Self Assessment Exercises 1:

1. A student obtained following data in an experiment at 20°C.

P(atm)	V(dm^3)
0.350	0.707
0.551	0.450
0.762	0.325
0.951	0.261
1.210	0.205

Explain pressure-volume relationship using this data and the Boyles Law.

Solution:- Problem Solving Strategy:

1. According to the Boyles law, product of pressure and volume is constant at any two sets of conditions.
2. Calculate PXV for the two sets of condition and compare.

$P_1 \times V_1$ before change $= 0.350 \times atm \times 0.707 dm^3$
$= 0.247\ atm.dm^3$

$P_2 \times V_2$ after change $= 0.551\ atm \times 0.450\ dm^3$
$= 0.247\ atm.dm^3$

$P_3 \times V_3$ after change $= 0.762\ atm \times 0.325\ dm^3$
$= 0.247\ atm.dm^3$

$P_4 \times V_4$ after change $= 0.951\ atm \times 0.261\ dm^3$
$= 0.247\ atm.dm^3$

$P_5 \times V_5$ after change $= 1.210\ atm \times 0.205 dm^3$
$= 0.247\ atm.dm^3$

$$P_1V_1 = P_2V_2 = P_3V_3 = P_4V_4 = P_5V_5$$

Thus the calculated result agrees with the pressure-volume relationship according to the Boyle's Law.

2.

2. Ammonia gas is used as refrigerant 0.474 atm. Pressure is required to change 2000 cm^3 sample of ammonia initially at 1.0 atm. to 4.22 dm^3 at constant temperature. Show that this data satisfies Boyle's law.

Solution:- PROBLEM SOLVING STRATEGY:

1. According to the Boyle's law, product of pressure and volume is constant at any two sets of conditions.
2. Calculate P x V for the two sets of condition and compare.

$P_1 \times V_1$ before change $= 0.474 \text{ atm} \times \frac{2000}{1000} \text{ dm}^3$

$= 0.948 \text{ atm-dm}^3$

$P_1 V_1 \neq P_2 V_2$

Thus the calculated result does not agree with the pressure-volume relationship according to the Boyle's Law.

SELF ASSESSMENT 5.2 EXERCISE

1 Chemist obtained data shown in table in an experiment at 1 atm.

TABLE: Temperature-Volume data of a gas at 1atm.

Temperature (°C)	Volume (cm^3)
25	117.5
30	119.4
35	121.3
40	123.2

Explain volume-temperature relationship using Charles law.

Solution :- Problem Solving Strategy :-

1. According to the Charles's law, ratio of volume to absolute temperature is constant for any set of conditions.
2. Convert °C temperature to kelvin temperature by adding 273.
3. Find $\frac{V}{T}$ for each set of conditions and compare.

TABLE :- Temperature-Volume relationship

Temperature (°C)	Volume(cm^3)	Temperature(k)	$\frac{V}{T}$
25	117.5	298	$\frac{117.5}{298} = 0.39$
30	119.4	303	$\frac{119.4}{303} = 0.39$
35	121.3	308	$\frac{121.3}{308} = 0.39$
40	123.2	313	$\frac{123.2}{313} = 0.39$

5.2 The ratio $\frac{V}{T}$ = 0.39 is fairly constant. The gas varies directly with the absolute temperature as stated by the Charles's law.

2. A bacterial culture isolated from Sewage produces 36.4 cm^3 of methane (CH_4) gas at 27 °C and 760 mm Hg. This gas occupies 33.124 cm^3 at 0°C and same pressure. Explain volume-temperature relationship from this data.

Solution:- Problem Solving strategy:

1. According to the Charles's law, ratio of volume to absolute temperature is constant for any set of conditions.
2. Convert °C temperature to kelvin temperature by adding 273.
3. Find $\frac{V}{T}$ for each set of conditions and compare.

TABLE: Temperature-Volume relationship

Temperature (°C)	volume (cm^3)	Temperature (K)	$\frac{V}{T}$
27	36.4	300	$\frac{36.4}{300} = 0.1$
0	33.124	273	$\frac{33.124}{273} = 0.1$

The ratio $\frac{V}{T} = 0.1$ is fairly constant. Thus volume of gas varies directly with the absolute temperature as stated by the Charles's law.

3. A perfect elastic balloon filled with helium gas has a volume of 1.25×20^3 dm^3 at 1.00

1-2 atm and 25 °C on ascending to a certain altitude where temperature is 15 °C the volume of balloon becomes 1.208×10^3 dm³. show that this data satisfies the Charles's law.

Solution:- Problem Solving strategy:

1. According to the Charles's law. ratio of volume to absolute temperature is constant for any set of conditions.
2. Convent °C temperature to kelvin temperature by adding 273.
3. Find $\frac{V}{T}$ for each set of conditions and compare.

TABLE:- Temperature - volume relationship.

Temperature (°C)	Volume (dm^3)	Temperature (K)	$\frac{V}{T}$
25	1.25×10^3	298	$\frac{1.25 \times 10^3}{298} = 4.19$
15	1.208×10^3	288	$\frac{1.208 \times 10^3}{273} = 4.19$

SELF ASSESSMENT Exercise 5.3

Give reason:-

1 When you put nail polish remover on your palm, you feel a sensation of coldness.

Ans: The chemical nail polish remover (usually acetone) is very volatile. it evaporates very quickly. To change from liquid state, to a gaseous state takes energy. The warmth of your palm supplies the energy. The flow of heat is from your palm and into the liquid. This removes heat from your palm and has the sensation of being cool.

2. Wet clothes dry quickly in Summer than in water.

Ans: At higher temperature, more molecules of a liquid are moving with high velocities. Thus more molecules esape from its surface. Thus evaporation is faster than at low temperature. That is why wet clothes dry quickly in the winter.

Q.20 Explain the term Vapour pressure. On what factor it depends?