Question 11

A spherical balloon of 21 cm diameter is to be filled up with hydrogen at N.T.P. from a cylinder containing the gas at 20 atmospheres at 27°C. If the cylinder can hold 2.82 litres of water, calculate the number of balloons that can be filled up.

Volume of ballon = 4.851 L (as calculated above) Let no. of balloons to be filled = n

 \therefore Total volume occupied by *n* balloons = $4.851 \times n$ Volume of H₂ present in cylinder = 2.82 L (given)

$$\therefore$$
 Total volume of H₂ at NTP= (4.851n + 2.82)L

$$P_1 = 1 \text{ atm}$$
 $P_2 = 20 \text{ atm}$
 $V_1 = 4.85 \times n + 2.82 \text{ L}$ $V_2 = 2.82 \text{ L}$
 $T_1 = 273 \text{ K}$ $T_2 = 300 \text{ K}$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$
 or $\frac{1 \times (4.85 \times n + 2.82)}{273} = \frac{20 \times 2.82}{300}$

$$n = \frac{48.504}{4.851} \approx 10$$