حل البنك المؤتمت لبحث النواس الثقلية

تتم الطالب المبتدئ

1) A 2) C 3) A

4) C 5) B 6) D

7) $\omega_0 = \sqrt{\frac{g}{\ell}} = \sqrt{\frac{10}{0.1}} = \sqrt{100}$

$= 10\ rad.s^{-1}$ (A)

8) A 9) C 10) A

11) B 12) C 13) C

14) A 15) C 16) B

17) B 18) C 19) A

20) C 21) C 22) B

23) D 24) B 25) B

26) A 27) C 28) D

29) C 30) D 31) A

تتم الطالب المتوسط

1) نواسين متوافقتين :

T_0 : T_0
بسيط مركب

$2\pi\sqrt{\frac{\ell}{g}} = 2$ نربع الطرفين

$40\frac{\ell}{10} = 4 \Rightarrow \ell = 1m$

2) B 3) A 4) A

5) D 6) C 7) A

8) C

9) $I_0 = mr^2 = m\ell^2 = 0.5(20\times10^{-2})^2$

$I_0 = 0.5 \times 0.04 = 0.02\ Kg.m^2$

الجواب (D)

10) $I_0 = mr^2 = m\ell^2$

$8\times10^{-2} = 0.2\ell^2 \Rightarrow \ell^2 = \frac{8\times10^{-2}}{2\times10^{-1}}$

$\ell^2 = 0.4 = \frac{4}{10} \Rightarrow \ell = \frac{2}{\pi} = \frac{2\pi}{10}$

$\ell = \frac{6.25}{10} = 0.625\ m$ (B)

11) تخضع الكرة لتأثير : قوة ثقلها $\vec{w}$
قوة توتر الخيط $\vec{T}$

$\Sigma\vec{f} = m\vec{a}$

$\vec{w} + \vec{T} = m\vec{a}$

بالإسقاط على محور ينطبق على الناظم الذي له نفس حامل ومنحى $\vec{T}$

$-w\cos\theta + T = m a_c \Rightarrow$

$T = mg\cos\theta + m\frac{v^2}{r}$

ولكن استناداً على نظرية الطاقة الحركية نجد:

$v = \sqrt{2gl(\cos\theta - \cos\theta_{max})}$

$T = mg\cos\theta + m\frac{2gl(\cos\theta - \cos\theta_{max})}{l}$

$T = mg\cos\theta + 2mg\cos\theta - 2mg\cos\theta_{max}$

$T = 3mg\cos\theta - 2mg\cos\theta_{max}$

$T = mg(3\cos\theta - 2\cos\theta_{max})$ (C)

12) $h = l(1-\cos\theta_{max})$

$= 0.4\,(1-\frac{1}{2}) = 0.2\ m$ (D)

13) D

14) A

15) $T_0 = 2\pi\sqrt{\frac{l}{g}}$

$T_0' = 2\pi\sqrt{\frac{l'}{g}} = 2\pi\sqrt{\frac{\frac{l}{4}}{g}}$

$T_0' = \frac{1}{2}\times 2\pi\sqrt{\frac{l}{g}} = \frac{1}{2}T_0$ (B)

16) $T_0 = 2\pi\sqrt{\frac{l}{g}}$

$T_0' = 2\pi\sqrt{\frac{4l}{g}} = 2\times 2\pi\sqrt{\frac{l}{g}}$

$T_0' = 2T_0$ (A)

17) D

18) D

19) D

20) $\Delta E_k = \sum \overline{W}_{\vec{F}}$

$E_{k_2} - E_{k_1} = W_{\vec{w}} + W_{\vec{T}}$

الوضع الأول: $\theta = \theta_{max}$
بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$\frac{1}{2}mv^2 - 0 = mgh + 0$

عمل $\vec{T}$ يساوي الصفر في كل لحظة

$v^2 = 2gh \Rightarrow v = \sqrt{2gh}$

$v = \sqrt{2gl(1-\cos\theta_{max})}$ (A)

21) A

22) C

23) D

24) B

25) A

26) D

27) C

28) $T_{0\,\text{بسيط}} = T_{0\,\text{مركب}} \Rightarrow 2\pi\sqrt{\frac{l}{g}} = 4$

$40\frac{l}{10} = 16 \Rightarrow l = \frac{16}{4} = 4\ m$ (A)

A (ر31) C (ر30) B (ر29)

$h = d(1-\cos\theta_{max}) \Rightarrow$ (ر32)

$\frac{h}{d} = 1-\cos\theta_{max} \Rightarrow \cos\theta_{max} = 1-\frac{h}{d}$

الجواب (B)

A (ر35) D (ر34) A (ر33)

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D (ر36)

$I_{O10} = I_{O1C} + md^2$ $d = \frac{l}{2}$ (ر37)

$= \frac{1}{12}ml^2 + m\frac{l^2}{4}$ (3)

