Bài 2. CON LẮC LÒ XO

2.1. Câu A. **2.2.** Câu B. **2.3.** Câu D.

2.4. Câu A.

$$x = -\frac{1}{3}A$$

$$W_d = W - W_t = \frac{1}{2}kA^2\left(1 - \frac{1}{9}\right) = 0{,}9.\frac{8}{9} = 0{,}8 \text{ J}.$$

2.5. Câu B.

$$W = \frac{1}{2}mv^2 + \frac{1}{2}kx^2 = \frac{1}{2}kA^2$$

$$v = \sqrt{\frac{k}{m}(A^2 - x^2)} = \sqrt{\frac{200}{0{,}2}\left[(0{,}1)^2 - (0{,}025)^2\right]} \approx 3{,}06 \text{ m/s}.$$

2.6. Câu C. **2.7.** Câu A. **2.8.** Câu D.

2.9. Câu A. **2.10.** Câu D. **2.11.** Câu B.

2.12. Câu D.

$$a = \frac{F}{m} = -\frac{0,8}{0,5}\cos 4t = -1,6\cos 4t$$

$$a = -\omega^2 A\cos \omega t = -16A\cos 4t$$

Suy ra : $A = 0,1$ m = 10 cm.

2.13. a) $\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{0,2} = 10\pi$ rad/s

$$x = A\cos(\omega t + \varphi)$$

Tại $t = 0$ $\begin{cases} x = A\cos\varphi = 0 \Rightarrow \cos\varphi = 0 \\ v = -A\omega\sin\varphi < 0 \Rightarrow \sin\varphi > 0 \end{cases} \Rightarrow \varphi = \dfrac{\pi}{2}$

$$x = 0,20\cos\left(10\pi t + \frac{\pi}{2}\right) \text{ (m)}$$

b) Tại $t = \dfrac{3T}{4}$

$$(\omega t + \varphi) = \left[\frac{2\pi}{T}.\frac{3T}{4} + \frac{\pi}{2}\right] = 2\pi \ ; \ v = -A\omega\sin 2\pi = 0$$

$$a = -\omega^2 A\cos 2\pi = -(10\pi)^2(0,20).1 = -197 \approx -200 \text{ m/s}^2 < 0.$$

Ta nhận thấy, vectơ $\vec{a}$ hướng theo chiều âm của trục x về vị trí cân bằng.

$$F = ma = 0,050.(-197) = -9,85 \approx -9,9 \text{ N} < 0.$$

Vectơ $\vec{F}$ hướng cùng chiều với vectơ $\vec{a}$.

2.14. a) $k = \dfrac{2W}{A^2} = \dfrac{2.1,00}{(0,100)^2} = 200$ N/m

b) $W = \dfrac{1}{2}mv_{\text{m}}^2 \Rightarrow m = \dfrac{2W}{v_{\text{m}}^2} = \dfrac{2.1,00}{(1,20)^2} \approx 1,388 \approx 1,39$ kg

c) $\omega = \sqrt{\dfrac{k}{m}} = \sqrt{\dfrac{200}{1,39}} = 12$ rad/s ; $f = \dfrac{\omega}{2\pi} = \dfrac{12,0}{6,28} = 1,91$ Hz

2.15. a) $\omega = \dfrac{2\pi}{T} = \dfrac{\pi}{2}$ rad/s

Tại $t = 0$: $x = A\cos\varphi = -A \Rightarrow \cos\varphi = -1$

$\Rightarrow \quad \varphi = \pi$

$$x = 24\cos\left(\frac{\pi}{2}t + \pi\right) \text{ (cm ; s)}$$

b) Tại $t = 0{,}5$ s :

$$x = 24\cos\frac{5\pi}{4} = 24\left(-\frac{\sqrt{2}}{2}\right) = -16{,}9 \text{ cm}$$

$x \approx -17$ cm.

