AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.3.1

Particle motion in gases

Past-paper questions

Tier	**Higher**
Question groups	**7**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.3.3.1 Particle motion in gases

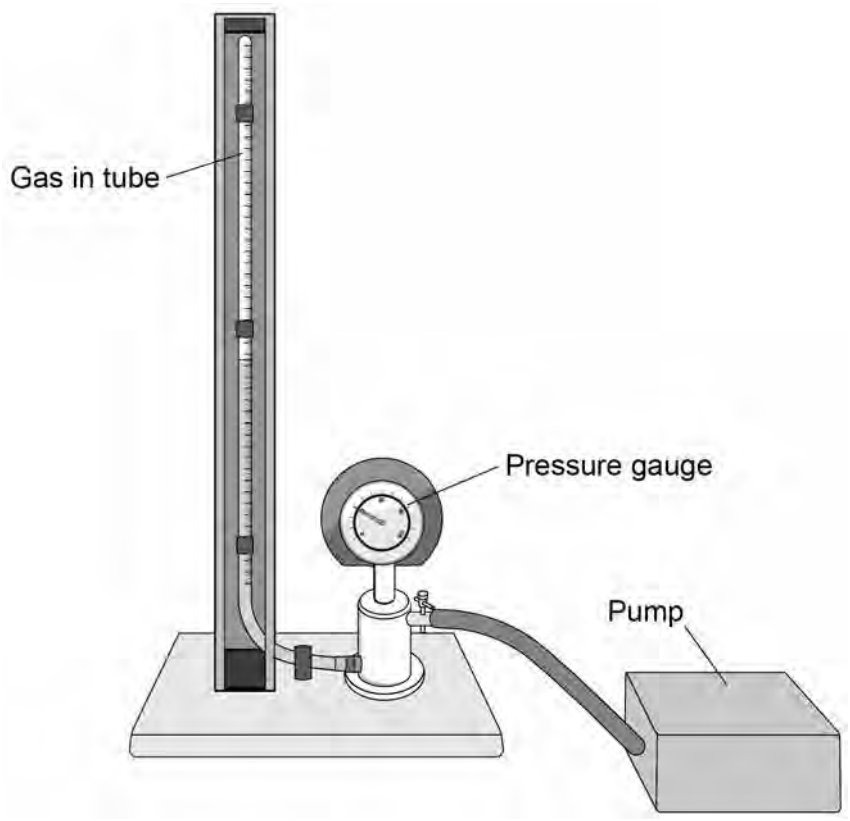
Question 01

June 2018 | 8463/1H | Original Q7

0 7 A student investigated how the pressure exerted by a gas varied with the volume of the gas.

Figure 12 shows the equipment the student used.

Figure 12



A pump was used to compress the gas in a tube. As the volume of the gas decreases, the pressure of the gas increases.

0 7 . 1 The student only recorded one set of results.

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

[2 marks]

1 _____

_____

2 _____

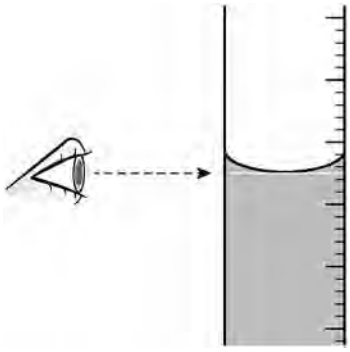
_____

4.3.3.1 Particle motion in gases

Question 01 · continued

0 7 . 2 **Figure 13** shows the position of the student's eye when taking volume measurements.

Figure 13



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 marks]

0 7 . 3 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 marks]

Question 7 continues on the next page

4.3.3.1 Particle motion in gases

Question 01 · continued

0 7 . 4 One of the student's results is given below.

pressure = 1.6×10^5 Pa
volume = 9.0 cm^3

Calculate the volume of the gas when the pressure was 1.8×10^5 Pa.

The temperature of the gas was constant.

[3 marks]

Volume = _____ cm^3

4.3.3.1 Particle motion in gases

Question 01 · continued

0 7 . 5 **Figure 14** shows a person using a bicycle pump to inflate a tyre.

Figure 14



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

Explain why.