$I_{O10} = \frac{4}{12}ml^2 = \frac{1}{3}ml^2$

$T_O = 2\pi\sqrt{\frac{I_O}{mgd}} = 2\pi\sqrt{\frac{\frac{1}{3}ml^2}{mg\frac{l}{2}}}$

$T_O = 2\pi\sqrt{\frac{2l}{3g}} = 2\pi\sqrt{\frac{2\times6}{3\times10}} = 4S$ (C)

متمم الطالب الجيد

(ر1) اعتماداً على السؤال (11) متمم الطالب المتوسط وجدنا أن:

$T = mg(3\cos\theta - 2\cos\theta_{max})$

وفي وضع السكون $\theta = 0 \Leftarrow \cos\theta = 1$

$\Rightarrow T = mg(3-2\cos\theta_{max})$

$= 0.1\times10\left(3-2\left(\frac{1}{2}\right)\right) = 2N$ (B)

3/

$T = mg(3-2\cos\theta_{max})$ (ر2)

$= 0.5\times10\left(3-2\left(\frac{1}{2}\right)\right) = 10N$ (D)

(ر3) اعتماداً على السؤال (20) متمم الطالب المتوسط وجدنا أن:

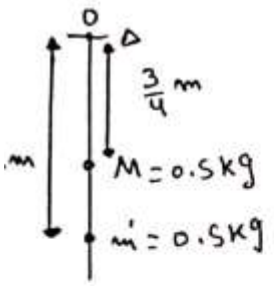
$v = \sqrt{2gl(1-\cos\theta_{max})}$

$2 = \sqrt{2(10)(0.4)(1-\cos\theta_{max})}$ (تربيع)

$4 = 8(1-\cos\theta_{max}) \Rightarrow$

$1-\cos\theta_{max} = \frac{1}{2} \Rightarrow \cos\theta_{max} = 1-\frac{1}{2} = \frac{1}{2}$

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



(ر4) $T_O = 2\pi\sqrt{\frac{I_O}{mgd}}$

$I_{O10} = I_{O1C} + Md^2 = \frac{1}{12}ML^2 + M\frac{L^2}{4} = \frac{1}{3}ML^2$

$= \frac{1}{3}\left(\frac{1}{2}\right)\left(\frac{3}{2}\right)^2 = \frac{9}{24} = \frac{3}{8}$ kg m²

$I_{O1m'} = m'r^2 = \frac{1}{2}(1)^2 = \frac{1}{2}$ kg m²

I_O جملة $= \frac{3}{8} + \frac{1}{2} = \frac{7}{8}$ kg m²

$m = m_1 + m_2 = 0.5 + 0.5 = 1kg$

$d = \frac{Mr + m'r}{M+m'} = \frac{\frac{1}{2}\left(\frac{3}{4}\right) + \frac{1}{2}(1)}{1}$

$d = \frac{3}{8} + \frac{1}{2} = \frac{7}{8}$ m $\Rightarrow$

$T_o = 2\pi\sqrt{\frac{\frac{\pi^2}{8}}{1\times 1.6\times\frac{9}{8}}} = 2\ S$

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الجواب (C)

(س5) D

(س6)

$d = \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1 + m_2}$

$d = \frac{(0.3)(-0.4) + (0.5)(0.6)}{0.8} = \frac{0.18}{0.8}$

$d = 0.225\ m$ (B)

(س7)

$d = \frac{Mr + m'r'}{M + m'} = \frac{2(\frac{1}{4}) + (\frac{1}{4})(\frac{3}{4})}{2 + 0.25}$

$d = \frac{\frac{1}{2} + \frac{3}{16}}{2.25} = \frac{\frac{11}{16}}{\frac{9}{4}} = \frac{11}{36}\ m$ (A)

(س8) عزم قوة الثقل على النواس

$-w\cos\theta = -mg\cos\theta$

$= -0.4\times 10\times\frac{1}{2} = -2\ N$ (A)

(س9) $a_c = \frac{v^2}{r} = \frac{4}{0.2} = 20\ m\,s^{-2}$ (C)

(س10) اعتماداً على السؤال (11) تم الطالب المتوسط

(س11)

$T = mg(3\cos\theta - 2\cos\theta_{max})$

وفي وضع الاتزان: $\theta = 0 \Leftarrow \cos\theta = 1$

$\Rightarrow T = mg(3 - 2\cos\theta_{max})$ (D)

$T = mg(3 - 2\cos\theta_{max})$

$= 200\times 10^{-3}\times 10(3 - 2(\frac{1}{2}))$

$= 4\ N$ (A)

(س12) اعتماداً على السؤال (20) تم الطالب المتوسط

$v = \sqrt{2gl(1-\cos\theta_{max})}$

$v = \sqrt{2(10)(1)(1-\frac{1}{2})} = \pi\ m\,s^{-1}$

الجواب (C)

