♦ سلم تصحيح اختبار فيزياء مرن + فتل ... ♥

أولاً: السؤال الأول:

1) b) أو 2s.

2) b) أو $T_0$.

3) c) أو $T_0 = T_0$

4) a) أو $\Gamma = -K\theta$

5) b) أو 0.4

السؤال الثاني: وهي معادلة تفاضلية من المرتبة الثانية تقبل حلاً جيبياً من الشكل:

(9) $\theta = \theta_{max} \cos(\omega_0 t + \varphi)$

نشتق مرتين:

(4) $(\theta)'_t = \omega = -\omega_0 \theta_{max} \sin(\omega_0 t + \varphi)$

(4) $(\theta)''_t = \alpha = -\omega_0^2 \theta_{max} \cos(\omega_0 t + \varphi)$

(4) $(\theta)''_t = \alpha = -\omega_0^2 \theta$ ... (2)

بالمطابقة نجد:

$$-\omega_0^2 \theta = -\frac{K}{I_\Delta} \theta$$

(4) $\omega_0^2 = \frac{K}{I_\Delta} \Rightarrow \omega_0 = \sqrt{\frac{K}{I_\Delta}} > 0$

لأن $K$ و $I_\Delta$ مقادير موجبة.

(2) $\omega_0 = \frac{2\pi}{T_0} \Rightarrow T_0 = \frac{2\pi}{\omega_0} = \frac{2\pi}{\sqrt{\frac{K}{I_\Delta}}}$

(2) $\Rightarrow T_0 = 2\pi \sqrt{\frac{I_\Delta}{K}}$

السؤال الثالث:

(5) $x = X_{max} \cos(\omega_0 t)$

(3) $v = (x)'_t = -\omega_0 X_{max} \sin(\omega_0 t)$ :نشتق مرتين (10)

(2) $a = (x)''_t = -\omega_0^2 X_{max} \cos(\omega_0 t)$ (10)

(5) $a = -\omega_0^2 x$ (10)

(3) أعظمي: عندما $\cos(\omega_0 t) = \pm 1$ (10)

$\Rightarrow x = \pm X_{max}$ (10)

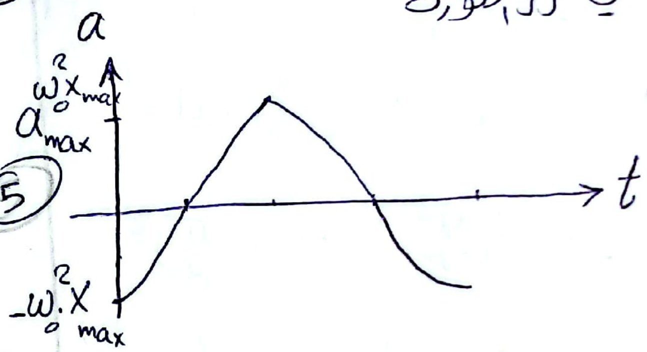
(2) في الوضعين الطرفيين.

(3) معدوم: عندما $\cos(\omega_0 t) = 0$

$\Rightarrow x = 0$

(2) في مركز التوازن

(5)




ثانياً: المسألة الأولى:

1)

(5) $I_\Delta = \frac{1}{12} m l^2$

(3) $= \frac{1}{12}(0.3)(20\times10^{-2})^2 = \frac{1}{4}\times10^{-1}\times4\times10^{-2}$ (4)

(2) $\Rightarrow I_\Delta = 10^{-3}\ kg.m^2$

2)

(2+3+5) $T_0 = 2\pi\sqrt{\frac{I_\Delta}{K}} = 2\pi\sqrt{\frac{10^{-3}}{10^{-2}}} = 2s$

3)

(5) $\theta = \theta_{max} \cos(\omega_0 t + \varphi)$

(3) $\theta = \theta_{max} = \frac{\pi}{4} rad$

المسألة الثانية (1):

(5) $T_0 = 2\pi\sqrt{\dfrac{I_\Delta}{K}}$

نربّع (3) $T_0^2 = 40 \cdot \dfrac{I_\Delta}{K} \Rightarrow K = \dfrac{40 \times I_\Delta}{T_0^2}$

(2+3) $K = \dfrac{40 \times 8\times10^{-3}}{(2)^2} = 8\times10^{-2}\, m.N.rad^{-1}$

(5) $I_{\Delta\,\text{جملة}} = I_{\Delta/m_1} + I_{\Delta/m_2} = 2 I_{\Delta/m_1}$