[2 marks]

11

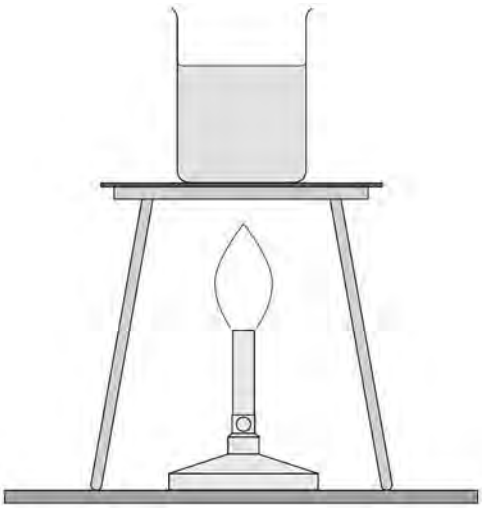
4.3.3.1 Particle motion in gases

Question 02

June 2019 | 8463/1H | Original Q11

1 1 **Figure 14** shows a Bunsen burner heating some water in a beaker. Eventually the water changes into steam.

Figure 14



1 1 . 1 Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C

[2 marks]

1 1 . 2 How is the particle model used to explain the difference in density between a liquid and a gas?

[1 mark]

Tick (✓) **one** box.

- Particles in a gas have less kinetic energy than particles in a liquid. ☐
- Particles in a gas have more potential energy than particles in a liquid. ☐
- Particles in a liquid are further apart than particles in a gas. ☐
- Particles in a liquid are larger than particles in a gas. ☐

4.3.3.1 Particle motion in gases

Question 02 · continued

1 1 . 3 A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts.

[4 marks]

7

4.3.3.1 Particle motion in gases

Question 03

November 2020 | 8463/1H | Original Q10

1 0 **Figure 15** shows a balloon filled with helium gas.

Figure 15



1 0 . 1 Which statements describe the movement of the gas particles in the balloon?

[2 marks]

Tick (✓) **two** boxes.

- The particles all move in a predictable way. ☐
- The particles move at the same speed. ☐
- The particles move in circular paths. ☐
- The particles move in random directions. ☐
- The particles move with a range of speeds. ☐
- The particles vibrate about fixed positions. ☐

4.3.3.1 Particle motion in gases

Question 03 · continued

10.2 The pressure of the helium in the balloon is 100 000 Pa.

The volume of the balloon is 0.030 m^3.

The balloon is compressed at a constant temperature causing the volume to decrease to 0.025 m^3.

No helium leaves the balloon.

Calculate the new pressure in the balloon.

[4 marks]

New pressure = _____ Pa

10.3 The temperature of the helium in the balloon was increased.

The mass and volume of helium in the balloon remained constant.

Explain why the pressure exerted by the helium inside the balloon would increase.

[4 marks]

