16.(D) $\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}}$

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 $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.14 \times \left(\frac{21}{2}\right)^3 cm^3 = 4847\ cm^3 \approx 4.85\ L$

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

$\Rightarrow \quad \frac{20 \times 2.82}{300} = \frac{1 \times V_2}{273}$, V_2 = NTP volume $\quad \Rightarrow \quad V_2 = 51.324$ 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, $5.6\,L = \frac{1}{4}$ 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, NH_3 has highest a, can most easily be liquefied.

27.(1682.5 k, 2142 K)

$$u_{av}\text{ (average velocity)} = \sqrt{\frac{8RT_1}{\pi M}} \Rightarrow \frac{9\times10^4}{100}\,ms^{-1} = \sqrt{\frac{8\times8.314T_1}{3.14\times44\times10^{-3}}} \Rightarrow T_1 = 1682.5\text{ K}$$

Also, for the same gas $\frac{u_{av}}{u_{mps}} = \sqrt{\frac{8RT_1}{\pi M}} : \sqrt{\frac{2RT_2}{M}} = \sqrt{\frac{8T_1}{\pi}\times\frac{1}{2T_2}} = \sqrt{\frac{4T_1}{\pi T_2}}$

$$\Rightarrow \quad 1 = \sqrt{\frac{4T_1}{\pi T_2}} \quad \Rightarrow \quad T_2 = \frac{4T_1}{\pi} = \frac{4\times1682.5}{3.14} = 2142\text{ K}$$

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

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

29.(5.23 L)

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

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