هنـــاء فرحان

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

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

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

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

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

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

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

Q(4)

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

(return)

Ⓑ

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

Q(5)

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

$$= 10t\,\hat{i} + -3t^2\,\hat{j}$$ Ⓐ

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

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

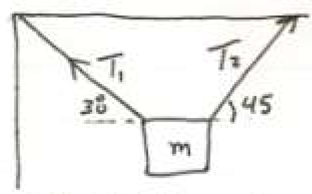
at $t = 2S \Rightarrow \vec{r} = [5(2)^2 + 16]\hat{i} + [-(2)^3 + 5]\hat{j}$

$$\vec{r} = 36\hat{i} - 3\hat{j}$$ Ⓑ

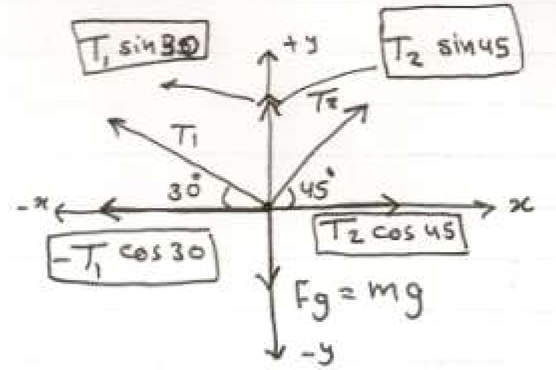
هنـــاء فرحات

Qs. [7-9]

$m = 5\ kg$



الجسم معلق بواسطة حبلة T_1 و T_2



Free Body Diagram for [m]

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

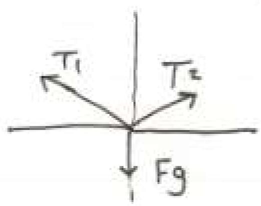
$$T_2 \cos(45^\circ) - T_1 \cos(30) = 0 \qquad (B)$$

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

و يمكن ايجادها في حالة معرفة قيمة T_1 و T_2 من معادلة الاتزان على محور الصادات

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

Q(9) (A)



Q(10) μ_s is dimensionless (B)

ليس له ابعاد
اي ليس له وحدة.

$$\boxed{f_s} = \mu_s \boxed{F_N}$$

$$N = (\mu_s)\ N$$

ليس له وحده لتساوي الوحدات في الطرفين

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

$$\boxed{a = -g}$$

دائماً سواء في حالة الصعود أو الهبوط

هنـــاء فرحان

Q(12) $\vec{F}_1 = 7\hat{i} - 5\hat{j}$ $\vec{F}_2 = -3\hat{i} + 4\hat{j}$ frictionless $\Rightarrow f = 0$

$|F_{net}| = ??$

$$F_{net} = \Sigma F = \vec{F}_1 + \vec{F}_2$$

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

($4 \to F_{net,x}$, $-1 \to F_{net,y}$)

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

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

$$= -7.98$$

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

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

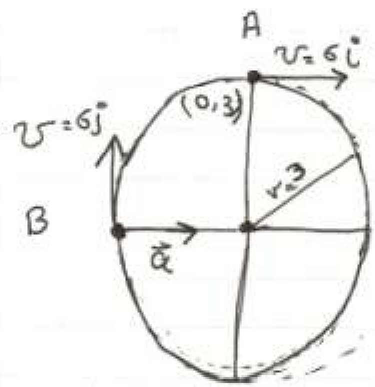
dir.: change, tangent — دائماً مماس للمسار

mag.: const. $S = |v|$

$a =$ (dir.) (mag.)

dir.: change, inward to center — دائماً يتجه الى المركز

mag.: const. $|a| = \frac{v^2}{r}$



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

at Point B

$v = +6\,\hat{j}$

له مقدار ثابت لا يتغير

له الاتجاه يحدد من الرسم (منطبق على محور y والأعلى) (مماس)

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

له مقدار ثابت من القانون

له الاتجاه من الرسم

(داخل الى المركز ← منطبق على محور x)

(A)

