Chemistry Class 11 NCERT Solutions: Chapter 5 States of Matter Part 6

Q: 18. 2.9 g of a gas at 95 ° C occupied the same volume as 0.184 g of dihydrogen at 17 °C, at the same pressure. What is the molar mass of the gas?

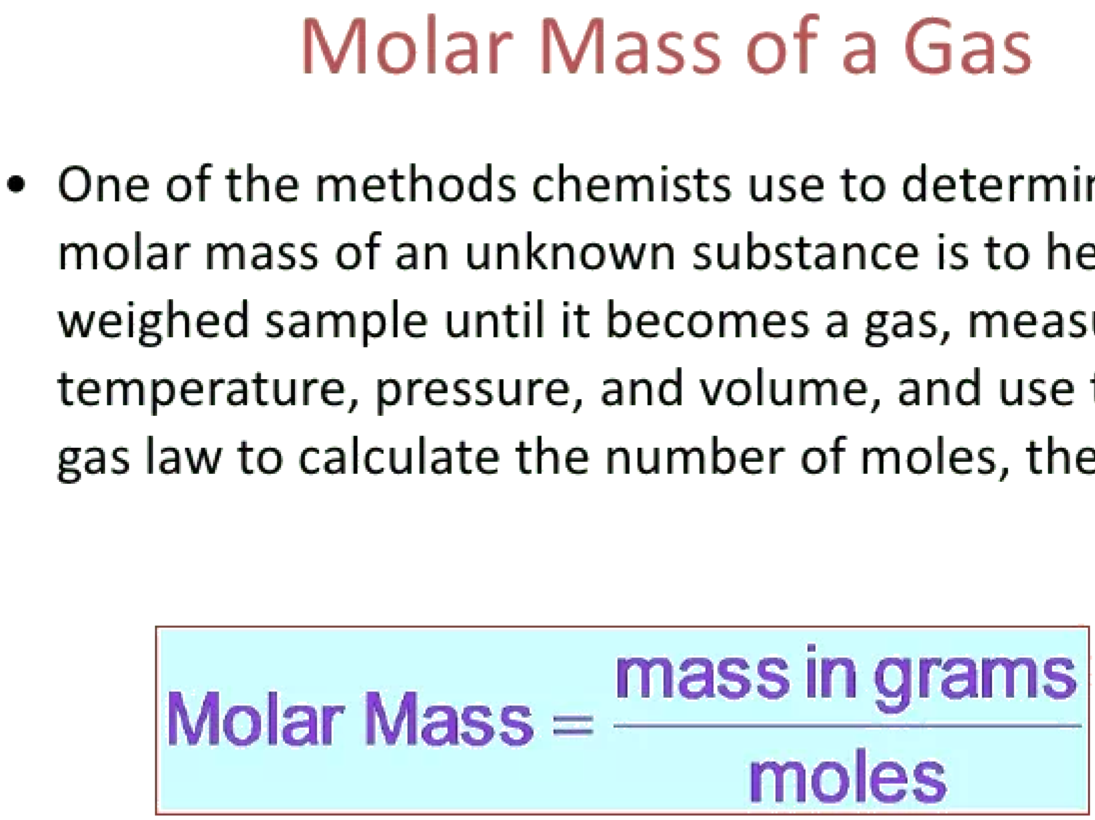

Image Showing Molar Mass of a Gas.

Answer:

Volume (V) occupied by dihydrogen is given by,

$$V = \frac{m}{M}\frac{RT}{p}$$

$$= \frac{0.184}{2} \times \frac{R \times 290}{p}$$

Let M be the molar of the unknown gas. Volume (V) occupied by the unknown gas can be calculated as: > $V = \frac{m}{M}\frac{RT}{p}$

$$= \frac{2.9}{M} \times \frac{R \times 368}{p}$$

According to the question,

$$\frac{0.184}{2} \times \frac{\mathrm{R} \times 290}{\mathrm{p}} = \frac{2.9}{\mathrm{M}} \times \frac{\mathrm{R} \times 368}{\mathrm{p}}$$

$$\Rightarrow \frac{0.184 \times 290}{2} = \frac{2.9 \times 368}{M}$$

$$\Rightarrow M = \frac{2.9 \times 368 \times 2}{0.184 \times 290}$$

$$= 40\ g\ mol^{-1}$$

Hence, the molar mass of the gas is $40\ g\ mol^{-1}$.

Q: 19. A mixtures of dihydrogen and Dioxygen at one bar pressure contain 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen.

Answer:

Let the weight of dihydrogen be 20 g and the weight of Dioxygen be 80 g.

Then, the number of moles of dihydrogen, $n_{H2} = \frac{20}{2} = 10\ moles$ and the number of moles

Of Dioxygen, $n_{O2} = \frac{80}{32} = 2.5\ moles$

Given,

Total pressure of the mixture, $p_{total} = 1$ bar

Then, partial pressure of dihydrogen,

$$\mathrm{p_{H_2}} = \frac{\mathrm{n_{H2}}}{\mathrm{n_{H2}} + \mathrm{n_{O2}}} \times \mathrm{P_{total}}$$

$$= \frac{10}{10 + 2.5} \times 1$$

$$= 0.8\ \text{bar}$$

Hence, the partial pressure of dihydrogen is $0.8\ bar$.

Q: 20. What would be the SI unit for the quantity $\frac{pV^2T^2}{n}$?

