Unit 7 · Gas Laws

WORKSHEET

Full marks 45

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 45

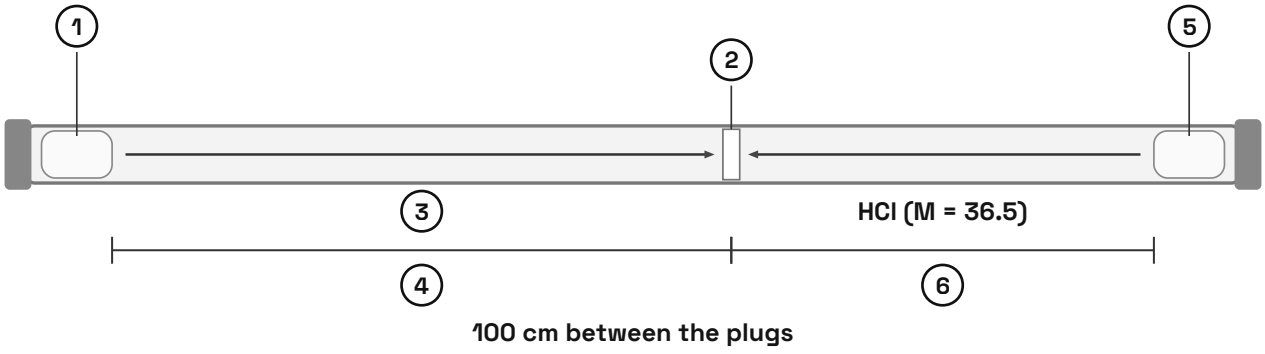
1 Key words [3]

Match each word in Column A with its description in Column B. Write the letter in the box. One description in Column B is not needed. Each match carries 0.5 mark.

Column A		Column B
1. absolute zero	☐	**a.** a gas spreading by the random motion of its molecules
2. STP	☐	**b.** obeys the gas laws exactly; a model that doesn't exist
3. molar volume	☐	**c.** a gas turning into a liquid when it is squeezed
4. ideal gas	☐	**d.** −273 °C, the start of the kelvin scale
5. diffusion	☐	**e.** a gas leaking molecule by molecule through a tiny hole
6. effusion	☐	**f.** 22.4 L at STP
		g. 0 °C and 760 mmHg

2 Label the diagram [3]

The diagram shows ammonia and hydrogen chloride spreading along a tube whose plugs are 100 cm apart. Name the parts numbered 1, 2 and 5, and the gas numbered 3 with its molar mass. Blanks 4 and 6 are the distances from each plug to the ring. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

5. _____ **6.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. A graph of the pressure of a fixed mass of gas against 1 ÷ its volume, at constant temperature, is: [1]

a. a curve that falls

b. a straight line through the origin

c. a straight line parallel to the 1 ÷ volume axis

d. a straight line that cuts the pressure axis above zero

ii. Which equation is the combined gas equation? [1]

a. $P_1V_1T_1 = P_2V_2T_2$

b. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

c. $\frac{P_1T_1}{V_1} = \frac{P_2T_2}{V_2}$

d. $\frac{V_1}{P_1T_1} = \frac{V_2}{P_2T_2}$

iii. Which is an assumption of the kinetic theory of gases? [1]

a. gas molecules attract each other strongly

b. gas molecules lose energy every time they hit a wall

c. the volume of the gas molecules is negligible compared with the volume of the container

d. gas molecules stay still until they are heated

iv. A real gas behaves most like an ideal gas at: [1]

a. high pressure and low temperature

b. high pressure and high temperature

c. low pressure and high temperature

d. low pressure and low temperature

v. A balloon holds 2 L of air at 0 °C. At the same pressure, at what temperature would it hold 4 L? [1]

a. 0 °C

b. 2 °C

c. 273 °C

d. 546 °C

4 Very short answers [4]

Write very short answers to the following questions.

a. Change 87 °C into kelvin. [1]

b. Who first suggested the kinetic theory of gases, and when? [1]

c. What must stay the same for Boyle's law to hold, besides the mass of the gas? [1]

d. In a closed, rigid container, what happens to the pressure of a gas when its kelvin temperature doubles? [1]

5 Short answers [8]

Write short answers to the following questions.

a. Give a reason: a weather balloon is filled only partly before it is launched. [2]

b. Give a reason: ammonia spreads through a room faster than hydrogen chloride gas. [2]

c. Give a reason: the air in a car's tyres is checked when the tyres are cold. [2]

d. What is STP, and why do chemists need it? [2]

6 Long answers [8]

Write long answers to the following questions.

a. State Boyle's law. Explain it using the kinetic theory of gases. [4]

b. Derive the combined gas equation from Boyle's law and Charles's law. [4]

7 Numerical problems [11]

Solve the following problems. Show your working.

a. 250 cm^3 of a gas at 7 °C is heated to 147 °C at constant pressure. Find its new volume. **[2]**

Answer:

b. 500 cm^3 of a gas is collected at 27 °C and 700 mmHg. Find its volume at STP. **[3]**

Answer:

c. 50 cm^3 of oxygen (M = 32) diffuses through a small hole in 40 s. How long will 50 cm^3 of carbon dioxide (M = 44) take under the same conditions? **[3]**

Answer:

d. A gas diffuses through a porous plug at half the rate of methane (M = 16). Find its molar mass. **[3]**

Answer:

8 Think [3]

A student says, “If I heat a gas from 20 °C to 40 °C at constant pressure, its volume doubles.” Explain the mistake and find the real change in volume.

9 Activity: Air in a bottle under a balloon (Practical 14) (not marked)

Stretch a balloon over the mouth of an empty, dry bottle. Stand the bottle in hot water (not boiling) for two or three minutes, then in cold water with ice, and write what you see.

Where the bottle stands	What the balloon does	What the air in the bottle is doing
room temperature		
hot water		
ice and cold water		

Which gas law does this show? What is kept nearly the same?