1. Consider the following reaction

$2Na + 2NH_3 \rightarrow 2NaNH_2 + H_2(g)$

$2NaNH_2 + C \rightarrow Na_2CN_2 + 2H_2(g)$

$Na_2CN_2 + C \rightarrow 2NaCN$

51gm dry ammonia gas is passed over excess heated sodium to form sodamide ($NaNH_2$) which is further reacted with carbon (excess) to finally form NaCN. Find the total volume of $H_2(g)$ evolved at 0.5 atm, 273K

(A) 201.6 L (B) 100.8 L (C) 403.2 L (D) 50.4 L

$V_M = 22.4 \times 2$

2. 34 gm of H_2O_2 is present in 1135 ml of solution. Volume strength of solution is

(A) 10 V (B) 20 V (C) 30 V (D) 32 V

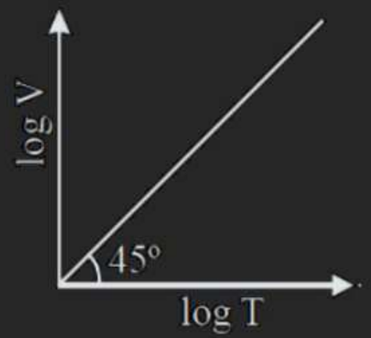
0.01 mol

3. 1.11 gm of $CaCl_2$ added to water forming 500 ml solution. 20 ml of this solution is taken and diluted 10 folds. Find moles of Cl^- ions in 2 ml of diluted solution -

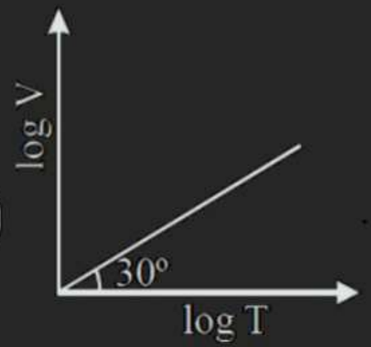
(A) 8×10^{-6} (B) 4×10^{-6} (C) 12×10^{-8} (D) 5×10^{-6}

4. For a closed (not rigid) container n = 10 moles of an ideal gas, fitted with movable, frictionless, weightless piston operating such that pressure of gas remains constant at 0.821 atm, Which graph represents correct variation of log V vs log T where V is in lit. & T in Kelvin.

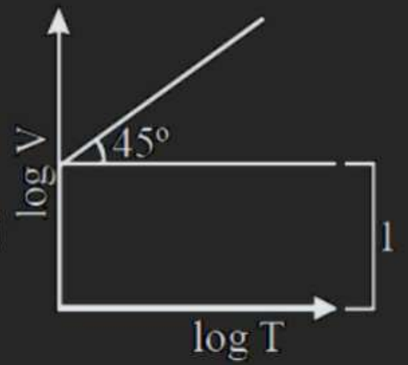
(A)



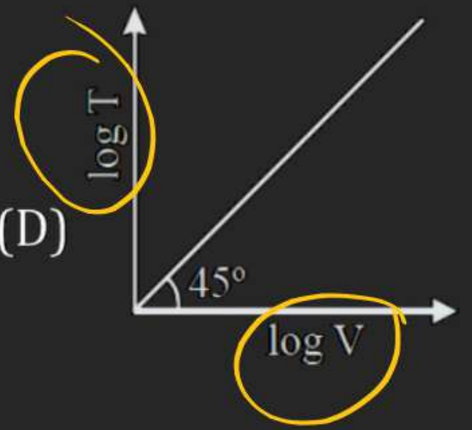
(B)



(C)



(D)



$\log \frac{nR}{P}$

$\log\left(\frac{10 \times 0.0821}{0.821}\right)$

$= 0$

5. A gas cylinder contains 320 gm of O_2 at 30 atm and 27°C. What mass (in gram) of O_2 would escape if first the cylinder is heated to 127° C and then valve is held open until the pressure inside the cylinder becomes 1 atm (the temperature being maintained at 127° C.

(A) 312 (B) 315 (C) 340 (D) 320

300K

400K

6. Which of the following combination of gases is most easiest to separate-

(A) H_2 and He

(B) CO_2 and N_2O

(C) $U^{235}F_6$ and $U^{238}F_6$

(D) C_3H_8 and C_3H_6

7. A sample of a gas was heated from 300°C to 600°C at constant pressure. Which of the following statement(s) is/are true.