هنـــاء فرحان

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

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

Ⓐ

$= 0.58 N$, North

ولذلك a و F_{net} دائماً في نفس الاتجاه

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

$r_i = (+5)\hat{i}\ (-6)\hat{j}\ (+2)k$ $\Delta t = 10s$

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

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

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

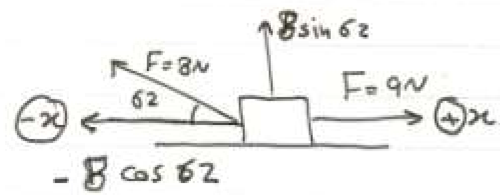
Q(17) $m = 980\ kg$ $|v| = 28\ m/s$ $r = 230\ m$

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

Ⓒ

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

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



$9 - 8\cos 62 = 3a_x$

$a_x = \frac{5.2}{3} = 1.75\ m/s^2$ Ⓑ

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

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

$v_x = v_{0x} = 5\ m/s$ Ⓓ

هنـــاء فرحان

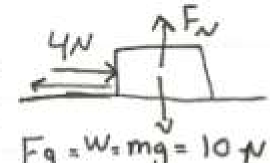
Q(20)

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

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

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

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

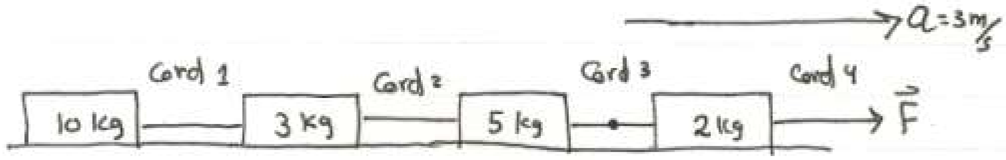


$\Rightarrow F_N = mg = W$

$F - f_k = 0$

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

Qs(22-23)



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

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

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

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

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

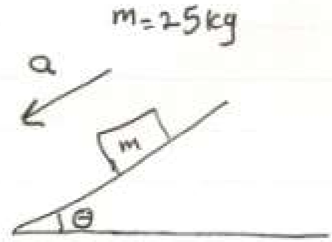
downward acceleration $\Rightarrow a_y = -1.7\ m/s^2 = -a$

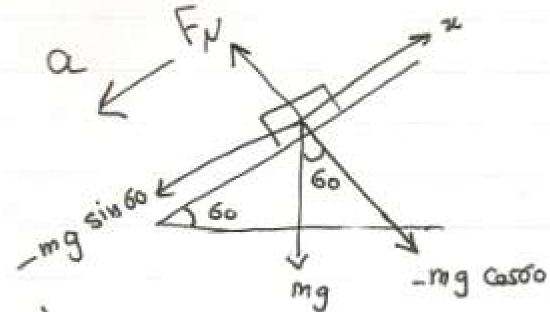
$F_N = m(g + a_y) = 75(9.8 - 1.7)$

$= 607.5\ N$ (D)

هنـــاء فرحات

Qs. (25-26a)





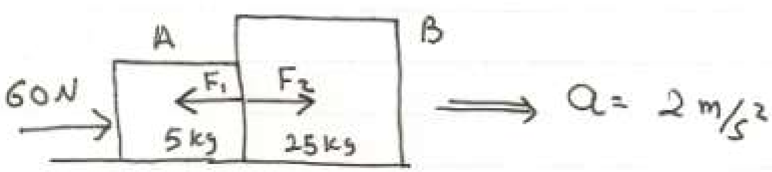
Q(25) $\sum F_y = 0 \quad (F_N - mg\cos 60 = 0)$

$$F_N = mg\cos 60 = mg\cos\theta \quad \text{(C)}$$

Q(26) $\sum F_x = ma_x$

$$|\sum F_x| = |-mg\sin 60| = mg\sin 60 = 25(9.8)\sin 60$$
$$= 212.17\ N \quad \text{(A)}$$

Q(27)



Force F on A from B $= F_1$ تخرج من B وتأثر على A

وهي تساوي القوه التي تخرج من A

وتأثر على B ولكنها عكس الاتجاه (قانون نيوتن الثالث)

$-F_1 = +F_2$ F_2 : Force on B from A

ردة فعل فعل

$|F_1| = |F_2|$

ويمكن حساب F_1 بطريقتين

① on A : $\sum F_x = m_A a_x$

$$60 - F_1 = 5(2) \Rightarrow F_1 = 60 - 10 = 50N \quad \text{(A)}$$

or.