Answer:

The SI unit for pressure, p is $\mathrm{Nm^{-2}}$.

The SI unit for volume, V is $\mathrm{m^3}$.

The SI unit for temperature, T is K.

The SI unit for the number of moles n is mol.

Therefore, the SI unit for quantity $\frac{pV^2T^2}{n}$ is given by,

$$= \frac{(Nm^{-2})(m^3)^2(K)^2}{mol}$$

$$= Nm^4K^2mol^{-1}$$

Q: 21. In terms of Charles' law explain why $-273°C$ is the lowest possible temperature.

Answer:

Charles' law states that constant pressure, the volume of a fixed mass of gas is directly proportional to its absolute temperature.

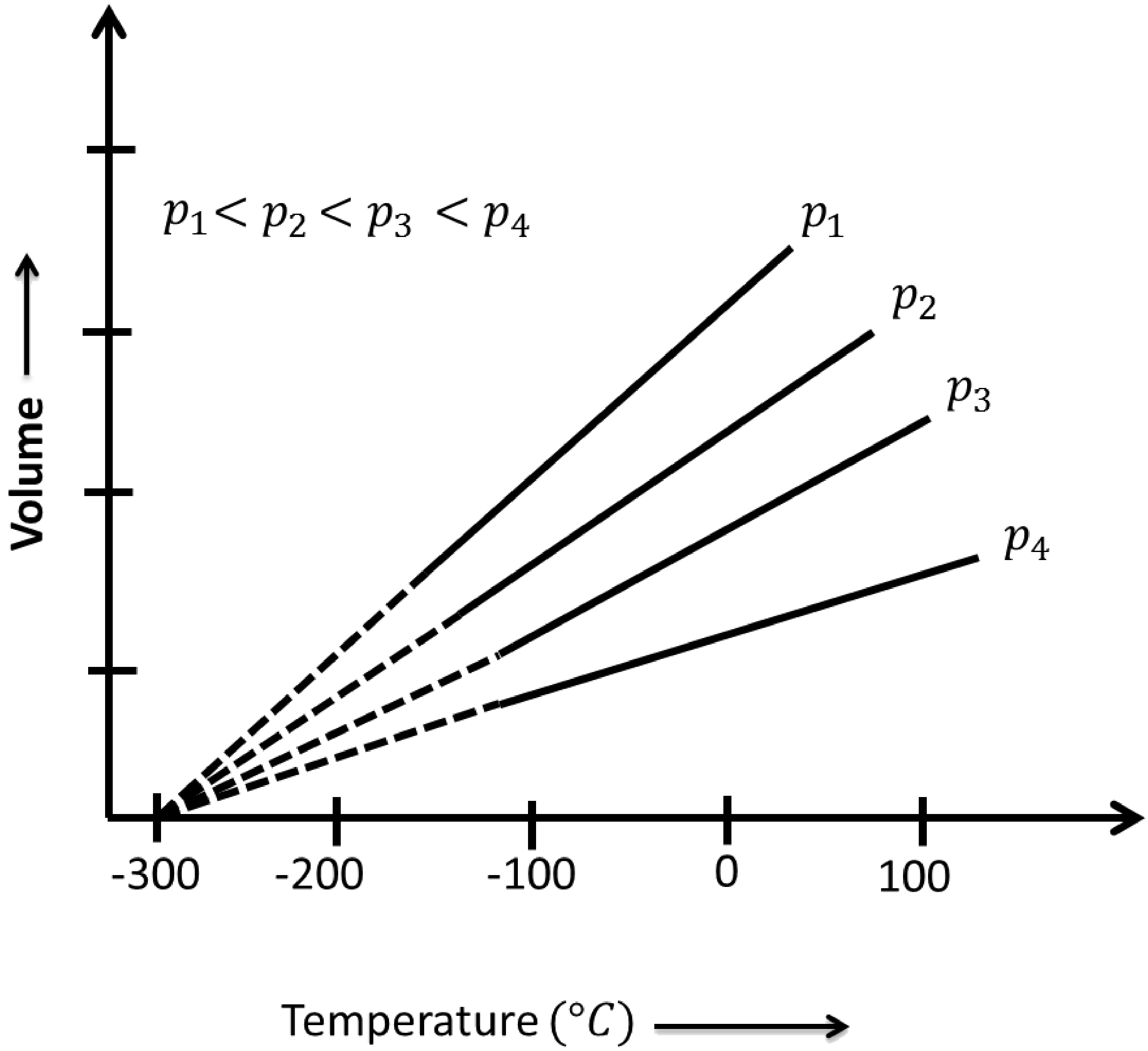

Image of Charles'law

It was found that for all gases (at any given pressure), the plots of volume vs. temperature (in °C) is a straight line. If this line is extended to zero volume, then it intersects the temperatureaxis at $-273°C$. In other words, the volume of any gas at $-273°C$ is zero. This is because all gases get liquefied before reaching a temperature of $-273°C$. Hence, it can be concluded that $-273°C$ is the lowest possible temperature.

Q: 22. Critical temperature for carbon dioxide and methane are $31.1\,°C$ and $-81.9\,°C$ respectively. Which of these has stronger intermolecular forces and why?

Answer:

Higher is the critical temperature of a gas, easier is its liquefaction. This means that the intermolecular forces of attraction between the molecules of a gas are directly proportional to its critical temperature; Hence, intermolecular forces of attraction are stronger in the case of CO_2.