10

4.3.3.1 Particle motion in gases

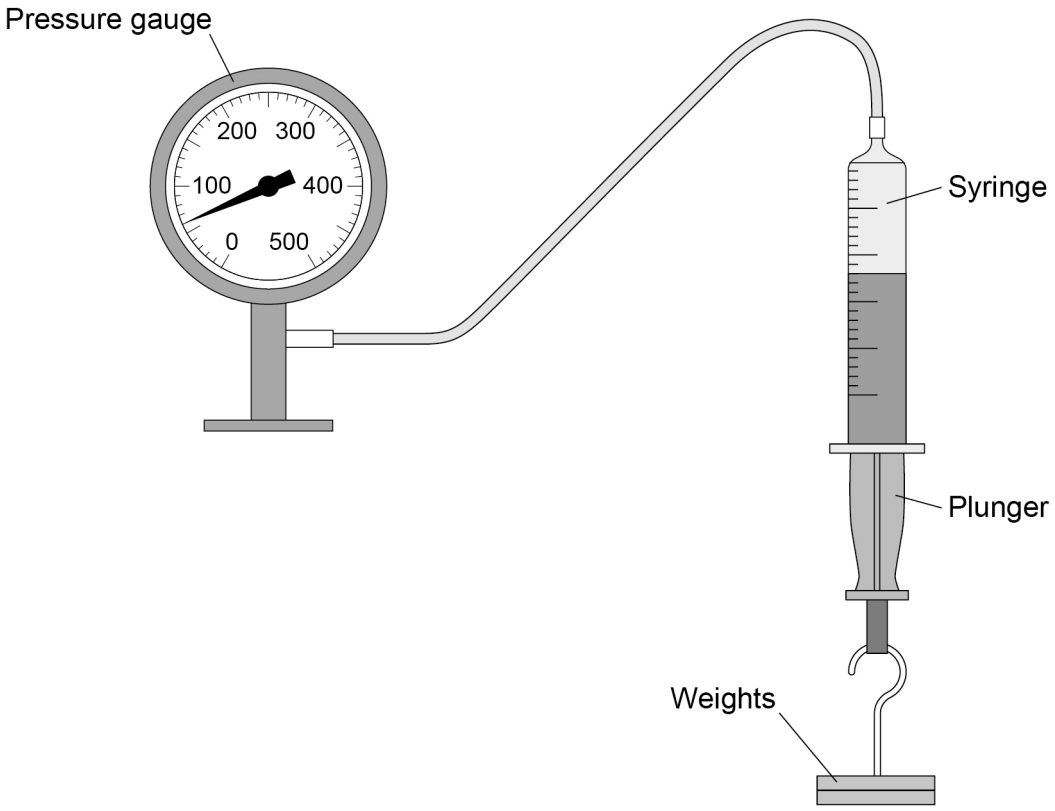
Question 04

November 2021 | 8463/1H | Original Q9

0 9 A teacher demonstrated the relationship between the pressure in a gas and the volume of the gas.

Figure 12 shows the equipment used.

Figure 12



This is the method used.

1. Record the initial volume of gas in the syringe and the pressure reading before any weights are attached.
2. Attach a 2.0 N weight to the syringe.
3. Record the volume of the gas and the reading on the pressure gauge.
4. Repeat steps 2 and 3 until a weight of 12.0 N is attached to the syringe.

0 9 . 1 What was the range of force used?

[1 mark]

From _____ N to _____ N

0 9 . 2 Give **one** control variable in the investigation.

[1 mark]

_____

4.3.3.1 Particle motion in gases

Question 04 · continued

0 9 . 3 When the volume of gas in the syringe was 45 cm^3, the pressure gauge showed a value of 60 kPa.

Calculate the pressure in the gas when the volume of gas in the syringe was 40 cm^3.

[4 marks]

Pressure = _____ kPa

0 9 . 4 When the volume of gas in the syringe increased, the pressure on the inside walls of the syringe decreased.

Explain why.

[3 marks]

9

4.3.3.1 Particle motion in gases

Question 05

June 2023 | 8463/1H | Original Q9

0 9 **Figure 9** shows air being pumped into a car tyre.

Figure 9



0 9 . 1 Complete the sentence.

[1 mark]

Air particles in the tyre move quickly in _____ directions.

0 9 . 2 When the tyre is at the correct pressure, pumping more air into the tyre causes the pressure to increase further.

The volume and temperature of the air in the tyre do **not** change.

Explain why the pressure increases as more air is pumped into the tyre.

[2 marks]

_____

_____

_____

_____

4.3.3.1 Particle motion in gases

Question 05 · continued

0 9 . 3 The air pressure in a car tyre changes if the temperature of the air in the tyre increases.

Explain why.

[4 marks]

7

4.3.3.1 Particle motion in gases

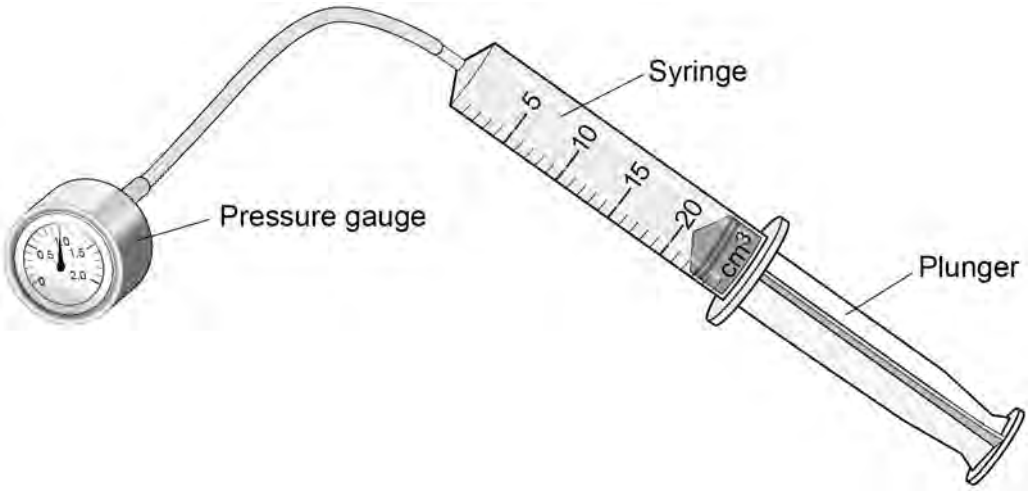
Question 06

June 2024 | 8463/1H | Original Q8

0 8 A student investigated how the pressure in a fixed mass of air varies with the volume of the air.