(س13) $w = mg = 0 \Rightarrow g = 0 \Rightarrow T_o = 2\pi\sqrt{\frac{l}{g}} = \infty$ (B)

(س14)

$I_{O1O} = I_{O1C} + md^2$

$= \frac{1}{12}ml^2 + m\frac{l^2}{36}$

$= \frac{4}{36}ml^2 = \frac{1}{9}ml^2$

$T_o = 2\pi\sqrt{\frac{I_O}{mgd}} = 2\pi\sqrt{\frac{\frac{1}{9}ml^2}{mg\frac{l}{6}}}$

$T_o = 2\pi\sqrt{\frac{6l}{9g}} = 2\pi\sqrt{\frac{2l}{3g}}$

(D)

A (15

A (16

$$v=\sqrt{2g\ell(1-\cos\theta_{max})}$$ (17

$$=\sqrt{2(10)(0.4)(1-\frac{1}{2})}=2\,m\,s^{-1}$$ (D)

$I_{D10}=I_{DIC}+md^2$ $d=R$ (18

$=mR^2+mR^2=2mR^2$

$$T_o=2\pi\sqrt{\frac{I_D}{mgd}}=2\pi\sqrt{\frac{2mR^2}{mgR}}$$

$$T_o=2\pi\sqrt{\frac{2R}{g}}$$ (B)

$$T_o=2\pi\sqrt{\frac{2R}{g}}=2\pi\sqrt{\frac{2\times2\times10^{-2}}{10}}$$ (19

$\Rightarrow T_o=2\times2\times10^{-1}=0.4\,S$ (A)

$$\alpha=-\omega_o^2\theta=-\left(\frac{2\pi}{T_o}\right)^2\theta$$ (20

$$=-\left(\frac{2\pi}{2}\right)^2\times-\frac{\pi}{6}=+\frac{10\pi}{6}=\frac{5\pi}{3}\,rad.s^{-2}$$

الجواب (D)

B (21

$T=mg(3-2\cos\theta_{max})$ (22

$=100\times10^{-3}\times10\left(3-2\left(\frac{1}{2}\right)\right)=2N$ (C)

9

$$d=\frac{m_1\bar{r}_1+m_2\bar{r}_2}{m_1+m_2}$$ (23

$$d=\frac{0.3(-\frac{1}{4})+0.5(\frac{1}{4})}{0.8}=\frac{\frac{1}{4}(0.2)}{\frac{0.8}{1}}$$

$$d=\frac{0.2}{3.2}=\frac{1}{16}\,m$$ (D)

C (24

تم الطلب بالتفوق

$$T_o=2\pi\sqrt{\frac{I_D}{mgd}}$$ (1

$I_D=m_1r_1^2+m_2r_2^2$

$=0.4(0.2)^2+(0.6)(0.8)^2=0.4\,kg\,m^2$

$m_{جملة}=m_1+m_2=0.4+0.6=1\,kg$

$$d=\frac{m_1\bar{r}_1+m_2\bar{r}_2}{m_1+m_2}=\frac{0.4(-0.2)+0.6(0.8)}{1}$$

$d=0.4\,m$

$$T_o=2\pi\sqrt{\frac{0.4}{1\times10\times0.4}}=2S$$ (B)

$$T_o=2\pi\sqrt{\frac{I_D}{mgd}}$$ (2

$I_{D_{جملة}}=m_1r_1^2+m_2r_2^2$

$=m_1\left(\frac{1}{4}\right)^2+2m_1\left(\frac{3}{4}L\right)^2$

$=\frac{1}{16}m_1L^2+\frac{9}{8}m_1L^2=\frac{19}{16}m_1L^2$

$m_{جملة}=m_1+m_2=m_1+2m_1=3m_1$

$$d = \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1+m_2} = \frac{m_1\left(-\frac{L}{4}\right) + 2m_1\left(\frac{3L}{4}\right)}{3m_1}$$

$$d = \frac{m_1 \times L}{3m_1} = \frac{L}{3} \Rightarrow$$

$$T_0 = 2\pi\sqrt{\frac{\frac{19}{8}m_1L^2}{3m_1 g\frac{L}{3}}} = 2\pi\sqrt{\frac{19L}{16g}}$$

$$1 = 2\pi\sqrt{\frac{19L}{16\cdot(10)}} \Rightarrow 1 = \frac{4\times19L}{16}$$

$$L = \frac{4}{19}\ m = 0.21\ m \quad (D)$$

(3)

