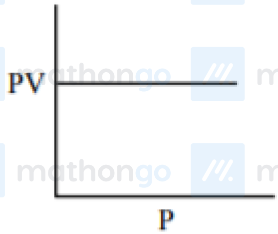
Q1 2021 (01 Sep Shift 2)

An empty LPG cylinder weighs 14.8 kg. When full, it weighs 29.0 kg and shows a pressure of 3.47 atm. In the course of use at ambient temperature, the mass of the cylinder is reduced to 23.0 kg. The final pressure inside of the cylinder is ____ atm. (Nearest integer)

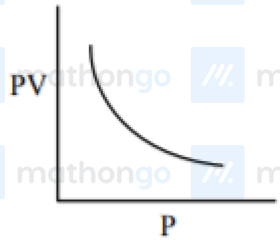
(Assume LPG of be an ideal gas)

Q2 2021 (31 Aug Shift 1)

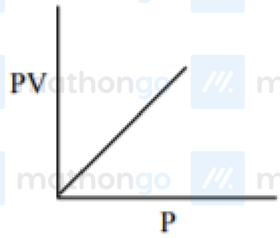
Which one of the following is the correct PV vs P plot at constant temperature for an ideal gas ? (P and V stand for pressure and volume of the gas respectively)



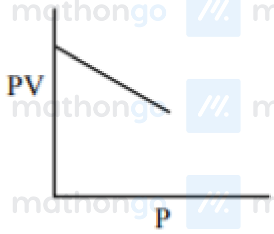
(1)



(2)



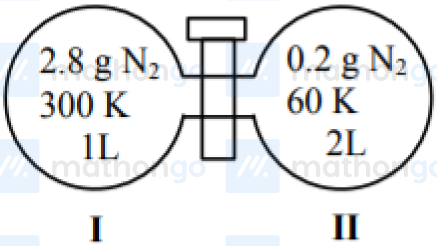
(3)



(4)

Q3 2021 (27 Aug Shift 2)

Two flasks I and II shown below are connected by a valve of negligible volume.



When the valve is opened, the final pressure of the system in bar is $x \times 10^{-2}$. The value of x is ____.

(Integer answer)

[Assume-Ideal gas; $1\text{ bar} = 10^5\ \text{Pa}$; Molar mass of

$N_2 = 28.0\ \text{g mol}^{-1}; R = 8.31\ \text{J mol}^{-1}\ \text{K}^{-1}$]

Q4 2021 (27 Aug Shift 1)

The unit of the van der Waals gas equation parameter 'a' in $\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$ is :

(1) kg m s^{-2}

(2) $\text{dm}^3\ \text{mol}^{-1}$

(3) kg m s^{-1}

(4) $\text{atm dm}^6\ \text{mol}^{-2}$

Answer Key

Q1 (2) **Q2** (1) **Q3** (84) **Q4** (4)

Q1 (2)

Initial mass of gas $= 29 - 14.8 = 14.2$ Kg

mass of gas used $= 29 - 23 = 6$ Kg

gas left $= 14.2 - 6 = 8.2$ Kg

(1) $3.47 \times V = \left(\frac{14.2 \times 10^3}{M}\right) \times R \times T$

(2) $p \times V = \left(\frac{8.2 \times 10^3}{M}\right) \times R \times T$

Divide :

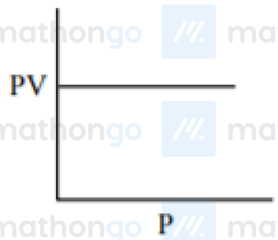
$\frac{(1)}{(2)} \Rightarrow \frac{3.47}{P} = \frac{14.2}{8.2}$

$P = 2.003$

Q2 (1)

$PV = nRT(n, T \text{ constant })$

$PV = \text{constant}$



Q3 (84)

Applying ; $(n_I + n_{II})_{initial} = (n_I + n_{II})_{final}$

$\Rightarrow$ Assuming the system attains a final temperature of T (such that $300 < T < 60$)

$$\Rightarrow \begin{pmatrix} \text{Heat lost by} \\ N_2 \text{ of container} \\ \text{I} \end{pmatrix} = \begin{pmatrix} \text{Heat gained by} \\ N_2 \text{ of container} \\ \text{II} \end{pmatrix}$$

$\Rightarrow n_I C_m (300 - T) = n_{II} C_m (T - 60)$

$\Rightarrow \left(\frac{2.8}{28}\right)(300 - T) = \frac{0.2}{28}(T - 60)$

$\Rightarrow 14(300 - T) = T - 60$

$\Rightarrow \frac{(14 \times 300 + 60)}{15} = T$

$\Rightarrow T = 284$ K (final temperature)

$\Rightarrow$ If the final pressure $= \mathrm{P}$

$\Rightarrow (\mathrm{n_I} + \mathrm{n_{II}})_{\text{final}} = \left(\frac{3.0}{28}\right)$

$\Rightarrow \frac{\mathrm{P}}{\mathrm{RT}}(\mathrm{V_I} + \mathrm{V_{II}}) = \frac{3.0\mathrm{gm}}{28\mathrm{gm/mol}}$

$\mathrm{P} = \left(\frac{3}{28}\ \mathrm{mol}\right) \times 8.31 \frac{\mathrm{J}}{\mathrm{mol-K}} \times \frac{284\ \mathrm{K}}{3 \times 10^{-3}\ \mathrm{m}^3} \times 10^{-5} \frac{\mathrm{bar}}{\mathrm{Pa}}$

$\Rightarrow 0.84287$ bar

$\Rightarrow 84.28 \times 10^{-2}$bar

$\Rightarrow 84$

Q4 (4)

$\frac{\mathrm{an}^2}{\mathrm{V}^2} = \mathrm{atm} \Rightarrow \mathrm{a} = \mathrm{atm} \times \frac{\mathrm{dm}^6}{\mathrm{mol}^2}$