② on B : $\sum F_x = m_B a_x$

$$F_2 = 25(2) = 50N \Rightarrow F_1 = F_2 = 50N \quad \text{(A)}$$

هنـــاء فرحاز

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

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

$\Rightarrow$ accelerating upward (A)

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

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

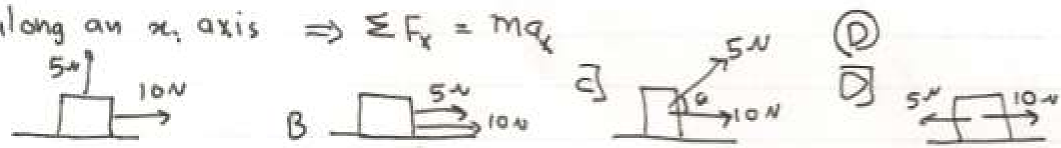
Q(30) (D) Normal force always ⊥ the surface.

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

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

$\Rightarrow a_1 = a_2$ (C)

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



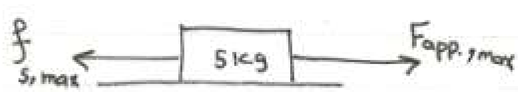
A] $10 = ma_x$

B] $10 + 5 = ma_x$
$15 = ma_x$

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

D] $10 - 5 = ma_x$
$5 = ma_x$
اقل قيمة

Q(33)



before it slips ⇒ 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)

هنـــاء فرحان

Q(1) $v_0 = 283\ m/s$ $\theta_0 = 60°$ (B)

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

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

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

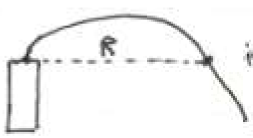
$$\vec{a}_{avg.} = \frac{v_f - v_i}{\Delta t} = \frac{\hat{i} + 5\hat{j}}{5} = 0.2\,\hat{i} + \hat{j}$$ (B)

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

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

Q(4)

نقطة الأنطلاق



R

initial height

launching height

Horizontal range (R) : المسافة الأفقية من نقطة الأنطلاق الى أن يعود الى نفس مستوى الأنطلاق (اي نفس الارتفاع)

(return)

(B)

Qs. [5–6] : $x = 5t^2 + 16$ $y = -t^3 + 5$

Q(5)

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

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

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

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

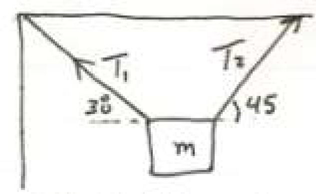
at $t = 2s \Rightarrow \vec{r} = [5(2)^2 + 16]\hat{i} + [-(2)^3 + 5]\hat{j}$

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

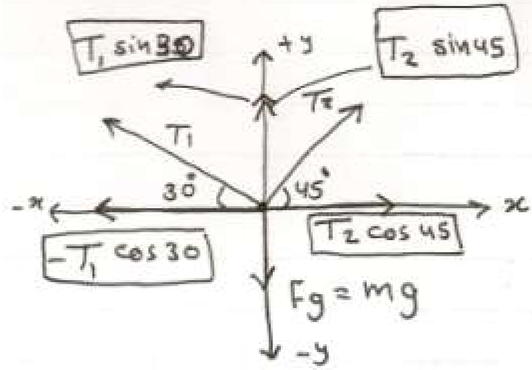
هنـــاء فرحان

Qs. 7-9

$m = 5\ kg$



الجسم معلق بواسطة حبلة T_1 و T_2



Free Body Diagram for m

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

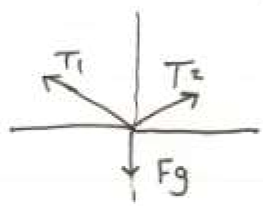
$$T_2 \cos(45^\circ) - T_1 \cos(30) = 0 \quad (B)$$

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

ويمكن ايجادها في حالة معرفة قيمة T_1 و T_2 من معادلة الاتزان على محور الصادات

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

Q(9) (A)



Q(10) μ_s is dimensionless (B)

ليس له ابعاد
اي ليس له وحدة.

$$[f_s] = \mu_s [F_N]$$

$$N = (\mu)\ N$$

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) $\vec{F}_1 = 7\hat{i} - 5\hat{j}$ $\quad \vec{F}_2 = -3\hat{i} + 4\hat{j}$ $\quad$ frictionless $\Rightarrow f = 0$

