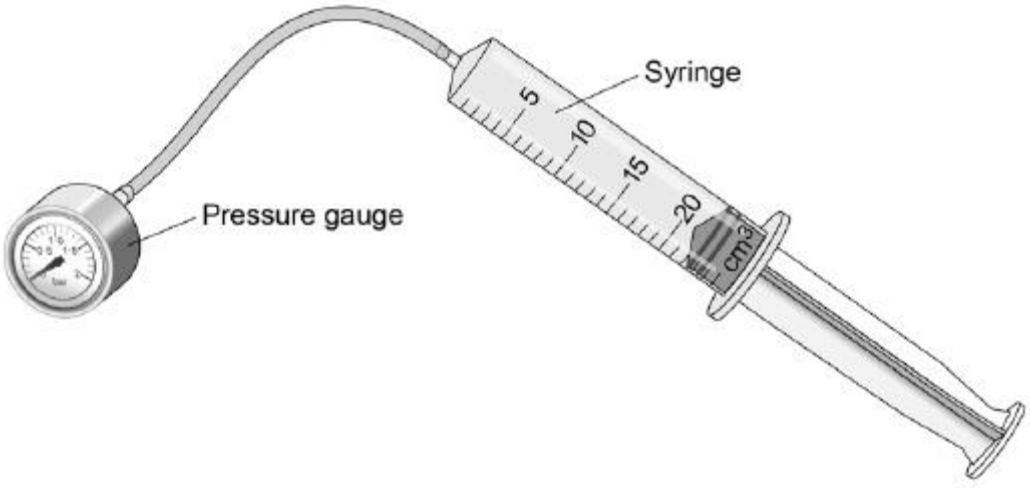
## Q3.

A student investigated how the pressure of a gas varied with the volume of the gas.

The mass and temperature of the gas were constant.

**Figure 1** shows the equipment the student used.

**Figure 1**




(a) What is the resolution of the syringe?

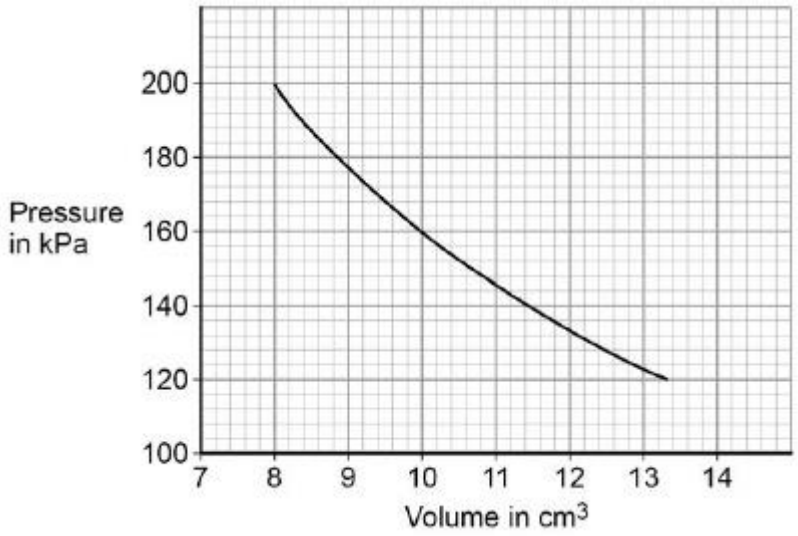
_____ $cm^3$

**(1)**

The student compressed the gas in the syringe and read the pressure from the pressure gauge.

**Figure 2** shows the student's results.

**Figure 2**




(b) What conclusion can the student make from the data in **Figure 2**?

Use data from **Figure 2** in your answer.

Give the reason for your answer.

**(3)**

(c) Explain why the pressure in the gas increases as the gas is compressed.

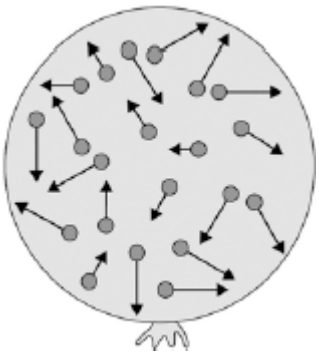
_____

**(4)**

**(Total 8 marks)**

## Q4.

The figure below shows a balloon filled with helium gas.



(a) Describe the movement of the particles of helium gas inside the balloon.

_____

_____

_____

_____

**(2)**

(b) What name is given to the total kinetic energy and potential energy of all the particles of helium gas in the balloon?

Tick **one** box.

External energy ☐

Internal energy ☐

Movement energy ☐

**(1)**

(c) Write down the equation which links density, mass and volume.

