به نام خدا



سایت گروه آموزشی آلم

ابتدایی، راهنمایی، دبیرستان، کنکور و دانشگاه

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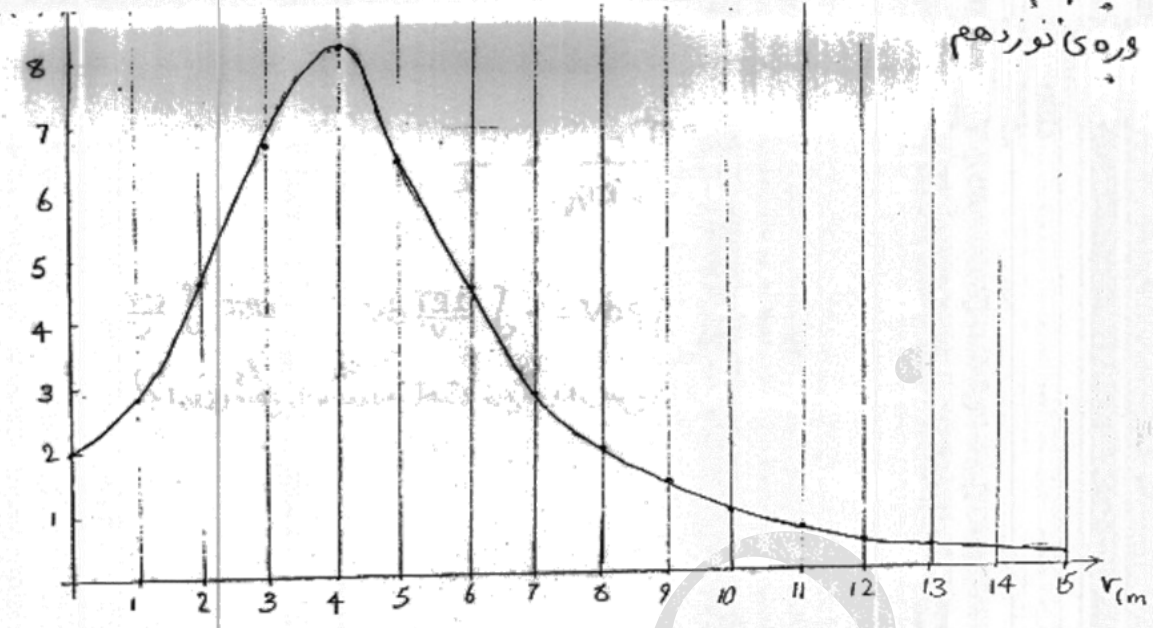
ورده ی نوزدهم

۱)

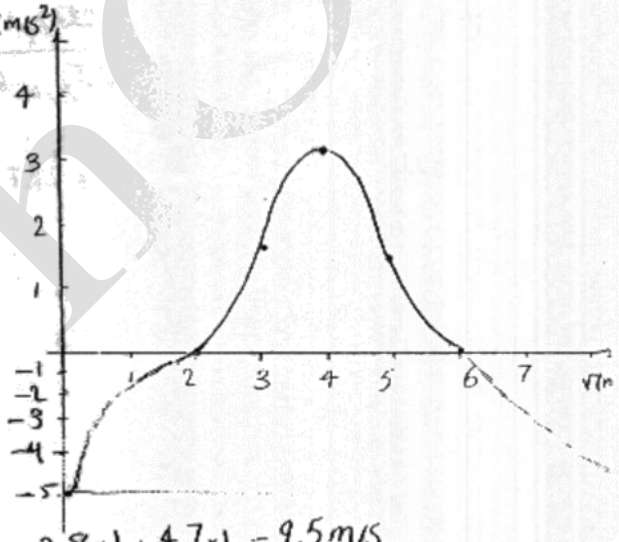
الف)



$P = FV \Rightarrow F = \frac{P}{V}$

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

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



د) $\begin{cases} a_1 = 2\,m/s^2 \\ a_2 = 2.8\,m/s^2 \\ a_3 = 4.7\,m/s^2 \end{cases} \Rightarrow V = 2\times1 + 2.8\times1 + 4.7\times1 = 9.5\,m/s$

