**هنـــاء فرحان**

Q(1) $v_0 = 283\ m/s \qquad \theta_0 = 60^\circ$

$$h = \frac{v_{oy}^2}{2g} = \frac{v_0^2(\sin\theta_0)^2}{2g} = \frac{(283)^2(\sin 60)^2}{2(9.8)} = 3064.6\ m$$

(B)

Q(2) $\vec{v}_f = 3\hat{i} + 9\hat{j}$

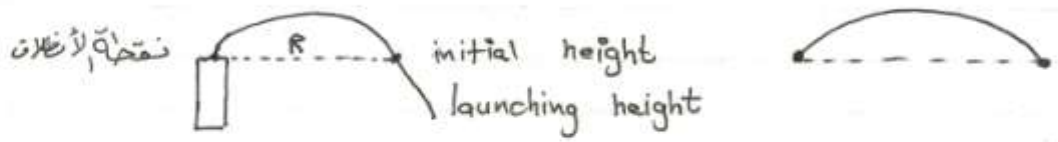
$v_i = 2\hat{i} + 4\hat{j} \qquad \Delta t = 5S$

$$\vec{a}_{avg.} = \frac{v_f - v_i}{\Delta t} = \frac{\hat{i} + 5\hat{j}}{5} = 0.2\,\hat{i} + \hat{j} \quad (B)$$

Q(3) circular path $\quad S = |v| = 5\ m/s \quad r = 10m$

$$\text{Period} = \frac{2\pi r}{|v|} = \frac{2\pi(10)}{5} = 4\pi\ S \quad (B)$$

Q(4)




Horizontal range (R) = المسافة الأفقية من نقطة الانطلاق الى أن يعود الى نفس مستوى الانطلاق (اي نفس الارتفاع)
(return)

(B)

Qs. 5-6 : $x = 5t^2 + 16$ $\qquad y = -t^3 + 5$

Q(5)

$$\vec{v} = v_x\hat{i} + v_y\hat{j} = \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j}$$

$$= 10t\,\hat{i} + -3t^2\,\hat{j} \quad (A)$$

Q(6) $\vec{r} = x\hat{i} + y\hat{j}$

$$= (5t^2 + 16)\hat{i} + (-t^3 + 5)\hat{j}$$

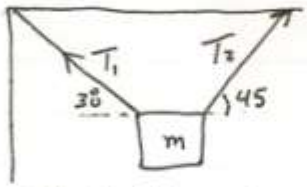
at $t = 2S \Rightarrow \vec{r} = [5(2)^2 + 16]\hat{i} + [-(2)^3 + 5]\hat{j}$

$$\vec{r} = 36\hat{i} - 3\hat{j} \quad (B)$$

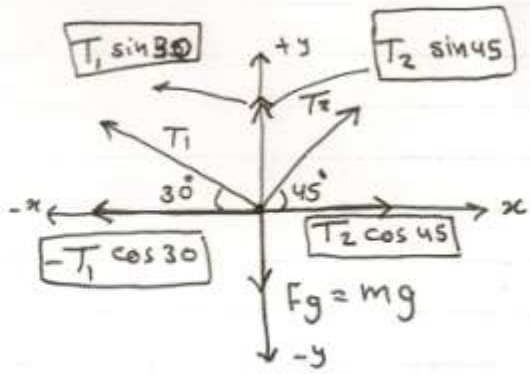
هنـــاء فرحان

Qs. 7-9

$m = 5\ kg$




الجسم معلق بواسطة حبلين $T_1$ و $T_2$




Free Body Diagram for (m)

Q(7) $F_{net,x} = \Sigma F_x = 0$

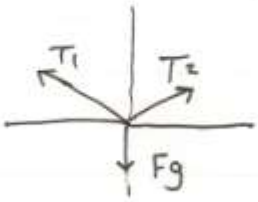
$T_2 \cos(45^\circ) - T_1 \cos(30) = 0$ (B)

Q(8) $|W| = |F_g| = mg = 5(9.8) = +49\ N$ (D) المطلوب المقدار فقط

وعلى ايجادها في حالة معرفة قيمة $T_1$ و $T_2$ من معادلة الاتزان على المحور الصادات

$\Sigma F_y = 0 \Rightarrow T_1 \sin(30) + T_2 \sin(45) = mg$

Q(9) (A)




Q(10) $\mu_s$ is dimensionless (B) ليس له ابعاد اي ليس له وحدة.