$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

$$I_\Delta = m_1r_1^2 + m_2r_2^2 = 0.3\left(\frac{1}{4}\right)^2 + 0.5\left(\frac{1}{4}\right)^2$$

$$= 0.05\ kg\,m^2$$

$$m_{\text{جملة}} = 0.3 + 0.5 = 0.8\ kg$$

$$d = \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1+m_1} = \frac{0.3\left(-\frac{1}{4}\right) + 0.5\left(\frac{1}{4}\right)}{0.8}$$

$$d = \frac{\frac{0.2}{4}}{\frac{0.8}{1}} = \frac{0.2}{3.2} = \frac{1}{16}\ m$$

$$T_0 = 2\pi\sqrt{\frac{0.05}{0.8\times10\times\frac{1}{16}}} = 2\ S \quad (C)$$

(4)

$$\Delta E_K = \Sigma \bar{W}_{\vec{F}}$$

$$E_{K_2} - E_{K_1} = \bar{W}_{\vec{w}} + W_{\vec{R}}$$

الوضع (1): بمرور سريع ابتدائية $\theta = \theta_{max}$

الوضع (2): $\theta = 0$

$$\frac{1}{2}I_\Delta\omega^2 - 0 = mgh + 0 \rightarrow \vec{R}$$ نقطة تأثير لا تنتقل

10

$$\omega = \sqrt{\frac{2mgd(1-\cos\theta_{max})}{I_\Delta}}$$

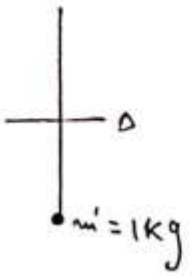
اعتماداً على السؤال (4) حسب الطالب لدينا:

$$\omega = \sqrt{\frac{2\times2\times10\times\frac{7}{8}\left(1-\frac{1}{2}\right)}{\frac{7}{8}}}$$

$$\omega = \sqrt{20} = 2\sqrt{5}\ rad.s^{-1}$$

(A)

(5)



$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

$$I_\Delta = I_{\Delta_{\text{جملة}}} + I_{\Delta/m'}$$

$$= \frac{1}{12}ML^2 + m'r^2$$

$$I_\Delta = \frac{1}{12}(3)(1)^2 + 1\left(\frac{1}{2}\right)^2 = \frac{1}{2}\ kg\,m^2$$

$$m = m + m' = 3 + 1 = 4\ kg$$

$$d = \frac{m\bar{r} + m'r'}{m+m'} = \frac{3(0) + 1\left(\frac{1}{2}\right)}{4}$$

$$d = \frac{1}{8}\ m \Rightarrow T_0 = 2\pi\sqrt{\frac{\frac{1}{2}}{4\times10\times\frac{1}{8}}} = 2S$$

(A)

(6)

$v_{m} = \omega . r_{m}$

حساب ω:

$\Delta E_K = \Sigma W_{\vec{F}}$

$E_{K_2} - E_{K_1} = W_{\vec{w}} + W_{\vec{R}}$

الوضع الأول: $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نعلم تأثير $\vec{R}$ تنعدم

$\omega = \sqrt{\frac{2mgd(1-\cos\theta_{max})}{I_\Delta}}$

اعتماداً على السؤال (5) (السابق)

$\omega = \sqrt{\frac{2(4)(10)(\frac{1}{8})(1-\frac{1}{2})}{\frac{1}{2}}} = \pi \ rad.s^{-1}$

$v_m = \pi \times \frac{1}{2} = \frac{\pi}{2} \ m.s^{-1}$ (B)

(7)

$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$

$I_{\Delta/O} = I_{\Delta/C} + md^2 = \frac{1}{2}mr^2 + mr^2$

$= \frac{3}{2}mr^2$

$\Rightarrow T_0 = 2\pi\sqrt{\frac{\frac{3}{2}mr^2}{mgr}} = 2\pi\sqrt{\frac{3r}{2g}}$

$T_0 = 2\pi\sqrt{\frac{3\times\frac{1}{6}}{2(10)}} = 1S$ (A)

(8)

$-\Delta E_K = \Sigma W_{\vec{F}}$

$E_{K_2} - E_{K_1} = W_{\vec{w}} + W_{\vec{R}}$

الوضع الأول: $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نعلم تأثير $\vec{R}$ تنعدم

$\omega = \sqrt{\frac{2mgd(1-\cos\theta_{max})}{I_\Delta}}$

اعتماداً على السؤال 5 متم الطالب المتفوق

$\omega = \sqrt{\frac{2\times mg\times r(1-\cos\theta_{max})}{\frac{3}{2}mr^2}}$

$\omega = \sqrt{\frac{4g(1-\cos\theta_{max})}{3r}}$

$\omega = \sqrt{\frac{4(10)(\frac{1}{2})}{3(\frac{1}{6})}} = 2\pi \ rad.s^{-1}$

الجواب (D)

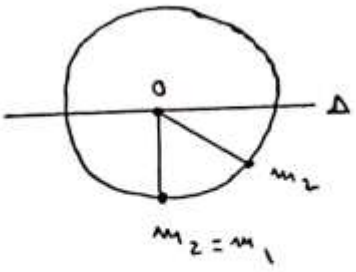
(9)

