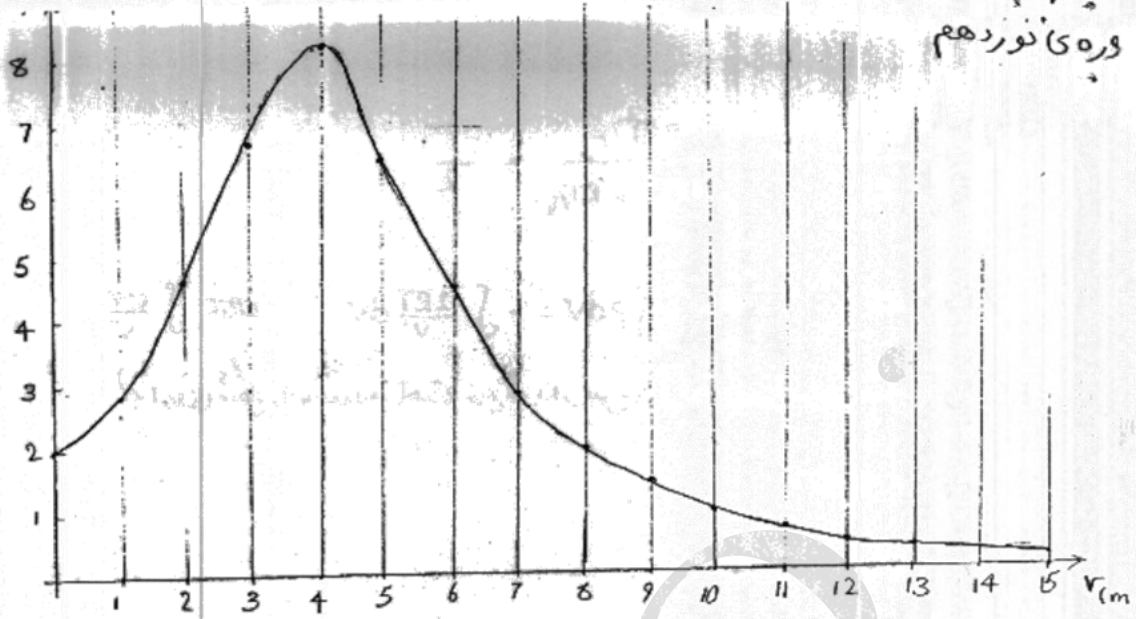


ورہی نوردھم

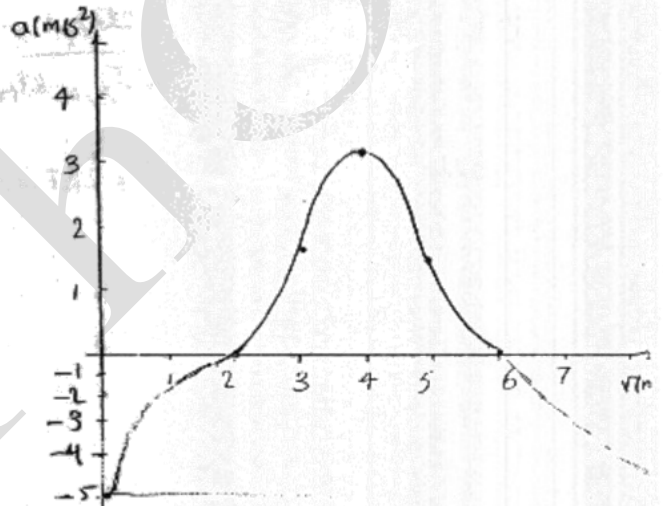
1)
الف)



$$P = Fv \Rightarrow F = \frac{P}{v}$$

ب) $F = mg \sin \phi \Rightarrow \sin \phi = 0.8$

ج) $a = \frac{F - mg \sin 30}{m} = \frac{F - 5}{m}$



د) $\begin{cases} a_1 = 2 \text{ m/s}^2 \\ a_2 = 2.8 \text{ m/s}^2 \\ a_3 = 4.7 \text{ m/s}^2 \end{cases} \Rightarrow v = 2 \times 1 + 2.8 \times 1 + 4.7 \times 1 = 9.5 \text{ m/s}$