$f_s = \mu_s F_N$

$N = (1) N$

ليس له وحدة لتساوي الوحدات في الطرفين

Q(11) $v_y = v_{0y} - gt = v_0 \sin\theta_0 - gt$ (C)

$a = -g$ دائماً سواء في حالة الصعود أو الهبوط

**هنـــاء فرحان**

Q(12) $\vec{F_1} = 7\hat{i} - 5\hat{j}$ $\vec{F_2} = -3\hat{i} + 4\hat{j}$ friction less $\Rightarrow f_k = 0$

$|F_{net}| = ??$

$F_{net} = \Sigma F = \vec{F_1} + \vec{F_2}$

$= (7-3)\hat{i} + (-5+4)\hat{j} = 4\hat{i} - 1\hat{j}$

$F_{net,x}$ $F_{net,y}$

$|F_{net}| = \sqrt{4^2 + 1^2} = 4.12\,N$ (B)

Q(13) $m = 0.15\,kg$ $a(t) = 8 - 18t$ $t = 3.4\,s$

$F_{net} = ma$

$= 0.15(8 - 18t)$

along an x-axis $\Rightarrow \hat{i}$

$\vec{a} = a\hat{i}$

at $t = 3.4 \Rightarrow F_{net} = 0.15(8 - 18(3.4))$

$= -7.98$

$\vec{F_{net}} = m\vec{a} = -7.98\,\hat{i}$ (A)

Q(14) in circular path $\Rightarrow$ $v =$ (dir.) (magn.)

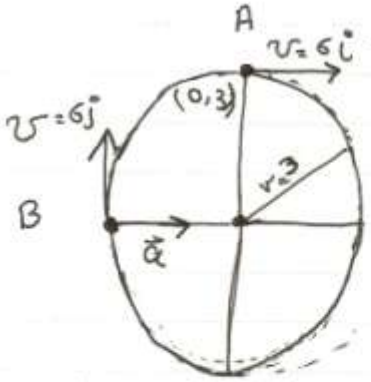
Change (direction changes) — tangent — دائماً مماس للمسار

const. (magnitude constant) $S = |v|$

$a =$ (dir.) (magn.)

Change (direction changes) — inward to center — دائماً يتجه الى المركز

const. (magnitude constant) $|a| = \frac{v^2}{r}$




at (0,3) $v = 6\hat{i}$

$r = 3$

at Point B

$v = +6\,\hat{j}$ | $\vec{a} = \frac{v^2}{r}\hat{i} = 12\hat{i}$

لها مقدار ثابت لا تتغير | لها مقدار ثابت من القانون

لها اتجاه يحدد من الرسم (منطبق على محور y والأعلى) (مماس) | لها اتجاه من الرسم (داخل الى المركز ← منطبق على محور x)

(A)

هنـــاء فرحان

Q(15) $m = 12\ kg$ $\quad F_{net} = 7N$, North $= 7\hat{j}$

$$\vec{F}_{net} = m\vec{a} \Rightarrow \vec{a} = \frac{\vec{F}_{net}}{m} = \frac{7\hat{j}}{12} = 0.58\ \hat{j}$$

(A)

$= 0.58\ N$, North

وبذلك a و $F_{net}$ دائماً في نفس الاتجاه

Q(16) $\quad r_f = -2\hat{i} + 8\hat{j} - 2\hat{k}$

$r_i = (+5)\hat{i} + (-6)\hat{j} + (-3)\hat{k}$ $\quad \Delta t = 10\ s$

$r_f - r_i = -7\hat{i} + 14\hat{j} - 4\hat{k}$

$$v_{avg.} = \frac{r_f - r_i}{\Delta t} = \frac{-7}{10}\hat{i} + \frac{14}{10}\hat{j} - \frac{4}{10}\hat{k}$$

$$= -0.7\hat{i} + 1.4\hat{j} - 0.4\hat{k}$$ (B)