اعتماداً على السؤال 7 متم الطالب المتفوق وجدنا أنه دور النواس:

$T_0 = 2\pi\sqrt{\frac{3r}{2g}} = 2\pi\sqrt{\frac{3\times\frac{2}{3}}{2(10)}} = 2S$

الجواب (C)

(10)



$m_2 = m_1$

I_Δ جملة $= I_\Delta$ قرص $+ I_{\Delta/m_2} = \frac{1}{2}m_1r^2 + m_2r^2$

$= \frac{3}{2}m_1r^2$

m جملة $= m_1 + m_2 = 2m_1$

$$d = \frac{m_1 r_1 + m_2 r_2}{m_1 + m_2} = \frac{0 + m_2 r}{2m_2} = \frac{r}{2}$$

$$\Delta E_K = \sum W_{\vec{F}}$$

$$E_{K_2} - E_{K_1} = W_{\vec{w}} + W_{\vec{R}}$$

الوضع البدائي (1) : $\theta = \theta_{max}$ بعد سرعة ابتدائية

الوضع النهائي (2) : $\theta = 0$

$$\frac{1}{2} I_\Delta \omega^2 - 0 = 2mgh + 0$$

نقطة تأثير $\vec{R}$ تنتقل

$$\frac{1}{2} \times \frac{3}{2} m r^2 \times \left(\frac{v}{\frac{r}{2}}\right)^2 = 2mg\frac{r}{2}(1 - \cos\theta_{max})$$

$$\frac{3}{4} m r^2 \times \frac{4v^2}{r^2} = mgr(1 - \cos\theta_{max})$$

$$3v^2 = gr(1 - \cos\theta_{max})$$

$$3\left(\frac{\pi}{6}\right)^2 = 10\left(\frac{1}{6}\right)(1 - \cos\theta_{max})$$

$$\frac{30}{36} = \frac{10}{6} = (1 - \cos\theta_{max})$$

$$\frac{1}{2} = 1 - \cos\theta_{max} \Rightarrow \cos\theta_{max} = \frac{1}{2}$$

$$\theta_{max} = \frac{\pi}{3}\ rad \quad (C)$$

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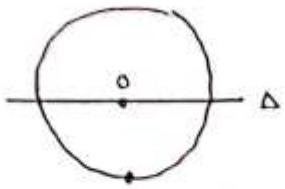
س 11



$m_2 = m_1$

$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

I_Δ جملة = $I_{\Delta 1}$ نواس + $I_{\Delta 1 m_2}$

$$= \frac{1}{2} m_1 r^2 + m_2 r^2 = \frac{3}{2} m_1 r^2$$

m جملة $= m_1 + m_2 = 2m_1$

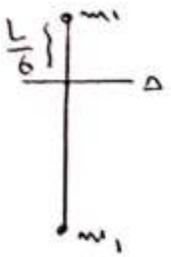
$$d = \frac{m_1 \bar{r}_1 + m_2 \bar{r}_2}{m_1 + m_2} = \frac{0 + m_2 r}{2m_2} = \frac{r}{2}$$

$$T_0 = 2\pi\sqrt{\frac{\frac{3}{2} m_1 r^2}{2 m_1 g \frac{r}{2}}}$$

$$T_0 = 2\pi\sqrt{\frac{3r}{2g}} = 2\pi\sqrt{\frac{3 \times \frac{1}{6}}{2(10)}}$$

$T_0 = 1\ S$ (A)

س 12



$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

I_Δ جملة $= I_{\Delta 1 m_1} + I_{\Delta 1 m_2}$

$$= m_1 r_1^2 + m_2 r_2^2$$

$$= m_1\left(\frac{L}{6}\right)^2 + m_1\left(\frac{5L}{6}\right)^2$$

I_Δ جملة $= \frac{1}{36} m_1 L^2 + \frac{25}{36} m_1 L^2$

$$= \frac{26}{36} m_1 L^2 = \frac{13}{18} m_1 L^2$$

$m_{جملة} = m_1 + m_1 = 2m_1$

$d = \frac{m_1\bar{r_1} + m_2\bar{r_2}}{m_1+m_2} = \frac{m_1(-\frac{L}{6}) + m_1(\frac{5L}{6})}{2m_1}$

$d = \frac{m_1(\frac{4L}{6})}{2m_1} = \frac{L}{3}$

$\Rightarrow T_0 = 2\pi\sqrt{\frac{\frac{13}{18}m_1L^2}{2m_1 g\frac{L}{3}}}$

$T_0 = 2\pi\sqrt{\frac{13L}{12g}} \Rightarrow$

$T_0^2 = 4\pi^2\frac{13L}{12g} = \frac{13\pi^2 L}{3g}$

$L = \frac{3gT_0^2}{13\pi^2}$ (C)

