(2) A certain amount of a gas at 27°c and 1 atm pressure occupies a volume of 25 m3. If the pressure is kept constant and the temperature is raised to 77° c, what would be the volume of a gas ?

Case (I)

Temperature $(t) = 27°c$
$= 300\,K$

Pressure $(P_1) = 1\,atm$
$= 760\,mm\,Hg$

volume $(V_1) = 25\,m^3$
$= 25 \times 1000$
$= 25000$ litre

Case (II)

Temperature $(t_2) = 77°C$
$= 350\,K$

Pressure $(P_2) = 1\,atm$
$= 760\,mm\,Hg$

volume $(V_2) = ?$

We know that

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

$$\frac{\cancel{760} \times 250\cancel{00}}{3\cancel{00}} = \frac{\cancel{760} \times V_2}{350}$$

$$\frac{250 \times 350}{3} = V_2$$

$$V_2 = 29166.67\ \text{ltrs}$$

which means $V_2 = \frac{29166.67}{1000} = 29.16\,m^3$

(3) A sample of nitrogen gas occupies a volume of 1 litre at a pressure of 0.500 atm at 40°C. Calculate the pressure. If the gas is compressed to 0.225 cm3 at -6°C.

Case (I)

Temperature $(T_1) = 40°C = 313\,K$

Pressure $(P_1) = 0.5\,atm$

$\frac{760}{2} = 380\,mm\,Hg$

volume $(V_1) = 1$ litre

Case II

Temperature $(t_2) = -6°C$ 267K

Pressure $(P_2) = ?$

volume $= 0.225\,cm^3$

$1\,cm^3 = 0.001$ litre

$0.22\,cm^3 = 0.001 \times 0.215$

$= 0.000225$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{380 \times 1}{313} = \frac{P_2 \times 0.000225}{267}$$

$$P_2 = \frac{101960}{0.07}$$

$$= 1490681 \text{ mm Hg}$$

Now Pressure in atm

$$P = \frac{1490681}{760} = 1895.63 \text{ atm}$$

(4) A toy ballon blown up at 10 degree Celsius has a volume 960 cc. At this stage the ballon is distented to 7 by 8 of its maximum streching capacity.

(a) will the ballon will brust, if it is bought to 25°

(b) if not, calculate the temperature at which it will brust.

Let capacity be x,

960 cc of volume distented $7/8$ of its capacity

960 cc volume $= 7/8x$

$$\frac{7x}{8} = 960$$

$$7x = 960 \times 8$$

$$x = \frac{960 \times 8}{7}$$

$$x = 1097.14 \text{ cc}$$

$$x = 1.0971 \text{ ltrs}$$

$$\frac{\cancel{P_1} V_1}{T_1} = \frac{\cancel{P_2} V_2}{T_2}$$

$$\frac{0.96}{283} = \frac{V_2}{298}$$

$$V_2 = \frac{298 \times 0.96}{283}$$

$$V_2 = 1.01 \text{ ltrs}$$

since, 1.01 is less than than maximum disdentent capacity so the the ballon will not brust.

Now,

$$\frac{\cancel{P_1} V_1}{T_1} = \frac{\cancel{P_2} V_2}{T_2}$$

$$\frac{1.091 \times 285}{T_1} = \frac{0.96}{283}$$

$$T_1 = \frac{310.9919}{0.96}$$

$$= 323.92 K$$

$$Degree = 273 - 32.93$$

$$= 50.92$$

(5) A gas cylinder containing cooking gas can withstand up to a pressure of 14.9 atm. The pressure gauge of the cylinder indicates 12 atm at 27°c. Due to the sudden fire in building, its temperature starts rising. At what temperature will be the cylinder explode?

$\boxed{14.9 \text{ atm}}$

case(1)

$P_1 = 12 \times 760 = 9120$ mm Hg

$T_1 = 27 + 273 = 300 K$

After fire

$P_1 = 14.9 = 14.9 \times 760$

$= 11324$

$T_1 = ?$

$V = 0$

$$\frac{P_1 \cancel{V_1}}{T_1} = \frac{P_2 \cancel{V_2}}{T_2}$$

$$\frac{9120x}{300} = \frac{11329}{T}$$

$$T = \frac{11329 \times 30}{912}$$

$$T = 372.5$$

$$372.5 - 273$$

$$99.5^{\circ}C$$

(6) Calculate the mass of oxygen gas whose volume is 320 ml at 17°C & 2 atm

Volume = 320 ml = 0.32 litre

Pressure = 2 atm = 2

Temperature = 17°C = 273 + 17 = 290°C

$$PV = nRT$$

$$2 \times 0.32 = n \times 0.082 \times 290$$

$$0.64 = 23.78n$$

$$n = \frac{0.64}{23.78} = 0.26 \text{ mole}$$

1 mole = 32 gm

0.026 = 32 × 0.026

= 0.861

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6 mole of Helium $= 6 \times 4$
$= 24\,gm$

Volume $= 4.5$ litre
$P = 3\,atm$
$PV = nRT$

$3 \times 4.5 = 6 \times 0.082 \times T$

$13.5 = 0.492\,T$

$T = \frac{13.5}{0.492}$

$T = 27.43$ kelvin

$d = m/v$
$= 24/4.5$
$= 5.33\,gm/ltr$

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Case (I)

$P_1 =$ constant

Temp $= 293\,K$

$V = x$

Case II

$P_1 =$ constant

Temp $= T_2$

$V_2 = x + 10\%$ of x
$= x + 10 \times \frac{x}{100}$
$= 1.1x$

$$\frac{\cancel{P_1} V_1}{T_1} = \frac{\cancel{P_2} V_2}{T_2}$$

$$\frac{x}{293} = \frac{1.1x}{T_2}$$

$$T_2 = \frac{1.1\cancel{x} \times 293}{\cancel{x}}$$

$$T_2 = 322.3\ K$$