$$a = -\omega^2 x = -\left(\frac{\pi}{2}\right)^2(-16{,}9)\,\text{cm/s}^2 = 42\ \text{cm/s}^2$$

$$F = ma \approx (0{,}010)(0{,}42) \approx 0{,}0042\,\text{N}$$

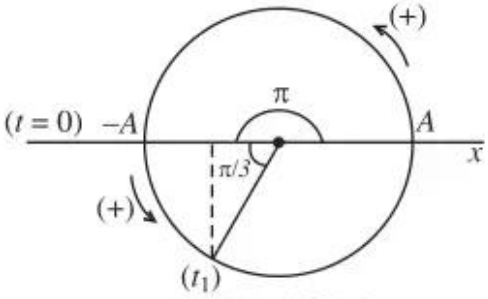
c) Tại $x = -12$ cm

$$-12 = 24\cos\left(\frac{\pi}{2}t + \pi\right)$$

$$\Rightarrow \cos\left(\frac{\pi}{2}t + \pi\right) = -\frac{1}{2}$$

$$\Rightarrow \frac{\pi}{2}t_1 + \pi = \pi + \frac{\pi}{3} \text{ (H.2.1G)}$$

$$\Rightarrow t_1 = \frac{2}{3}s.$$



Hình 2.1G

$$v = -\omega A\sin\left(\frac{\pi}{2}t + \pi\right)$$

$$= -\frac{\pi}{2}(0{,}24)\sin\left(\frac{\pi}{2}.\frac{2}{3} + \pi\right) = -0{,}12\pi\left(-\frac{\sqrt{3}}{2}\right) \text{ m/s}$$

$v \approx 0{,}33$ m/s.

2.16. a) $A = \dfrac{l_2 - l_1}{2} = \dfrac{24 - 20}{2} = 2$ cm

$l_0 = l_1 + A = 20 + 2 = 22$ cm

b) Tại $t = 0$:

$A = A\cos\varphi \Rightarrow \cos\varphi = 1 \Rightarrow \varphi = \pi$

$$x = A\cos s(2\pi ft) = 2\cos(2\pi.2,5t) \text{ (cm)}$$

$$x = 2\cos 5\pi t \text{ (cm ; s)}$$

c) $v = -A\omega\sin\omega t$

Tại $x = 0 : \cos 5\pi t = 0 \Rightarrow \sin 5\pi t = \pm 1$

$$v = \pm A\omega = \pm 0,02.5\pi \text{ (m/s)}$$

$$v = \pm 0,31 \text{ (m/s)}$$

$$a = -\omega^2 x = 0$$

2.17. a) $W = \frac{1}{2}kA^2$

Tại $x = \frac{1}{2}A :$ $W_t = \frac{1}{2}kx^2 = \frac{1}{4}\left(\frac{1}{2}kA^2\right) = \frac{1}{4}W$

$$W_đ = W - W_t = \frac{3}{4}W$$

b) $W_t = W_đ$

$$W_t + W_đ = 2W_t = W$$

$$\Rightarrow \quad W_t = \frac{1}{2}W$$

$$\frac{1}{2}kx^2 = \frac{1}{2}\left(\frac{1}{2}kA^2\right) \quad \Rightarrow x = \pm\frac{A}{\sqrt{2}}$$

2.18. a) $W = \frac{1}{2}kA^2 = \frac{1}{2}(20)(3,0.10^{-2})^2 = 9,0.10^{-3}\text{J}$

$$W = \frac{1}{2}mv_m^2 \Rightarrow v_m = \sqrt{\frac{2W}{m}} = \sqrt{\frac{2.9,0.10^{-3}}{0,50}}$$

$v_m = 0,19$ m/s.

b) $W_t = \frac{1}{2}kx^2 = \frac{1}{2}(20)(2,0.10^{-2})^2 = 4,0.10^{-3}\text{J}$

$$W_đ = W - W_t = (9,0 - 4,0).10^{-3} = 5,0.10^{-3}\text{J}$$

$$v = \sqrt{\frac{2W_đ}{m}} = \sqrt{\frac{2.5,0.10^{-3}}{0,5}}$$

$v = 0,14$ m/s.