(5) $= 2\times m_1 \left(\dfrac{l}{2}\right)^2 = 2\times 100\times10^{-3} \times \left(\dfrac{40\times10^{-2}}{2}\right)^2$

(3)

(2) $= 2\times10^{-1}\times(4\times10^{-2}) = 8\times10^{-3}\, Kg.m^2$

(2)

(5) $\theta = \theta_{max}\cos(\omega_0 t + \varphi)$

(3) $\theta_{max} = \dfrac{\pi}{3}\, rad$

(2+3) $\omega_0 = \dfrac{2\pi}{T_0} = \dfrac{2\pi}{2} = \pi\, rad.s^{-1}$

نعوض الشروط البدئية:

(1) $(t=0,\ \theta = \theta_{max})$

(2) $\theta_{max} = \theta_{max}\cos\varphi$

(2) $\dfrac{\pi}{3} = \dfrac{\pi}{3}\cos\varphi \Rightarrow \cos\varphi = 1$

(2) $\boxed{\varphi = 0\, rad}$

(5) $\boxed{\theta = \dfrac{\pi}{3}\cos(\pi t)}$

(5) $\omega = -\omega_0\,\theta_{max}\sin(\omega_0 t_3 + \varphi)$

(3)

(2+3) $t_3 = \dfrac{5T_0}{4} = \dfrac{5\times2}{4} = \dfrac{5}{2}\, s$

(2+3) $\omega = -\pi \cdot \dfrac{\pi}{3}\sin\left(\pi\times\dfrac{5}{2}\right) = -\dfrac{10}{3}\, rad.s^{-1}$

(5) $\omega_0 = \dfrac{2\pi}{T_0} = \dfrac{2\pi}{2} = \pi\, rad.s^{-1}$ (2)

(3)

نعوض الشروط البدئية:

(1) $(t=0,\ \theta = \theta_{max})$

(2) $\theta_{max} = \theta_{max}\cos\varphi$

$\dfrac{\pi}{4} = \dfrac{\pi}{4}\cos\varphi \Rightarrow \cos\varphi = 1$

(2) $\varphi = 0\, rad$

(5) $\Rightarrow \theta = \dfrac{\pi}{4}\cos(\pi t)$

(4)

(2+2) $t_2 = \dfrac{3T_0}{4} = \dfrac{3(2)}{4} = \dfrac{3}{2}\, s$

(5) $\omega = -\omega_0\,\theta_{max}\sin(\omega_0 t_2 + \varphi)$

(2+3) $= -\pi\times\dfrac{\pi}{4}\sin\left(\pi\cdot\dfrac{3}{2}\right) = -\dfrac{10}{4}(-1)$

$\Rightarrow \omega = \dfrac{10}{4} = \dfrac{5}{2}\, rad.s^{-1}$

(5)

(5) $E_p = \dfrac{1}{2}K\theta^2 = \dfrac{1}{2}(10^{-2})\left(\dfrac{\pi}{8}\right)^2$

(2+3) $= \dfrac{1}{2}\times10^{-2}\times\dfrac{10}{64} = \dfrac{10^{-1}}{128}\, J$

(5) $E_K = E - E_p$

(5) $E = \dfrac{1}{2}K\theta_{max}^2 = \dfrac{1}{2}(10^{-2})\left(\dfrac{\pi}{4}\right)^2$

(2+3) $= \dfrac{1}{2}\times10^{-2}\times\dfrac{10}{16} = \dfrac{10^{-1}}{32}\, J$

(2+1) $E_K = \dfrac{1}{32}\times10^{-1} - \dfrac{1}{128}\times10^{-1} = \dfrac{3}{128}\times10^{-1}\, J$

(5) (2) $= \frac{\pi}{4} \cdot 8\times10^{-2} = 2\pi\times10^{-2}\, m.s^{-1}$

3)

(5) $T_0 = 2\pi\sqrt{\frac{m}{K}}$

$T_0^2 = 40 \cdot \frac{m}{K} \Rightarrow K = \frac{40 \cdot m}{T_0^2}$

(2+3) $K = \frac{40\times10^{-1}}{64} = \frac{1}{16}\, N.m^{-1}$

4)

(3) $a = -\omega_0^2 \cdot x$

(2) $= -\left(\frac{\pi}{4}\right)^2 \cdot 5\times10^{-2}$

(1) $= -\frac{5}{160} = -\frac{1}{32}\, m.s^{-2}$

(3) $F = -K \cdot x$

(2) $= -\frac{1}{16}\times 5\times10^{-2} = -\frac{5}{1600}$

(1) $= -\frac{1}{320}\, N$

5)