_____

**(1)**

(d) The helium in the balloon has a mass of 0.00254 kg.

The balloon has a volume of 0.0141 $m^3$.

Calculate the density of helium. Choose the correct unit from the box.

| | | |
|---|---|---|
| **$m^3$ / kg** | **kg / $m^3$** | **kg $m^3$** |

Density = _____ Unit _____

**(3)**

**(Total 7 marks)**

## Q5.

**In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The information in the box is about the properties of solids and gases.

Solids:
- have a fixed shape
- are difficult to compress (to squash).

Gases:
- will spread and fill the entire container
- are easy to compress (to squash).

Use your knowledge of kinetic theory to explain the information given in the box.

You should consider:
- the spacing between the particles
- the movement of individual particles
- the forces between the particles.

Extra space _____

**(Total 6 marks)**

Mark schemes

## Q1.

(a) any **two** from:

- calculate a mean
- reduces the effect of random errors

  *reduces human error is insufficient*
- identify / remove anomalies

  *allow to assess the repeatability of the data*

**2**

(b) random error

*allow a parallax error*
*human error is insufficient*

**1**

(because) eye position would not be the same each time (relative to the liquid)

*allow systematic error only if it is clear that the student always viewed liquid level from above meniscus (or below)*

**1**

(c) (a temperature increase would) increase the pressure in the tube (even if the volume was constant)

**1**

(because a higher temperature would mean) higher (average) kinetic energy of molecules / particles

*allow higher (average) speed for higher (average) kinetic energy*

**1**

(d) $1.6 \times 10^5 \times 9.0$ ($= 1.44 \times 10^6$)

**1**

$1.44 \times 10^6 = 1.8 \times 10^5 \times V$

*allow for **2** marks*

$$V = \frac{1.6 \times 10^5 \times 9.0}{1.8 \times 10^5}$$

**1**

**or**

$$V = \frac{1.44 \times 10^6}{1.8 \times 10^5}$$

$V = 8.0$ ($cm^3$)

**1**

*an answer of 8.0 ($cm^3$) scores **3** marks*

(e) work is done on the air (in the tyre)

**1**

so the temperature (of the air) increases

*allow the (average) kinetic energy of the particles increases*

1

**[11]**

## Q2.

(a) 0 to 25 $cm^3$

1

(b) control

1

(c) 2 sets of data recorded from line of best fit to show that the product is the same in both cases (1600)

*allow for **1** mark one set of calculated data for one point on the line of best fit*

2

(d) decreases

1

increases

1

increases

1

**[7]**

## Q3.

(a) 1 ($cm^3$)

1

(b) pressure is inversely proportional to volume

1

data to prove inversely proportional relationship

*eg 8 × 200 = 1600*

*and 10 × 160 = 1600*

*if no other marks score allow for **1** mark: as volume decreases pressure increases*

2

(c) (as the gas is compressed) the volume of gas decreases

1

(so there are) more frequent collisions of gas particles with container walls

1

(and) each particle collision with the wall causes a force

1

(so there is a) greater force on walls

1

**[8]**

## Q4.

(a) range of speeds

1

moving in different directions

*accept random motion*

1

(b) internal energy

1

(c) density = mass / volume

1

(d) 0.00254 / 0.0141

1

0.18

1

*accept 0.18 with no working shown for the **2** calculation marks*

kg / $m^3$

1

**[7]**

## Q5.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

**0 marks**
No relevant content.

**Level 1 (1–2 marks)**
Considers either solid or gas and describes at least one aspect of the particles.

**or**

Considers both solids and gases and describes an aspect of each.

**Level 2 (3–4 marks)**
Considers both solids and gases and describes aspects of the particles.

**or**

Considers one state and describes aspects of the particles and explains at least one of the properties.

**or**

Considers both states and describes an aspect of the particles for both and explains a property for solids or gases.

**Level 3 (5–6 marks)**

Considers both states of matter and describes the spacing and movement / forces between the particles. Explains a property of both solids and gases.

**examples of the points made in the response**

***extra information***

**Solids**

- (particles) close together
- (so) no room for particles to move closer (so hard to compress)
- vibrate about fixed point
- strong forces of attraction (at a distance)
- the forces become repulsive if the particles get closer
- particles strongly held together / not free to move around (shape is fixed)

*any explanation of a property must match with the given aspect(s) of the particles.*

**Gases**

- (particles) far apart
- space between particles (so easy to compress)
- move randomly
- negligible / no forces of attraction
- spread out in all directions (to fill the container)

**[6]**