Figure 12 shows the equipment used.

Figure 12



0 8 . 1 When the plunger was pushed slowly into the syringe, the pressure in the syringe increased.

The temperature of the air remained constant.

Explain why the pressure increased.

[3 marks]

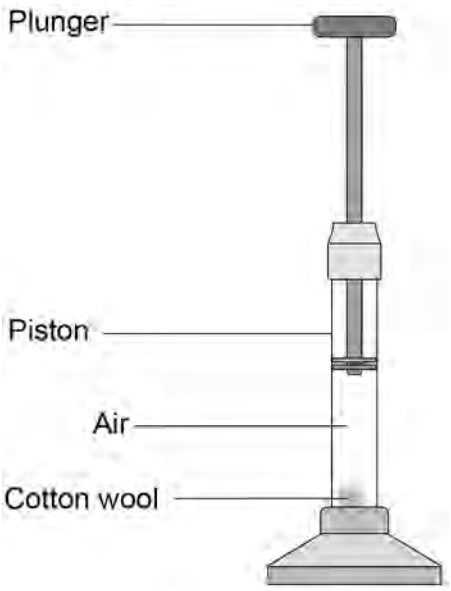
4.3.3.1 Particle motion in gases

Question 06 · continued

A fire piston is a special type of syringe that can be used to start fires.

Figure 13 shows a fire piston.

Figure 13



The plunger is pushed quickly downwards and compresses the air.

When the air is compressed quickly, the temperature of the air increases.

0 8 . 2 How does an increase in temperature affect the air particles inside the piston?

[1 mark]

Tick (✓) **one** box.

- The mean kinetic energy of the particles increases. ☐
- The mean potential energy of the particles increases. ☐
- The mean separation of the particles increases. ☐

4.3.3.1 Particle motion in gases

Question 06 · continued

0 8 . 3 When the air is hot enough, a small piece of cotton wool in the piston catches fire.

The energy transferred to the air in the piston is 0.0130 J.

The mass of air in the piston is 2.60×10^{-8} kg.

specific heat capacity of air = 1.01 kJ/kg °C

Calculate the temperature change of the air.

Use the Physics Equations Sheet.

[4 marks]

Temperature change = _____ °C

8

4.3.3.1 Particle motion in gases

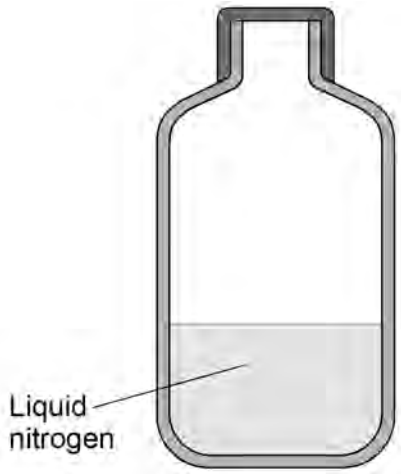
Question 07

0 8 A scientist poured some liquid nitrogen into a container.

The container was then sealed.

Figure 10 shows the container.

Figure 10



0 8 . 1 The liquid nitrogen was at its boiling point.

When 9950 J of thermal energy was transferred to the liquid nitrogen, 50 g of the nitrogen turned into a gas.

Calculate the specific latent heat of vaporisation of nitrogen.

Use the Physics Equations Sheet.

[4 marks]

Specific latent heat of vaporisation = _____ J/kg

4.3.3.1 Particle motion in gases

Question 07 · continued

0 8 . 2 Explain how the internal energy of the nitrogen changed as the nitrogen turned from a liquid to a gas.

[3 marks]

0 8 . 3 After the nitrogen had boiled, the temperature of the gas increased.

Explain how the pressure in the container changed as the temperature increased.

[4 marks]

11