(3) $E_{tot} = \frac{1}{2} K X_{max}^2$

(2) $= \frac{1}{2}\times\frac{1}{16}\left(8\times10^{-2}\right)^2$

(2) $= \frac{1}{32}\times 64\times10^{-4} = 2\times10^{-4}\, J$

6)

(3) $E_K = E_{tot} - E_p$

(3) $E_p = \frac{1}{2} K \cdot x^2 = \frac{1}{2}\times\frac{1}{16}\left(4\times10^{-2}\right)^2$

(3) (2) $= 5\times10^{-5}\, J$

(2) $E_K = 2\times10^{-4} - 0,5\times10^{-4} = 1.5\times10^{-4}\, J$

4)

(5) $l' = \frac{l}{4} \Rightarrow \frac{T_0'}{T_0} = \sqrt{\frac{l'}{l}}$

(3) $\frac{T_0'}{T_0} = \sqrt{\frac{\frac{l}{4}}{l}} \Rightarrow \frac{T_0'}{T_0} = \sqrt{\frac{1}{4}}$

(2) $\Rightarrow \frac{T_0'}{T_0} = \frac{1}{2}$

(2) $\boxed{T_0' = \frac{T_0}{2} = \frac{2}{2} = 1s}$

المسألة الثالثة:

1)

(5) $x = X_{max}\cos(\omega_0 t + \varphi)$

(3) $d = 16cm \Rightarrow d = 2X_{max}$

$X_{max} = \frac{d}{2} = \frac{16\times10^{-2}}{2}$

(2) $= 8\times10^{-2}\, m$

(1) $(t = 0,\ x = -X_{max})$ نفوض شروط البدء:

(3) $-X_{max} = X_{max}\cos\varphi$

$\Rightarrow \cos\varphi = -1$

(2) $\varphi = \pi\, rad$

(5) $t = \frac{T_0}{2} \Rightarrow 4 = \frac{T_0}{2} \Rightarrow T_0 = 8s$

(2)

(2) $\omega_0 = \frac{2\pi}{T_0} = \frac{2\pi}{8} = \frac{\pi}{4}\, rad.s^{-1}$

(2) (1)

(5) $x = 8\times10^{-2}\cos\left(\frac{\pi}{4}t + \pi\right)$

2)

$t_1 = \frac{T_0}{4} = \frac{8}{4} = 2s$

(3) (2)

(5) $V_{max} = \omega_0 \cdot X_{max}$

السؤال الرابع: (2) $E_{tot} = E_p + E_K = const$

(2) $E_{tot} = \frac{1}{2}K\cdot\theta^2 + \frac{1}{2}I_\Delta\cdot\omega^2$

نشتق بالنسبة للزمن:

(1) $0 = \frac{1}{2}K(2\theta)(\omega) + \frac{1}{2}I_\Delta\cdot 2\omega(\alpha)$

$0 = K\cdot\theta\cdot\omega + I_\Delta\cdot\omega\cdot\alpha$

بـ: $\omega$

$0 = K\cdot\theta + I_\Delta\cdot\alpha$

(3) $I_\Delta\cdot\alpha = -K\theta$

(2) $\alpha = -\frac{K}{I_\Delta}\cdot\theta$

(3) $(\theta)''_t = -\frac{K}{I_\Delta}\cdot\theta \dots (1)$

(1) وهي معادلة تفاضلية من المرتبة الثانية تقبل حلاً جيبياً من الشكل:

(5) $\theta = \theta_{max}\cos(\omega_0 t + \varphi)$

نشتق مرتين:

(2) $\omega = (\theta)'_t = -\omega_0\cdot\theta_{max}\sin(\omega_0 t + \varphi)$

(2) $\alpha = (\theta)''_t = -\omega_0^2\,\theta_{max}\cos(\omega_0 t + \varphi)$

(2) $(\theta)''_t = -\omega_0^2\theta \dots (2)$

بالمطابقة بين (1) و(2) نجد أنّ:

$-\frac{K}{I_\Delta}\cdot\theta = -\omega_0^2\theta$

(5) $\omega_0^2 = \frac{K}{I_\Delta} \Rightarrow \omega_0 = \sqrt{\frac{K}{I_\Delta}} > 0$

(5) ⇐ حركة النواس هي حركة جيبية دورانية

أ. فاطمة جبل ... ♥

أ. أمل أمريان ... ♥