2)

$$\text{الف) } \frac{P_{\text{NH}_3}}{P_{\text{H}_2} + P_{\text{N}_2}} = \frac{2RT/V}{3RT/V + RT/V} = \frac{1}{2}$$

$$PV = 2RT \quad W = -\int p dV = -\int \frac{2RT}{V} dV = -2RT \int \frac{dV}{V}$$

از روی شکل داده شده مساحت زیر نمودار بین x و $2x$ را بخوانید، این مساحتی است که ما می‌خواهیم

$$W = 1.38RT$$

$$\text{ب) } \Delta T = 0 \Rightarrow \Delta U = 0$$

$$\text{ج) } \frac{P_{\text{NH}_3}}{P_{\text{H}_2} + P_{\text{N}_2}} = \frac{2RT/V'}{3RT/V' + RT/V'} = 1 \Rightarrow V' = \sqrt{2}$$

$$\Delta U = -Q' + \frac{PV}{2} = -Q' + 2RT = -Q' + W \Rightarrow Q' = 2RT + Q - 1.38RT > 0$$

الف) روشن : $\alpha(T_0 - T)dt - Jdt = c dT$

$$= \frac{dT}{dQ} \times \frac{dQ}{dt} \Rightarrow \frac{dT}{dt} = \frac{-(\alpha(T_0 - T) - J)}{c}$$

خاموش : $\frac{dT}{dt} = -\frac{\alpha(T_0 - T)}{c}$

ب) سردکننده روشن $\Rightarrow \frac{dT}{dt} \Big|_{T=T_2} < 0 \Rightarrow J > \alpha(T_0 - T_2)$

ج) روشن : $\frac{dT}{dt} = \frac{\alpha(T_0 - \frac{T_1 + T_2}{2}) - J}{c}$

$$\Rightarrow t_1 = \frac{c(T_1 - T_2)}{\alpha(T_0 - \frac{T_1 + T_2}{2}) - J}$$

خاموش : $T_2 - T_1 = \frac{\alpha(T_0 - (\frac{T_1 + T_2}{2}))}{c} t_2$

$$\Rightarrow t_2 = \frac{c(T_2 - T_1)}{\alpha(T_0 - \frac{T_1 + T_2}{2})}$$

$$4) \ddot{F}_z = IB = \frac{\mu_0 I^2}{2\pi D} = - \frac{\mu_0 I^2 \cos^2 \omega t}{2\pi D} \hat{x}$$

$$\therefore a = - \frac{K}{\lambda} x - \frac{\alpha}{\lambda} v - \frac{\mu_0 I^2 \cos^2 \omega t}{2\pi D \lambda}$$

$$c) x = A + B \cos \Omega t + C \sin \Omega t$$

$$v = -B \Omega \sin \Omega t + C \Omega \cos \Omega t$$

$$a = -B \Omega^2 \cos \Omega t - C \Omega^2 \sin \Omega t$$

$$-B \Omega^2 \cos \Omega t - C \Omega^2 \sin \Omega t = \frac{K}{\lambda} x - \frac{K}{\lambda} B \cos \Omega t - \frac{K}{\lambda} C \sin \Omega t + \frac{\alpha}{\lambda} B \Omega \sin \Omega t - \frac{\alpha}{\lambda} C \Omega \cos \Omega t - \frac{\mu_0 I^2 \cos^2 \omega t}{2\pi D \lambda}$$

$$\cos^2 \omega t = \frac{\cos 2\omega t + 1}{2} \Rightarrow \Omega = 2\omega$$

$$\cos: \left\{ -B \Omega^2 = -\frac{K}{\lambda} B - \frac{\alpha}{\lambda} C \Omega - \frac{\mu_0 I^2}{4\pi D \lambda} \right.$$