(13)

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

$\omega_0 = \frac{2\pi}{T_0} = \frac{2\pi}{1} = 2\pi$ rad.s^{-1}

$\left.\begin{matrix} t=0 \\ \omega=0 \end{matrix}\right\} \Rightarrow \theta = \theta_{max} = \frac{3}{\pi}$ rad.s^{-1}

$\left.\begin{matrix} t=0 \\ \theta=\theta_{max} \end{matrix}\right\} \Rightarrow \theta = \theta_{max}\cos(\omega_0 t + \bar{\varphi})$

$\theta_{max} = \theta_{max}\cos\bar{\varphi}$

$\cos\bar{\varphi} = 1 \Rightarrow \varphi = 0$ rad

$\theta = \frac{3}{\pi}\cos 2\pi t$ (A)

المدرس فراس قلعه جي
إجازة في العلوم الفيزيائية والكيميائية
دبلوم في التأهيل التربوي
٠٩٨٨٤٤٠٥٧٤

9/ (13) اعتماداً على السؤال السابق

$\omega = -\omega_0\theta_{max}\sin(\omega_0 t + \bar{\varphi})$

$\omega = -2\pi \times \frac{3}{\pi}\sin(2\pi t + 0)$

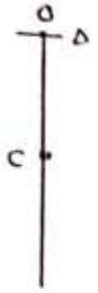
$\omega = -6\sin 2\pi t$

$t = \frac{3T_0}{4} = \frac{3}{4}$ s المسافة المقطوعة خلال الزمن السابق

$\Rightarrow \omega = -6\sin 2\pi \times \frac{3}{4} = 6$ rad.s^{-1}

الجواب (B)

(15)



$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$

$I_{\Delta/O} = I_{\Delta/C} + md^2$

$= \frac{1}{12}ml^2 + m(\frac{l}{2})^2$

$= \frac{4}{12}ml^2 = \frac{1}{3}ml^2$

$T_0 = 2\pi\sqrt{\frac{\frac{1}{3}ml^2}{mg\frac{l}{2}}} = 2\pi\sqrt{\frac{2l}{3g}}$

الجواب (C)

(16)

$T_0 = 2\pi\sqrt{\frac{l}{g}} = 2\pi\sqrt{\frac{0.4}{10}}$

$T_0 = 2\pi \times \frac{2}{10} = 0.4\pi$ s

$T_0' \simeq T_0\left[1 + \frac{\theta_{max}^2}{16}\right]$

$\simeq 0.4\pi\left[1 + \frac{(\frac{\pi}{3})^2}{16}\right]$ (C)

$\simeq 0.4\pi\left[1 + \frac{10}{144}\right] \simeq 1.33$ s

17

$\Delta E_k = \Sigma W_{\vec{F}}$

$E_{k_2} - E_{k_1} = W_{\vec{w}} + W_{\vec{R}}$

الوضع الأول : $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني : $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نقطة تأثير $\vec{R}$ لا تنتقل

اعتماداً على السؤال السابق (1.5)

$\frac{1}{2} \times \frac{1}{3} m l^2 \omega^2 = mg \frac{l}{2} (1 - \cos\theta_{max})$

$\frac{1}{3} l \omega^2 = g(1 - \cos\theta_{max})$

$\omega^2 = \frac{3g(1-\cos\theta_{max})}{l} \Rightarrow$

$\omega = \sqrt{\frac{3g(1-\cos\theta_{max})}{l}}$ (C)

18

$v_c = \omega . r_c$ (A)

$T_0 = 2\pi \sqrt{\frac{I_\Delta}{mgd}}$

$m_1 = 0.3\,kg$

$m_2 = 0.5\,kg$

$I_\Delta = I_{\Delta/m_1} + I_{\Delta/m_2}$

$= m_1 r_1^2 + m_2 r_2^2 = 0.3\left(\frac{1}{4}\right)^2 + 0.5\left(\frac{1}{4}\right)^2$

$= 0.05\,kg\,m^2$

10

$m = m_1 + m_2 = 0.3 + 0.5$

$= 0.8\,kg$

$d = \frac{m_1 \bar{r}_1 + m_2 \bar{r}_2}{m_1 + m_2} = \frac{0.3(-\frac{1}{4}) + 0.5(\frac{1}{4})}{0.8}$

$d = \frac{0.2}{0.8} = \frac{0.2}{3.2} = \frac{1}{16}\,m$

$T_0 = 2\pi \sqrt{\frac{0.05}{0.8 \times 10 \times \frac{1}{16}}} = 2\,S$

$\Delta E_k = \Sigma W_{\vec{F}}$

$E_{k_2} - E_{k_1} = W_{\vec{w}} + W_{\vec{R}}$

الوضع الأول : $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني : $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نقطة تأثير $\vec{R}$ لا تنتقل