(A) Kinetic energy of the gas is doubled

(B) Boyle's law will apply

(C) Volume of the gas will be doubled

(D) None of the above

8. Average velocity (in m/s) of oxygen gas at 120π Kelvin is [Given $R = \frac{25}{3}$ J/mole − K]

(A) 707

(B) 500

(C) $5\sqrt{10}$

(D) 316.2

$$\sqrt{\frac{8 \times 25/3 \times 120}{\pi \times 32 \times 10^{-3}}}$$

9. Which of the following changes will double the mean free path of gas in closed container

(A) Increasing temperature two times at constant volume

(B) Increasing temperature four times at constant volume

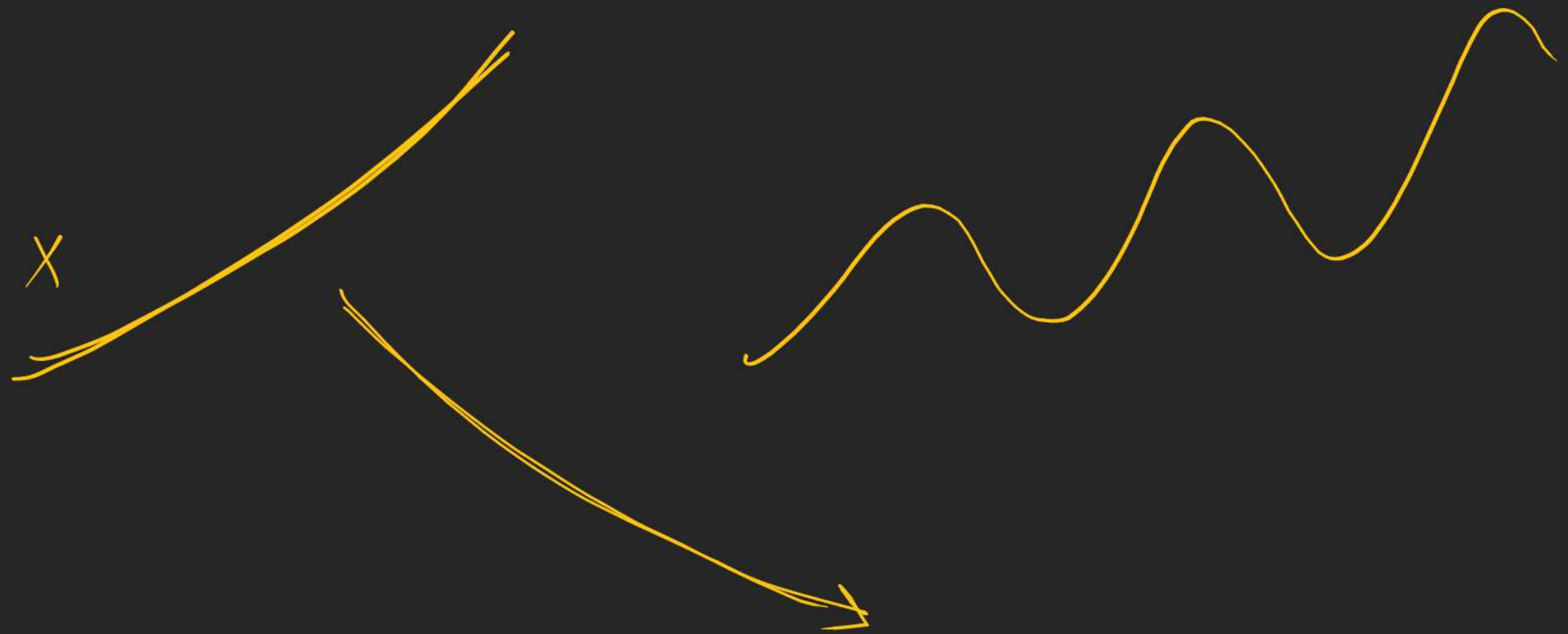
(C) Increasing temperature two times at constant pressure

(D) Increasing temperature four times at constant pressure

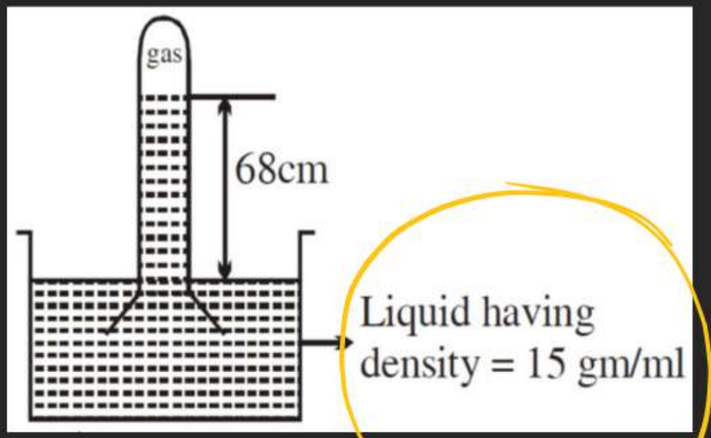
$\lambda \propto \frac{T}{P}$

$\lambda \propto V$

10. H_2 and O_2 are kept in mass ratio 1: 8 respectively at 6 atm. If small orifice is made then relative rate of effusion of H_2 with respect to O_2 initially is.