$|F_{net}| = ??$

$$F_{net} = \Sigma F = \vec{F}_1 + \vec{F}_2$$

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

($4 \to F_{net,x}$, $-1 \to F_{net,y}$)

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

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

$$F_{net} = ma$$
$$= 0.15\,(8 - 18t)$$

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

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

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

$$= -7.98$$

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

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

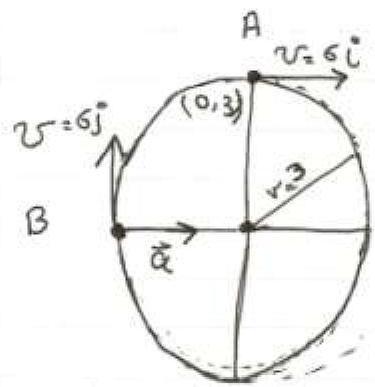
dir.: change, tangent — دائماً مماس للمسار

mag.: const. $S = |v|$

$a =$ (dir.) (mag.)

dir.: change, inward to center — دائماً يتجه الى المركز

mag.: const. $|a| = \frac{v^2}{r}$



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

$r = 3$

at Point B

$v = +6\,\hat{j}$

له مقدار ثابت لا يتغير

له اتجاه يحدد من الرسم (منطبق على محور y والأعلى) (مماس)

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

له مقدار ثابت من القانون

له اتجاه من الرسم

(داخل الى المركز ← منطبق على محور x)

(A)

هنـــاء فرحان

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

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

Ⓐ

$= 0.58 N$, North

ولأن a و F_{net} دائماً في نفس الاتجاه

Q(16)

$$r_f = -2\hat{i} + 8\hat{j} - 2k$$
$$r_i = (+5)\hat{i}\ (-6)\hat{j}\ (+2)k \qquad \Delta t = 10 s$$
$$r_f - r_i = -7\hat{i} + 14\hat{j} - 4k$$

$$v_{avg.} = \frac{r_f - r_i}{\Delta t} = \frac{-7}{10}\hat{i} + \frac{14}{10}\hat{j} - \frac{4}{10}k$$
$$= -0.7\hat{i} + 1.4\hat{j} - 0.4k \quad Ⓑ$$

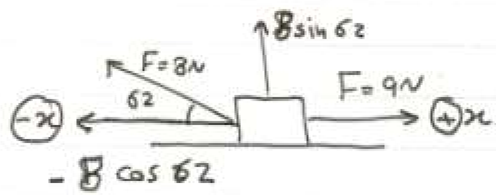
Q(17) $m = 980\ kg$ $\quad |v| = 28\ m/s$ $\quad r = 230\ m$

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

Ⓒ

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

Q(18) $\sum F_x = m a_x$



$$9 - 8\cos 62 = 3a_x$$

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

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

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

$$v_x = v_{0x} = 5\ m/s \quad Ⓓ$$

هنـــاء فرحان

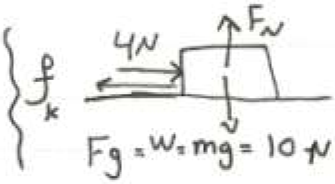
Q(20)

$v_{0x} = 23\ m/s \qquad v_{0y} = 54\ m/s$

$\theta_0 = \tan^{-1}\frac{v_{0y}}{v_{0x}} = \tan^{-1}\frac{54}{23} = 66.9 \simeq 67^\circ$ (B)

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

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

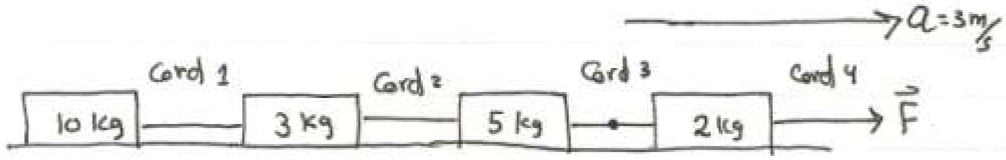


$\Rightarrow$ $F_N = mg = W$

$F - f_k = 0$

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

Q(22-23)



Q(22) $\vec{F} = (m_1 + m_2 + m_3 + m_4)\, a = (10 + 3 + 5 + 2)\, 3 = 20 \times 3 = 60\ N$ (D)

