

GCSE Physics

Worksheet: Particle motion in gases

TIME 30 min	TOTAL 27 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Particle motion in gases

NAME	CLASS	DATE
-------------	--------------	-------------

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1 A fixed mass of gas is sealed in a rigid container. The temperature of the gas decreases.

What happens to the pressure of the gas?

Tick (✓) **one** box.

It increases.

☐

It decreases.

☐

It stays the same.

☐

It becomes zero.

☐

[1 mark]

0 1 . 2 State what causes the pressure of a gas on the walls of its container.

.....

.....

[1 mark]

0 2

0 2 . 1

Which statement describes the motion of the molecules in a gas?

Tick (✓) **one** box.

The molecules are not moving.

☐

The molecules vibrate about fixed positions.

☐

The molecules are in constant random motion.

☐

The molecules all move in the same direction.

☐

[1 mark]

0 2 . 2

Which quantity is related to the average kinetic energy of the molecules in a gas?

Tick (✓) **one** box.

Density

☐

Mass

☐

Temperature

☐

Volume

☐

[1 mark]

0 2 . 3

A sealed metal can contains air. The can is heated. The volume of the can does not change.

What happens to the pressure of the air inside the can?

.....

.....

.....

[1 mark]

0 2 . 4

Aerosol cans contain gas under pressure. They carry the warning 'Do not heat'. Suggest why.

.....

.....

[1 mark]

0 3

A student investigates how the temperature of a fixed mass of gas at constant volume affects its pressure, using a sealed rigid flask connected to a pressure gauge, with the flask standing in a water bath.

0 3 . 1

Write a hypothesis for how the pressure of the gas will change as its temperature increases.

.....

.....

[1 mark]

0 3 . 2

Identify the independent variable, the dependent variable, and one variable that should be controlled in this investigation.

.....

.....

.....

.....

.....

.....

[3 marks]

0 4

A driver checked the pressure of the air in the tyres of a car before a long journey. At the end of the journey, the pressure was higher. The volume of the tyres did not change.

0 4 . 1

Suggest why the pressure of the air in the tyres increased during the journey.

.....

.....

.....

.....

.....

.....

[3 marks]

0 4 . 2

Table 1

Temperature in °C	Pressure reading in kPa
10	230
20	242
30	253
40	265

Table 1 shows the pressure reading on a tyre gauge at different temperatures. Describe the relationship between the pressure reading and the temperature.

.....

.....

.....

.....

[2 marks]

0 4 . 3

Suggest why drivers are advised to check the pressure of their tyres when the tyres are cold.

.....

.....

[1 mark]

0 5

0 5 . 1

A vacuum is a region containing no gas particles. Explain, in terms of the particle model, why a vacuum exerts no pressure on the walls of its container.

.....

.....

.....

.....

[2 marks]

0 6

A sealed glass flask contains air. The flask is put in a water bath and heated from 20 °C to 60 °C. The volume of the flask does not change.

0 6 . 1

Explain why the pressure of the air in the flask increases.

Your answer should refer to the motion of the air molecules.

.....

.....

.....

.....

.....

.....

[3 marks]

0 6 . 2

A second sealed flask of air at 20 °C is cooled to 5 °C.

Describe what happens to the motion of the air molecules and to the pressure of the air in this flask.

.....

.....

.....

.....

[2 marks]

0 7

Table 2 shows the pressure of a fixed mass of gas in a sealed, rigid container at different temperatures.

Table 2

Temperature in °C	Pressure in kPa
0	98
25	107
50	116
75	125

0 7 . 1

Describe the relationship shown by Table 2 between the temperature and the pressure of the gas.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Predict the pressure of the gas at 100 °C.

.....

.....

.....

Pressure = kPa

[1 mark]

0 7 . 3

Suggest why the container must be rigid (a constant volume) for this relationship to hold.

.....

.....

[1 mark]

END OF QUESTIONS

Mark scheme

GCSE Physics · Worksheet: Particle motion in gases · 27 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: It decreases.

01.2 [1 mark]

Answer: Collisions of the gas particles with the walls.

- collisions of the gas particles (molecules) with the walls (1)
-
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: The molecules are in constant random motion.

02.2 [1 mark]

Correct: Temperature

02.3 [1 mark]

Answer: It increases.

- it increases (1)
-

02.4 [1 mark]

Answer: Heating would increase the pressure of the gas, so the can could burst.

- heating increases the pressure of the gas inside the can, so the can could burst / explode (1)
-

Question 3 (4 marks)

03.1 [1 mark]

Answer: As the temperature increases, the pressure of the gas increases.

- as the temperature of the gas increases, its pressure increases (1)

03.2 [3 marks]

Answer: Independent: temperature. Dependent: pressure. Control: volume of gas (rigid, sealed flask).

- independent variable: temperature (of the water bath/gas) (1)
- dependent variable: pressure of the gas (1)
- control variable: volume of the gas (the flask is sealed and rigid) / mass (amount) of gas (1)

Question 4 (6 marks)

04.1 [3 marks]

Answer: The tyres warmed up, so the air molecules moved faster and hit the inside of the tyre more often and harder, increasing the pressure.

- the temperature of the air in the tyres increased (the tyres warmed up during the journey) (1)
- so the air molecules moved faster / had more kinetic energy (on average) (1)
- so the molecules hit the inside of the tyre more often and with more force (1)

04.2 [2 marks]

Answer: As the temperature increases the pressure increases, by about 12 kPa for every 10 °C.

- the pressure increases as the temperature increases (1)
- by about 12 kPa for every 10 °C increase / at a (roughly) constant rate (1)

04.3 [1 mark]

Answer: A warm tyre reads high, so a tyre checked when warm could be under-inflated once it cools.

- warm tyres give a higher reading, so a tyre that is correctly inflated when warm would be under-inflated when it cools (1)

Question 5 (2 marks)

05.1 [2 marks]

Answer: With no particles present, there are no collisions with the walls, so no force and no pressure is exerted.

- a vacuum contains no (or almost no) gas particles (1)
 - so there are no particle collisions with the walls, so no force (and therefore no pressure) is exerted on them (1)
-

Question 6 (5 marks)

06.1 [3 marks]

Answer: The molecules gain kinetic energy and move faster, so they hit the walls more often and with more force, increasing the force per unit area.

- the (average) kinetic energy of the molecules increases / the molecules move faster (on average) (1)
- the molecules collide with the walls of the flask more often (1)
- the molecules exert a greater force on the walls in each collision (1)
- so the force on each unit area of the walls / the pressure increases (1)

Any 3 of the points above.

06.2 [2 marks]

Answer: The molecules move more slowly on average, so the pressure of the air decreases.

- the molecules move more slowly (on average) / have a lower average kinetic energy (1)
 - the pressure decreases (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Answer: The pressure increases steadily, by 9 kPa for every 25 °C rise in temperature.

- as the temperature increases, the pressure increases (1)
- the pressure increases by the same amount (9 kPa) for each 25 °C rise — it increases at a constant rate (1)

Notes: Do not accept 'directly proportional' (the pressure is not zero at 0 °C).

07.2 [1 mark]

Answer: 134 kPa

- 134 (kPa) (allow 132–136) (1)

07.3 [1 mark]

Answer: If the volume could change, the gas would expand when heated, so the pressure would rise less (or not at all); volume is a variable that must be controlled.

- if the volume could change, the gas would expand as it is heated, so the particles would hit each unit area of the walls less often and the pressure would not rise in the same way — the volume must be kept constant (controlled) (1)
-