WORKSHEET 2

CHAPTER 7 – STUDY OF GAS LAWS

A. Tick (✓) the correct option.

1. Volume–pressure relationship was given by
   a. Robert Boyle. b. Gay Lussac. c. Jacques Charles. d. Dalton.
2. When volume is plotted against pressure at a constant temperature, the graph obtained will be a
   a. curve. b. straight line. c. circular. d. elliptical.
3. The absolute temperature value that corresponds to 27 °C is
   a. 200 K. b. 300 K. c. 400 K. d. 246 K.
4. Which of the following expresses a correct inverse proportionality?
   a. As P increases, V increases b. As P decreases, V increases
   c. As T increases, P increases d. As T increases, V decreases
5. The law that relates volume of a gas with its temperature is
   a. Boyle's law. b. Gay-Lussac's law. c. Charles' law. d. Avogadro's law.

B. Fill in the blanks from the choices given within the brackets.

1. A –273 °C, the volume of a gas is theoretically _____ (272 cc/0 cc/273 cc)
2. The standard pressure is _____ (760 cm/1200 atm/760 mm)
3. If the temperature of a fixed mass of a gas is kept constant and the pressure is increased, the corresponding volume _____ (increases/decreases/remains same)
4. If the pressure of a fixed mass of a gas is kept constant and the temperature is increased, the volume correspondingly _____ (increases/decreases/remains same)
5. The effect of temperature on the volume of the gas was first studied by _____ (Robert Boyle/Jacques Charles)

C. Give reasons for the following.

1. Gases have lower density compared to that of solids or liquids.
2. Gases exert pressure in all directions.
3. All temperatures in the absolute scale are in positive figures.
4. Gas fills the vessel completely in which it is kept.
5. When stating the volume of a gas, the pressure and temperature should also be given.

D. State whether the statements are correct or incorrect. If incorrect, rewrite those statements.

1. Gases are not compressible.
2. Gases diffuse easily in one another.

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3. A gas which follows the laws exactly is called an ideal gas.
4. The curve obtained by plotting volume *Vs*. pressure at any given temperature is called an isotherm.
5. Any temperature on the Celsius scale can be converted to that on the Kelvin scale by just subtracting 273.

E. Answer the following questions.

1. What is the value of standard pressure in centimetres?
2. What do you understand by the term standard temperature? Express its value on the Kelvin scale.
3. A gas occupies 150 cm^3 at 57 °C. Find the temperature to which the gas must be heated, so that its volume triples, without any change in pressure.
4. a. Explain Charles' law on the basis of kinetic theory of gases.
   b. Give the graphical representation of Charles' law.
5. a. State the relation between absolute and Celsius scale of temperature.
   b. A gas occupies 560 cm^3 at S.T.P., find its volume when
      i. pressure is 700 mm of mercury and temperature is 27 °C.
      ii. pressure is 800 mm of mercury and temperature is –173 °C.

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ANSWERS

WORKSHEET 2

A. Tick (✓) the correct option.

1. a
2. a
3. b
4. b
5. c

B. Fill in the blanks from the choices given within the brackets.

1. 0 cc
2. 760 mm
3. decreases
4. increases
5. Jacques Charles

C. Give reasons for the following.

1. The intermolecular distance between the molecules of gases is very large. Therefore, the number of molecules per unit volume of a gas is much lower compared to solids and liquids. Hence, gases have very low densities.
2. The particles of a gas are in continuous rapid motion due to which they collide with each other and with the walls of a container. The pressure exerted by gases are the results of these collisions.
3. The lowest temperature in absolute scale is 0 °C or 273 K. It is supposed that at this temperature, the volume of a gas becomes zero, which is not possible. Thus, any temperature taken in Kelvin scale is always positive.
4. The molecules of gas are far apart and in random motion. This random motion causes the gas to expand and fill the vessel completely in which it is kept.
5. Volume of gases change with temperature and pressure. Hence, while stating the volume of a gas, the pressure and temperature should be given.

D. State whether the statements are correct or incorrect. If incorrect, rewrite those statements.

1. Incorrect
   Gases are highly compressible.
2. Correct
3. Correct
4. Correct
5. Incorrect

   Any temperature on the Celsius scale can be converted to that on the Kelvin scale by just adding 273.

E. Answer the following questions.

1. 76 cm of mercury.
2. The temperature of 0 °C is taken as the standard temperature. Its value on the Kelvin scale is 273 K.
3. Given

$$\text{Initial volume, } V_1 = 150 \text{ cm}^3$$
$$\text{Initial temperature, } T_1 = 57 \text{ °C} = 57 + 273 = 330 \text{ K}$$
$$\text{Final volume, } V_2 = 150 \times 3 = 450 \text{ cm}^3$$
$$\text{Final temperature, } T_2 = ?$$

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By Charles' law,

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\Rightarrow \quad T_2 = \frac{V_2 \times T_1}{V_1}$$

$$= \frac{450 \times 330}{150} = 990 \text{ K}$$

4. a. On heating the gas, the kinetic energy of molecules increases. This means the molecules will move faster. Hence, the gas will expand provided pressure remains constant.

   b. When the volume of a certain mass of a gas is plotted against the corresponding temperature at constant pressure, a straight line is obtained.

   Refer Figure 7.4 on page 96 of the textbook.

5. a. ℃ = ℃ + 273 K

   b. Given

   Initial volume, V_1 = 560 cm^3 at S.T.P.

   Initial pressure, P_1 = 760 mm of mercury

   Initial temperature, T_1 = 273 K

   i. Final pressure, P_2 = 700 mm of mercury

   Final temperature, T_2 = 27 ℃ = 27 + 273 = 300 K

   By the gas equation

$$\frac{PV_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2}$$

$$= \frac{760 \times 560}{273} \times \frac{300}{700} = 668.1 \text{ cm}^3$$

   ii. Final pressure, P_2 = 800 mm of mercury

   Final temperature, T_2 = –173 ℃ = –173 + 273 = 100 K

$$V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2}$$

$$= \frac{760 \times 560}{273} \times \frac{100}{800} = 194.8 \text{ cm}^3$$

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