$$\sin: \left\{ -C \Omega^2 = -\frac{K}{\lambda} C + \frac{\alpha}{\lambda} B \Omega \right.$$

$$-\frac{KA}{\lambda} - \frac{\mu_0 I^2}{4\pi D \lambda} = 0 \Rightarrow A = - \frac{\mu_0 I^2}{4\pi D K}$$

$$C \left(\frac{K}{\lambda} - \Omega^2 \right) = \frac{\alpha \Omega}{\lambda} B \Rightarrow B = \frac{K - \lambda \Omega^2}{\alpha \Omega} C$$

$$B \left(\Omega^2 - \frac{K}{\lambda} \right) = \frac{\alpha C \Omega}{\lambda} + \frac{\mu_0 I^2}{4\pi D \lambda}$$

$$C \left(\frac{\alpha \Omega}{\lambda} + \frac{(K - \lambda \Omega^2)^2}{\alpha \Omega \lambda} \right) = - \frac{\mu_0 I^2}{4\pi D \lambda}$$

$$C = \frac{-\mu_0 I^2 \alpha \Omega}{4\pi D ((K - \lambda \Omega^2)^2 + (\alpha \Omega)^2)}$$

5)

$$\text{الف) } \Delta x = \sqrt{2R^2(1-\cos\theta)} - R_0 \quad \frac{\theta_0}{2} = \frac{\pi}{N}$$

$$V = \frac{N}{2} K \sum_{i=1}^{N-1} \Delta x^2 = \frac{N}{2} K \left((N-1)(2R^2 + R_0^2) - 2R^2 \sum_{i=1}^{N-1} \cos\theta - 4R_0 \sum_{i=1}^{N-1} \sin\theta/2 \right)$$

$$= \frac{NK}{2} \left((N-1)(2R^2 + R_0^2) - 2R^2 \frac{\cos\pi \sin \frac{(N-1)\pi}{N}}{\sin \frac{\pi}{N}} - 4R_0 \frac{\sin \frac{N\pi}{2N} \sin \frac{(N-1)\pi}{2N}}{\sin \frac{\pi}{2N}} \right)$$

$$= \frac{NK}{2} \left((N-1)(2R^2 + R_0^2) + 2R^2 - 4R_0 \cotg \frac{\pi}{2N} \right)$$

$$\text{ب) } \frac{dV}{dR} = 0 \Rightarrow 4NR^* - 4R_0 \cotg \frac{\pi}{2N} = 0 \Rightarrow R^* = \frac{R_0}{N} \cotg \frac{\pi}{2N}$$

$$\text{ج) } R = \frac{4R_0 \cotg \theta/2 \pm \sqrt{16R_0^2 \cotg^2 \theta/2 - 8N^2 R_0^2}}{4N}$$

علامت منفی برای R_0 و علامت
مثبت برای جواب دیگر

6)

$$\text{الف) } \frac{V_A}{T_A} = \frac{V_B}{T_B} \Rightarrow T_B = \frac{V_B}{V_A} T_A = \frac{35}{10} \times 80 = 280 \text{ K}$$

$$\text{ب) } \frac{P_C}{P_B} = \frac{T_C}{T_B} = \frac{600}{280} = \frac{15}{7}$$

$$\frac{5 \times 10^4 + 3x}{5 \times 10^4 + x} = \frac{15}{7} \Rightarrow 7 \times 10^4 + 7x = 15 \times 10^4 + 3x$$

$$4x = 8 \times 10^4 \Rightarrow x = 2 \times 10^4$$

$$\Rightarrow P_B = 5 \times 10^4 + 2 \times 10^4 = 7 \times 10^4 \text{ Pa}$$

$$\text{ج) } P \cdot V = nR \cdot T$$

$$7 \times 10^4 \times 35 \times 10^{-3} = n \times 8.3 \times 280$$

$$\Rightarrow n \approx 1.05 \text{ mol}$$