$\omega = \sqrt{\frac{2mgd(1-\cos\theta_{max})}{I_\Delta}}$

$\omega = \sqrt{\frac{2(0.8)(10)(\frac{1}{16})(1-\frac{1}{2})}{0.05}}$

$\omega = \pi\ rad.s^{-1}$ (A)

(A)

(19)

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

$$\omega_0 = \frac{2\pi}{T_0} = \frac{2\pi}{2} = \pi \ rad.s^{-1}$$

$$\left.\begin{matrix} t=0 \\ \omega=0 \end{matrix}\right\} \Rightarrow \theta = \theta_{max} = \frac{1}{24\pi} rad$$

$$\left.\begin{matrix} t=0 \\ \theta=\theta_{max} \end{matrix}\right\} \Rightarrow \theta = \theta_{max}\cos(\omega_0 t + \bar{\varphi})$$

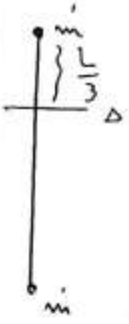
$$\theta_{max} = \theta_{max}\cos\bar{\varphi}$$

$$\cos\bar{\varphi} = 1 \Rightarrow \bar{\varphi} = 0 \ rad$$

$$\theta = \frac{1}{24\pi}\cos\pi t \quad (A)$$

(20)

$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$



$$I_\Delta = m'_1 r^2 + m'_2 r^2$$

$$= m'\left(\frac{L}{3}\right)^2 + m'\left(\frac{2L}{3}\right)^2$$

$$= m'\frac{L^2}{9} + m'\frac{4L^2}{9} = \frac{5m'L^2}{9}$$

$$m_{\text{جملة}} = 2m'$$

$$d = \frac{m'_1 r_1 + m'_2 r_2}{m'_1 + m'_2} = \frac{m'\left(-\frac{L}{3}\right) + m'\left(\frac{2L}{3}\right)}{2m'}$$

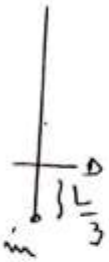
$$d = \frac{m'\frac{L}{3}}{2m'} = \frac{L}{6} \Rightarrow$$

$$T_0 = 2\pi\sqrt{\frac{\frac{5m'L^2}{9}}{2m'g\frac{L}{6}}} = 2\pi\sqrt{\frac{5L}{3g}}$$

$$T_0^2 = 4\pi^2\frac{5L}{3g} \Rightarrow L = \frac{3gT_0^2}{20\pi^2} \quad (C)$$

11/

(21) عندما تنفصل الكتلة السفلية سوف يكون النواس ذا دور توازن ثقلة وسيتحول إلى توازن مستقر كما في الشكل



$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

$$I_\Delta = m'r^2 = m'\frac{L^2}{9}$$

$$d = \frac{L}{3}$$

$$T_0 = 2\pi\sqrt{\frac{m'\frac{L^2}{9}}{m'g\frac{L}{3}}} = 2\pi\sqrt{\frac{L}{3g}} \quad (C)$$

(22)

$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

$$I_\Delta = m_1 r_1^2 + m_2 r_2^2$$

$$= (0.2)\left(\frac{1}{4}\right)^2 + 0.1\left(\frac{1}{2}\right)^2$$

$$I_\Delta = \frac{0.2}{16} + \frac{0.1}{4} = \frac{0.6}{16} = \frac{0.3}{8} \ kg\,m^2$$

$$m_{\text{جملة}} = m_1 + m_2 = 0.2 + 0.1 = 0.3 \ kg$$

$$d = \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1 + m_2} = \frac{0.2\left(\frac{1}{4}\right) + 0.1\left(\frac{1}{2}\right)}{0.3}$$

$$d = \frac{\frac{0.2}{4} + \frac{0.1}{2}}{0.3} = \frac{0.1}{0.3} = \frac{1}{3} \ m$$

$$T_0 = 2\pi\sqrt{\frac{\frac{0.3}{8}}{0.3\times 10\times\frac{1}{3}}} = 2\sqrt{\frac{3}{8}}$$

$$T_0 = \sqrt{1.5} \ s \quad (B)$$

(13)

$\Delta E_k = \sum \vec{W}_F$

$E_{k_2} - E_{k_1} = W_{\vec{W}} + W_{\vec{R}}$

الوضع الأول: $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نقطة تأثير $\vec{R}$ تنعدم

$\frac{1}{2} I_\Delta \omega^2 = mgd(1 - \cos\theta_{max})$

$1 - \cos\theta_{max} = \frac{\frac{1}{2} I_\Delta \omega^2}{mgd}$

$\cos\theta_{max} = 1 - \frac{I_\Delta \omega^2}{4mgd}$ (D)

(24)