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

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

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

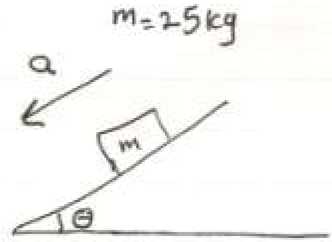
downward acceleration $\Rightarrow a_y = -1.7\ m/s^2 = -a$

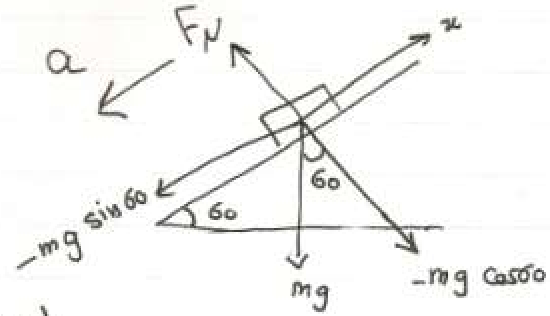
$F_N = m(g + a_y) = 75(9.8 - 1.7)$

$= 607.5\ N$ (D)

هنـــاء فرحان

Qs. (25-26a)





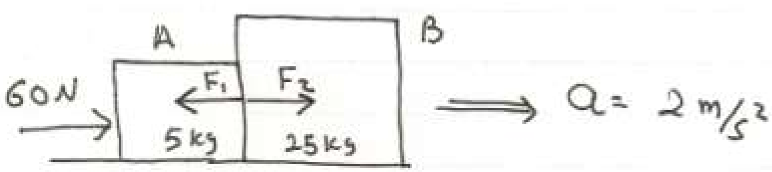
Q(25) $\Sigma F_y = 0 \quad (F_N - mg\cos 60 = 0)$

$$F_N = mg\cos 60 = mg\cos\theta \quad \text{(C)}$$

Q(26) $\Sigma F_x = m a_x$

$$|\Sigma F_x| = |-mg\sin 60| = mg\sin 60 = 25(9.8)\sin 60$$
$$= 212.17\ N \quad \text{(A)}$$

Q(27)



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

$-F_1 = +F_2$ $\quad$ F_2 : Force on B from A

ردة فعل $\quad$ فعل

$|F_1| = |F_2|$

ويمكن حساب F_1 بطريقتين

① on A : $\Sigma F_x = m_A a_x$

$$60 - F_1 = 5(2) \Rightarrow F_1 = 60 - 10 = 50N \quad \text{(A)}$$

or.

② on B : $\Sigma F_x = m_B a_x$

$$F_2 = 25(2) = 50N \Rightarrow F_1 = F_2 = 50N \quad \text{(A)}$$

هنـــاء فرحاز

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

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

$\Rightarrow$ accelerating upward (A)

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

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

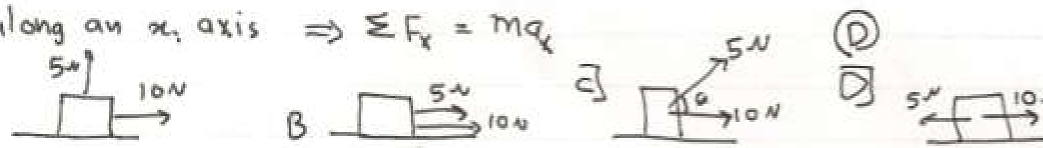
Q(30) (D) Normal force always $\perp$ the surface.

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

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

$\Rightarrow a_1 = a_2$ (C)

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



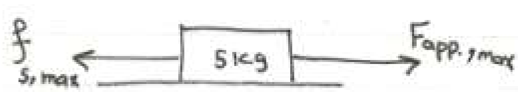
A] $10 = ma_x$

B] $10 + 5 = ma_x$
$15 = ma_x$

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

D] $10 - 5 = ma_x$
$5 = ma_x$
اقل 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)

KING ABDULAZIZ UNIVERSITY
FACULTY OF SCIENCE
Physics Department
Summer Term
Final Exam

A

Phys 110

Student Name :	Student Number:	Group:
Section:		

Choose The Correct Statement (True) or (False)?

