

Daily Tutorial Sheet-2

JEE Advanced (Archive)

$$\textbf{16.(D)} \qquad \frac{Rate_1}{Rate_2} = \sqrt{\frac{M_2}{M_1}}$$

So, Rate is inversely proportional to the square root of its molecular weight.

17. (F) KE = $\frac{3}{2}$ RT where, T is absolute temperature (in Kelvin). False

18. (Inversely, time)

Inversely, time.

19.(A)
$$V_{ave} = \sqrt{\frac{8RT}{\pi M}}$$

20.(10) Volume of balloon =
$$\frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.14 \times \left(\frac{21}{2}\right)^3 \text{ cm}^3 = 4847 \text{ cm}^3 \approx 4.85 \text{ L}$$

Now, when volume of $H_2(g)$ in cylinder is converted into NTP volume, then $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$

$$\Rightarrow \frac{20 \times 2.82}{300} = \frac{1 \times V_2}{273}, V_2 = \text{NTP volume} \Rightarrow V_2 = 51.324 \text{ L}$$

Also, the cylinder will into empty completely, it will hold 2.82 L of H_2 (g) when equilibrium with balloon will be established. Hence, available volume of H_2 (g) for filling into balloon is

$$51.324 - 2.82 = 48.504 L$$

$$\Rightarrow$$
 Number of balloons that can be filled $=\frac{48.504}{4.85} = 10$

21.pV = 0.25 RT

0.25 RT because at NTP, $5.6L = \frac{1}{4}$ mole

22.(B) Near the HCl bottle due to lower mass

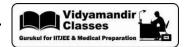
23.(C) In van der Waal's equation of state
$$\left(p + \frac{a}{V^2}\right)(V - b) = RT$$
 (For 1 mole)

The first factor $(p+a/V^2)$ correct for intermolecular force while the second term (V-b) correct for molecular volume.

24.(1:16) 1:16, KE =
$$\frac{3}{2}$$
 nRT. At same temperature, KE (total) \propto n.

- **25.(C)** At high temperature and low pressure, the gas volume is infinitely large and both intermolecular force as well as molecular volume can be ignored. Under this condition postulates of kinetic theory applies appropriately and gas approaches ideal behaviour.
- **26.(C)** The ease of liquefication of a gas depends on their intermolecular force of attraction which in turn is measured in terms of van der Waals' constant a. Hence, higher the value of a, greater the intermolecular force of attraction, easier the liquefication.

In the present case, NH₃ has highest a, can most easily be liquefied.



27.(1682.5 k, 2142 K)

$$\begin{split} u_{av} & \text{ (average velocity)} = \sqrt{\frac{8RT_1}{\pi M}} \ \Rightarrow \ \frac{9 \times 10^4}{100} \, \text{ms}^{-1} = \sqrt{\frac{8 \times 8.314 T_1}{3.14 \times 44 \times 10^{-3}}} \quad \Rightarrow \quad T_1 = 1682.5 \, \, \text{K} \\ & \text{Also, for the same gas} \ \frac{u_{av}}{u_{mps}} = \sqrt{\frac{8RT_1}{\pi M}} : \sqrt{\frac{2RT_2}{M}} = \sqrt{\frac{8T_1}{\pi} \times \frac{1}{2T_2}} = \sqrt{\frac{4T_1}{\pi T_2}} \\ & \Rightarrow \quad 1 = \sqrt{\frac{4T_1}{\pi T_2}} \quad \Rightarrow \quad T_2 = \frac{4T_1}{\pi} = \frac{4 \times 1682.5}{3.14} = 2142 \, \, \text{K} \end{split}$$

Hence, $T_1 = 1682.5 \text{ K}$ and $T_2 = 2142 \text{ K}$

28.(B) density =
$$\frac{PM}{RT}$$

29.(5.23 L)

$$pV = nRT \Rightarrow V = \frac{w}{M} \frac{RT}{p}$$
 \Rightarrow $V = 5.23 L$

30.(D) The means translational kinetic energy (
$$\in$$
) of an ideal gas is $\in = \frac{3}{2} k_B T$; $T = Absolute temperature. i.e. $\in \propto T$$