11. In the barometer shown below, if the height of the liquid column is 68 cm then calculate the pressure of the gas trapped in inverted tube (in mm of Hg)?
[Take P_{atm} = 760 mm of Hg]



$$68 \times 15 = \frac{136}{2} \times h$$

$$h = 75 \text{ cm of Hg}$$

$$P_{gas} + 75 = 76$$

$$P_{gas} = 1 \text{ cm of Hg}$$

12. A solution of A (MM = 20) and B (MM = 10), [$X_B = 0.6$] having density = 0.7 gm/mL, then the molarity of B in this solution.

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① Volume correction :→

$$V_{cont} = V_{gas} = V_{observed}$$

$$PV = nRT$$

$$\text{free volume} = V_{cont} - (\text{effective vol of gaseous molecules})$$

$$= V_{cont} - (\text{Excluded volume}) = V_{cont} - nb$$

Excluded vol of 1 mol gas $(b) = 4 \times \frac{4}{3}\pi r^3 \times N_A$

n → no. of moles

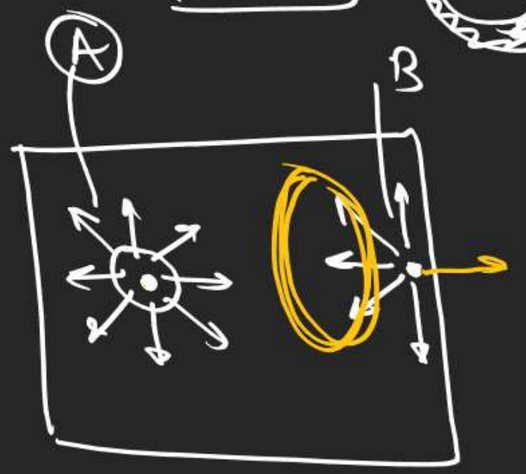
(11) Pressure correction :→

$$P_{gas} = P_{exerted} = P_{obs}$$

$$PV = nRT$$

↑ Pressure exerted by the gas when there is no attraction betⁿ molecules

$$= P_{obs} + P_{corr}$$



∵ If there is no attraction betⁿ molecules molecule will more pressure than when there is attraction betⁿ molecules.

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$P_{corr} = \frac{an^2}{V^2}$ n = no. of moles

V = Vol of container

a = Vander Waal's const which represents attraction bet^n molecules

$PV = nRT$

$V_{cont} - nb$

$P_{obs} + \frac{an^2}{V_{cont}^2}$

$\left(P_{obs} + \frac{an^2}{V_{cont}^2}\right)(V_{cont} - nb) = nRT$

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

a, b are <u>temperature independent</u> but gas dependent Vander Waal's const

Q. find pressure of real gas in 10 lit container at temperature 400 K. (moles = 1) $R = 0.08$ atm.lit/mol/K

$b = 2$ lit/mol $\quad a = 10$ atm.lit^2/mol^2

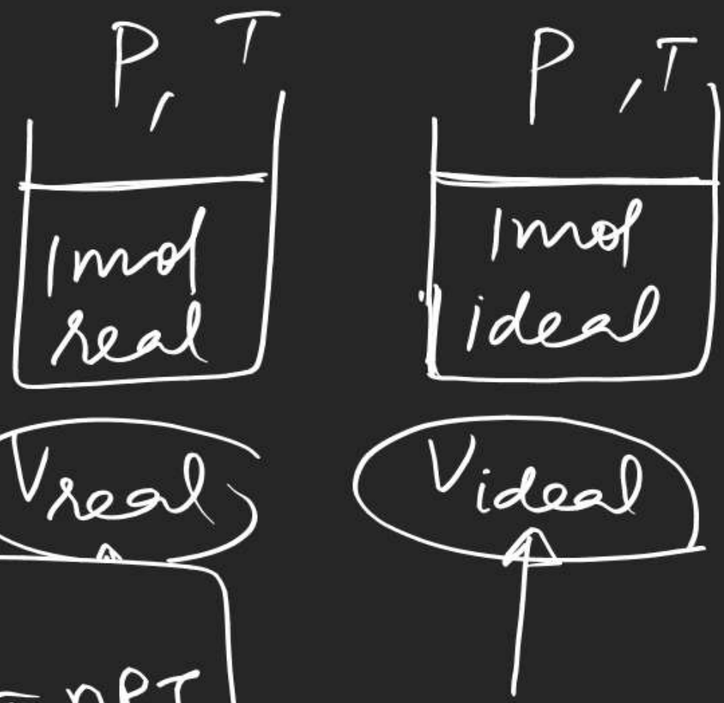
$$\left[P + \frac{10 \times 1^2}{(10)^2}\right]\left[10 - 1 \times 2\right] = 1 \times 0.08 \times 400$$

$$(P + 0.1) \times 8 = 8 \times 4$$

$$P = 3.9 \text{ atm}$$

Compressibility factor (Z) :-

$$Z = \frac{\text{Vol of real gas}}{\text{Vol of ideal gas at same } \underline{T \& P}} = \frac{V_{real}}{V_{ideal}}$$



$$Z = \frac{PV}{nRT}$$

$$Z = \frac{PM}{dRT}$$

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

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O-I	1 – 4
S-I	1 → 7

← Real Gases