1. In projectile motion the horizontal acceleration is Zero.
   a) True b) False
2. The horizontal range R is maximum for a launch angle of 90
   a) True b) False
3. A nanosecond is 10^8 s
   a) True b) False
4. If no net force acts on a body .the body's velocity cannot change , then the body cannot accelerate.
   a) True b) False
5. The instantaneous acceleration is $\vec{a} = \frac{\vec{v}_1 - \vec{v}_2}{\Delta t}$
   a) True b) False
6. The magnitude of $\vec{f}_s$ has maximum value that is given by: $f_{smax} = \mu_s F_N$
   a) True b) False
7. The value of $\hat{k} \cdot \hat{i}$ is Zero .
   a) True b) False
8. The magnitude of the gravitational force is equal to the product (ma).
   a) True b) False
9. The SI unit of kinetic energy is: kg.m/s^2.
   a) True b) False
10. In Newton's 2^{nd} law, the net force and acceleration are in the same directions.
    a) True b) False
11. The velocity is defined as the change in position from initial position to final position.
    a) True b) False
12. Watt is equal to: Joule per second
    a) True b) False

13. The SI base unit for mass is gram.
a) True b) False

14. The angle between the vector $\vec{A}$ given by; $\vec{A} = (25m)\hat{\imath} + (45m)\hat{\jmath}$ and the positive x-axis is: 61°.
a) True b) False

15. A 5kg object moving at a speed of 6 m/s, its kinetic energy is 80 Joule.
a) True b) False

16. The time rate of change of the linear momentum of a particle is equal to the net force acting on it (**i.e** $\vec{F}_{net} = \frac{d\vec{P}}{dt}$).
a) True b) False

Choose the Correct Answers :

17. A man weighing 800 N is standing in an elevator moving with a constant velocity. The force exerted by the man on the floor of the elevator is:
a) less than 80 N b) 800 N c) between 80 and 800 N d) more than 800 N

18. What is the speed of a 55 kg woman running with a kinetic energy of 412.7 J?
a) 15 m/s b) 3.87 m/s c) 2.7 m/s d) 4 m/s

19. A ball kicked with a velocity of 15 m/s and with an angle of θ =45° from the horizontal. The maximum range is:
a) 25.85 m b) 40.82m c) 50.20 m d) 22.96 m

20. In the projectile motion, the maximum range is:
a) $\frac{v_0^2}{g}(\cos\theta)$ b) $\frac{v_0^2}{g}$ c) $\frac{v_0}{g}$ d) $\frac{v_0^2}{g}(\cos\theta)^2$

21. A man stands on the groun, if his mass is 80 kg, his weight is:
a) 7.84 N b) 784 N c) 78.4 N d) 7840 N

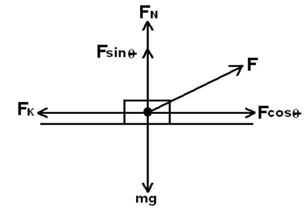
22. Having two vectors $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} - 2\hat{j} + \hat{k}$, the result of $\vec{A} \times \vec{B}$ is:
a) $3\hat{\imath} + 5\hat{\jmath} - 3\hat{k}$ b) 0 c) $3\hat{i} - 2\hat{j} - 7\hat{k}$ d) $\hat{i} - \hat{j}$

23. One Newton (1 N) in SI is equal to
a) $\frac{1\ kg.m}{s}$ b) $\frac{1\ kg.m}{s^2}$ c) $\frac{1\ kg.cm}{s}$ d) $\frac{1\ g.m}{s}$

24. The position of a car changes from $x_1 = 30m$ to $x_2 = 120m$ in the time interval from 2s to 4s , the average velocity of the car is :
a) 30m/s b) 40m/s c) 20 m/s d) 45m/s

25. An object dropped from a height of 80m, its speed after 3 s is:
a) 33 m/s b) -29.4m/s c) -9.8 m/s d) 39.5m/s

26. The expression that represents a stationary box in the figure is:
a) $F_N + F\, sin\theta = mg$
b) $F_N - F\, sin\theta = mg$
c) $F\, cos\theta$ - $F_k = mg$
d) $F_N + Fcos\theta - mg$

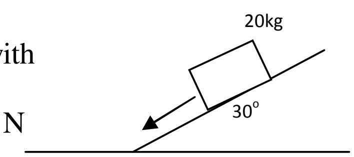


27. If $\vec{A} = 2\hat{\imath} + 2\hat{\jmath}$ and $\vec{B} = 2\hat{\imath} - 4\hat{\jmath}$, the resultant vector $\vec{A} + \vec{B}$ is:
a) $2\hat{\imath}+4\hat{\jmath}$ b) $4\hat{\imath}-2\hat{\jmath}$ c) $4\hat{\imath}+2\hat{\jmath}$ d) $2\hat{\imath}-4\hat{\jmath}$