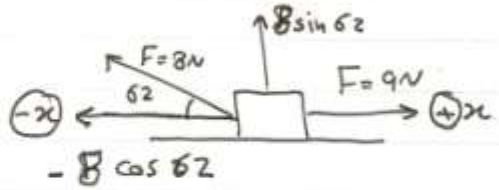
Q(17) $m = 980\ kg$ $\quad |v| = 28\ m/s$ $\quad r = 230\ m$

Circular track $\Rightarrow |F_\perp| = m a_\perp = m\frac{v^2}{r}$

$$|f| = |F_\perp| = m\frac{v^2}{r} = \frac{980}{230}(28)^2 = 3340.5N$$ (C)

Q(18) $\quad \Sigma F_x = m a_x$

$9 - 8\cos 62 = 3a_x$




$$a_x = \frac{5.2}{3} = 1.75\ m/s^2$$ (B)

Q(19) $\quad v_0 = \underbrace{5}_{v_{0x}}\hat{i} + \underbrace{4}_{v_{0y}}\hat{j}$

at any point $\Rightarrow v_x = v_{0x} = const$

?

$$v_x = v_{0x} = 5\ m/s$$ (D)

**هنـــاء فرحان**

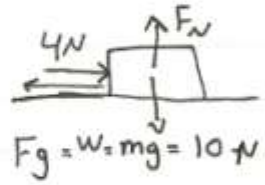
Q(20)

$$v_{ox} = 23 \text{ m/s} \qquad v_{oy} = 54 \text{ m/s}$$

$$\theta_p = \tan^{-1}\frac{v_{oy}}{v_{ox}} = \tan^{-1}\frac{54}{23} = 66.9 \simeq 67^\circ \quad (B)$$

Q(21) $F = 4N \qquad W = 10N$

$v \to$ const. $\Rightarrow a = 0 \Rightarrow \Sigma F_x = 0$

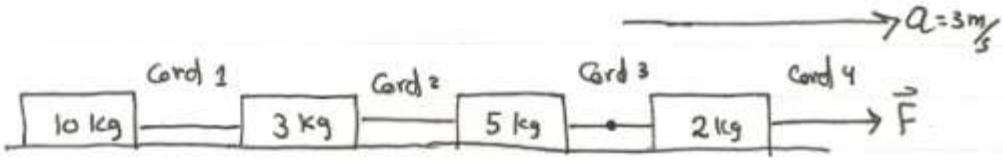



$\Rightarrow$ $F_N = mg = W$

$$F - f_k = 0$$

$$f_k = F = \mu_k F_N \Rightarrow \mu_k = \frac{F}{F_N} = \frac{4}{10} = 0.4 \quad (D)$$

Q(22-23)




Q(22) $\vec{F} = (m_1 + m_2 + m_3 + m_4)\, a = (10 + 3 + 5 + 2)\, 3 =$

$= 20 \times 3 = 60 N \quad (D)$

Q(23) at cord (3) $F_3 = T_3 = (\underbrace{m_1 + m_2 + m_3}_{\text{total mass}})\, a$

total mass $= m_1 + m_2 + m_3 = 10 + 3 + 5 = 18 kg \quad (A)$

Q(24) $m = 75kg \Rightarrow W = mg = 735 N$

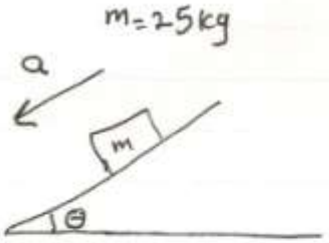
downward acceleration $\Rightarrow a_y = -1.7 \text{ m/s}^2 = -a$