$v_c = \omega \cdot r_c$

اعتماداً على السؤال (22) تم الطالب المتفوق

$d = \frac{1}{3}$

$\Rightarrow v_c = \omega \cdot r_c$

$\frac{2\pi}{3}\sqrt{\frac{2}{3}} = \omega \times \frac{1}{3} \Rightarrow$

$\omega = 2\pi\sqrt{\frac{2}{3}}\ rad.s^{-1}$

$v_{m_2} = \omega r_{m_2} = 2\pi\sqrt{\frac{2}{3}} \times \frac{1}{2}$

$= \pi\sqrt{\frac{2}{3}}\ m.s^{-1}$ (B)

(25)

$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$

$I_\Delta = m_1 r_1^2 + m_2 r_2^2$

$= 0.2\left(\frac{1}{2}\right)^2 + 0.6\left(\frac{1}{2}\right)^2$

$= \frac{1}{4}(0.8) = 0.2\ kg.m^2$

$m = m_1 + m_2 = 0.2 + 0.6 = 0.8kg$

$d = \frac{m_1\bar{r}_1 + m_2\bar{r}_2}{m_1 + m_2} = \frac{0.2(-\frac{1}{2}) + 0.6(\frac{1}{2})}{0.8}$

$d = \frac{0.2}{0.8} = \frac{1}{4}\ m$

$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}} = 2\pi\sqrt{\frac{0.2}{0.8 \times 10 \times \frac{1}{4}}}$

$T_0 = 2\ s$ (B)

(26)

$\Delta E_k = \sum \vec{W}_F$

$E_{k_2} - E_{k_1} = W_{\vec{W}} + W_{\vec{R}}$

الوضع الأول: $\theta = \theta_{max}$ بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$\frac{1}{2} I_\Delta \omega^2 - 0 = mgh + 0$

نقطة تأثير $\vec{R}$ تنعدم

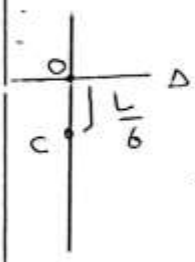
$\omega = \sqrt{\frac{2mgd(1 - \cos\theta_{max})}{I_\Delta}}$

اعتماداً على السؤال (25) تم الطالب المتفوق

$$\omega = \sqrt{\frac{2\times 0.8\times 10\times \frac{1}{4}\left(1-\frac{1}{2}\right)}{0.2}}$$

$$\omega = \pi \ rad.s^{-1} \quad (A)$$

(27)



$$T_0 = 2\pi\sqrt{\frac{I_\Delta}{mgd}}$$

$$I_{\Delta 10} = I_{\Delta 1C} + md^2$$

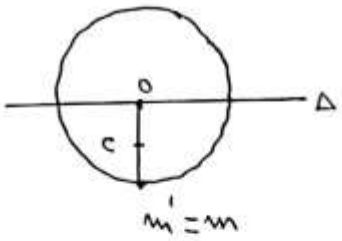
$$= \frac{1}{12}ml^2 + m\frac{l^2}{36}$$

$$I_{\Delta 10} = \frac{4}{36}ml^2 = \frac{1}{9}ml^2 \qquad d = \frac{l}{6}$$

$$\Rightarrow T_0 = 2\pi\sqrt{\frac{\frac{1}{9}ml^2}{mg\frac{l}{6}}} = 2\pi\sqrt{\frac{6l}{9g}}$$

$$T_0 = 2\pi\sqrt{\frac{2l}{3g}} \quad (C)$$

(28)



$$\Delta E_k = \Sigma \bar{W}_{\vec{F}}$$

$$E_{k_2} - E_{k_1} = W_{\vec{w}} + W_{\vec{R}}$$

(3)

الوضع الأول: $\theta = \theta_{max}$
بدون سرعة ابتدائية

الوضع الثاني: $\theta = 0$

$$\frac{1}{2}I_\Delta\omega^2 = 2mgh + 0 \qquad (*)$$

نقطة تأثير $\vec{R}$ تنتقل

$$I_\Delta = I_D + I_{m'}$$
عزم جملة

$$= \frac{1}{2}mr^2 + mr^2 = \frac{3}{2}mr^2$$

$$m_{\text{جملة}} = m + m' = 2m$$

$$d = \frac{mr_1 + m'r_2}{m_1 + m_2} = \frac{0 + m'r}{2m'}$$

$d = OC = \frac{r}{2} \Rightarrow$ نعوض في (*)

$$\frac{1}{2}\times\frac{3}{2}\times mr^2\times\frac{v^2}{r^2} = mg\frac{r}{2}(1-\cos\theta_{max})$$

$$\frac{3}{4}v^2 = gr(1-\cos\theta_{max})$$

$$1-\cos\theta_{max} = \frac{3v^2}{4gr} \Rightarrow$$

$$\cos\theta_{max} = 1 - \frac{3v^2}{4gr} \quad (D)$$