2)

الف) $\frac{P_{NH_3}}{P_{H_2}+P_{N_2}} = \frac{2RT/V}{3RT/V + RT/V} = \frac{1}{2}$

$PV = 2RT \qquad W = -\int P dV = -\int \frac{2RT}{V} dV = -2RT \int \frac{dV}{V}$

از روی شکل داده شده مساحت زیر نمودار بین x و 2x دلخواه را بدست آورید

$W = 1.38RT$

ب) $\Delta T = 0 \Rightarrow \Delta U = 0$

ج) $\frac{P_{NH_3}}{P_{H_2}+P_{N_2}} = \frac{2RT/V'}{3RT/V' + RT/V'} = 1 \Rightarrow V' = V/2$

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

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الف) روشن: $\alpha(T_0 - T)dt - J dt = C dT$

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

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

ب) سردشده 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: $T_2 - T_1 = \frac{\alpha(T_0 - (\frac{T_1+T_2}{2}))}{C} t_2$

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

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4) $\vec{F} = IB = \frac{\mu . I^2}{2\pi D} = -\frac{\mu . I^2 \cos^2 \omega t}{2\pi D}\hat{x}$

ب) $a = -\frac{K}{\lambda}x - \frac{\alpha}{\lambda}v - \frac{\mu . I^2 \cos^2 \omega t}{2\pi D \lambda}$

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

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

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

$-B\Omega^2 \cos \Omega t - C\Omega^2 \sin \Omega t = -\frac{KA}{\lambda} - \frac{K}{\lambda}B\cos \Omega t - \frac{K}{\lambda}C \sin \Omega t$

$+\frac{\alpha}{\lambda}B\Omega \sin \Omega t - \frac{\alpha}{\lambda}C\Omega \cos \Omega t$

$-\frac{\mu . I_.^2 \cos^2 \omega t}{2\pi D \lambda}$

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

$\cos: \quad -B\Omega^2 = -\frac{K}{\lambda}B - \frac{\alpha}{\lambda}C\Omega - \frac{\mu . I_.^2}{4\pi D \lambda}$

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

$-\frac{KA}{\lambda} - \frac{\mu . I_.^2}{4\pi D \lambda} = 0 \Rightarrow A = -\frac{\mu . I_.^2}{4\pi D K}$

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

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

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

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

5)

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

$$U = \frac{N}{2} K \sum_{i=1}^{N-1} \Delta x^2 = \frac{N}{2} K \left((N-1)(2R^2+R_0^2) - 2R^2 \sum_{i=1}^{N-1} \cos\theta - 4RR_0 \sum_{i=1}^{N-1} \sin\theta/2 \right)$$

$$= \frac{NK}{2} \left((N-1)(2R^2+R_0^2) - 2R^2 \frac{\cos\pi \sin\frac{(N-1)\pi}{N}}{\sin\frac{\pi}{N}} - 4RR_0 \frac{\sin\frac{N\pi}{2N}\sin\frac{(N-1)\pi}{2N}}{\sin\frac{\pi}{2N}} \right)$$

$$= \frac{NK}{2} \left((N-1)(2R^2+R_0^2) + 2R^2 - 4RR_0 \cot g \frac{\pi}{2N} \right)$$

ب) $\frac{dU}{dR} = 0 \Rightarrow 4NR^* - 4R_0 \cot g \frac{\pi}{2N} = 0 \Rightarrow R^* = \frac{R_0}{N} \cot g \frac{\pi}{2N}$

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

علامت منفی برای R_1 و علامت مثبت برای جواب دیگر

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6)

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

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

$$\frac{5\times10^4 + 8x}{5\times10^4 + x} = \frac{15}{7} \Rightarrow 7\times10^4 + 7x = 15\times10^4 + 3x$$

$$4x = 8\times10^4 \Rightarrow x = 2\times10^4$$

$$\Rightarrow P_B = 5\times10^4 + 2\times10^4 = 7\times10^4\,Pa$$

ج) $PV = nRT$

$$7\times10^4 \times 35\times10^{-3} = n \times 8.3 \times 280$$

$$\Rightarrow n \simeq 1.05\,mol$$

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