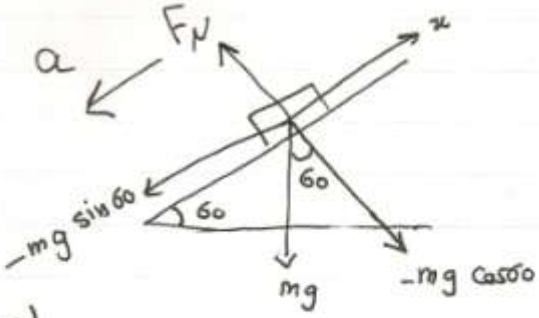
$$F_N = m(g + a_y) = 75(9.8 - 1.7)$$

$$= 607.5 N \quad (D)$$

**هنـــاء فرحان**

Qs. (25-26)




Q(25) $\Sigma F_y = 0 \quad (F_N - mg\cos 60 = 0)$

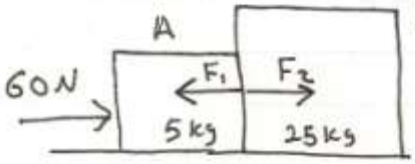
$F_N = mg\cos 60 = mg\cos\theta$ ©

Q(26) $\Sigma F_x = ma_x$

$|\Sigma F_x| = |-mg\sin 60| = mg\sin 60 = 25(9.8)\sin 60$

$= 212.17\ N$ (A)

Q(27)




$\Longrightarrow a = 2\ m/s^2$

Force F on A from B $= F_1$ A وتأثر عن B تخرج من
وهي تساوي القوه التي تخرج من A
وتأثر على B ولكنها عكس الاتجاه (قانون نيوتن الثالث)

$F_2$ : Force on B from A

$-F_1 = +F_2$
رد فعل فعل

$|F_1| = |F_2|$

ويمكن حساب $F_1$ بطريقتين

① on A : $\Sigma F_x = m_A a_x$

$60 - F_1 = 5(2) \Rightarrow F_1 = 60 - 10 = 50N$ (A)

or.

② on B : $\Sigma F_x = m_B a_x$

$F_2 = 25(2) = 50N \Rightarrow F_1 = F_2 = 50N$ (A)

هنـــاء فرحان

Q(28) $F_N = m(g + a_y) = mg + ma_y$

Scale reading $= F_N > mg \Rightarrow a_y = +a$

$\Rightarrow$ accelerate upward (A)

Q(29) $\theta_0 = 25^\circ \quad v_0 = ? \quad R = 140\ m$

$$R = \frac{v_0^2 \sin 2\theta_0}{g} \Rightarrow v_0 = \sqrt{\frac{Rg}{\sin 2\theta_0}} = \sqrt{\frac{140(9.8)}{(\sin 50)}} = 42.3\ m/s$$ (D)

Q(30) (D) Normal force always $\perp$ the surface.

Q(31) $m_1 = 1kg \quad m_2 = 2kg \quad v_1 = v_2 = v = 1\ m/s \quad r_1 = r_2 = r = 1\ m$

$$a_1 = \frac{|v_1|^2}{r} = \frac{1}{1} = 1 \qquad a_2 = \frac{|v_2|^2}{r_2} = \frac{1}{1} = 1$$

$\Rightarrow a_1 = a_2$ (C)

Q(32) along an $x_1$ axis $\Rightarrow \Sigma F_x = ma_x$

A] $10 = ma_x$

B] $10 + 5 = ma_x$

$15 = ma_x$

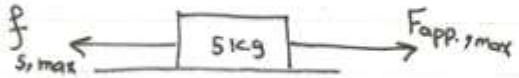
C] $10 + 5\cos\theta = ma_x$

D] $10 - 5 = ma_x$

$5 = ma_x$

أقل قيمة

Q(33)




before it slips $\Rightarrow$ start to move but not moving

$$= f_{s,max} = \mu_s F_N = \mu_s mg = 0.4(5)(9.8) = 19.6\ N$$

$$F_{app,max} = f_{s,max} = 19.6\ N$$ (B)