28. if A=10 units and B=6 units, the angle between them is 60^o, the dot product of the vectors ($\vec{A} \cdot \vec{B}$) is:
a) 20 unit b) 30 unit c) 51.96 unit d) 60 unit

29. A force was applied on an object of mass 50 kg with speed 32 m/s, the linear momentum is:
a) 1600 kg.m/s b)1900 kg.m/s c) 1500 kg.m/s d)1700 kg.m/s

30. A 20 kg object is sliding down in an incline smooth plane with 30^o with the horizontal , the net force in direction of sliding is:
a) 49N b) 98 N c) 196 N d) 294 N



31. A force acts on a spring with length 30 cm. This force compressed it by 25cm. The spring constant is k=50 N/m, the work done by the spring is:
a)10 joule b) 1.6 joule c) 0.69 joule d) 0.55 joule

32. An object is moving in the positive direction of the x-axis with a relationship $x(t)=8+2t+3t^2$, the instantaneous velocity after $2s$ is:
a) 24m/s b) 2+6t c) 14m/s d) 12m/s

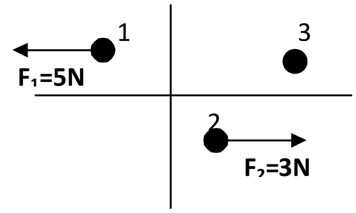
33. The direction of friction is always ________ to the direction in which the object is moving.
a) perpendicular b) opposite c) normal d) similar

34. When a 20 N force acts on an object then it moves 20 m in the same direction. The work is:
a) −40 J b) 40 J c) 400 J d) −400 J

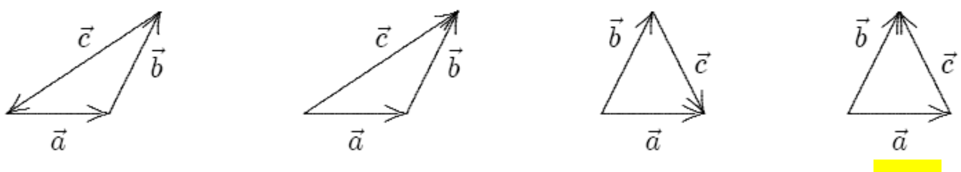
35. Which of the following relation gives negative displacement
a) x_1= - 2m , x_2= 4m c) x_1= - 8m , x_2= - 1m
b) x_1= 6m , x_2= - 2m d) x_1= 7m , x_2= 9m

36. A ball is thrown with initial velocity of 15 m/s at an angle of 30^o from the positive x direction. The y-component of the initial velocity is :
a)30 m/s b) 7.5 m/s c)15 m/s d) 13m/s

37. In the figure, what is the magnitude of the force F_3 acting on particle 3 if the center of mass of the system is stationary?
a) 8 N b) – 2 N c) -8 N d) 2 N

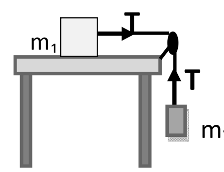


38. The vectors $\vec{a}, \vec{b}$, and $\vec{c}$ are related by $\vec{a} + \vec{c} = \vec{b}$. Which diagram below illustrates (يوضح) this relationship (العلاقة)?

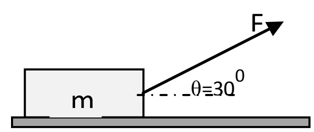


39. If the components of the vector A are given by A_x= 8.6 cm and A_y=4.20 cm, then the direction of this vector with respect to the positive x-axis is:
a) 32° b) 60° c)26° d) 180°

40. In the figure shown; m_2 moves down with acceleration of 2 m/s^2 , the tension in the rope is 10 N. The value of m_2 is:
a)2.5 kg b)1.28 kg c) 8.0 kg d) 50 kg



41. A block was pulled by a force 30 N, the block was going with a constant speed (as shown in the figure) on a rough (خشن) surface. The magnitude of the frictional force is:
a)26 N b) 15 N c) 98 N d) 3 N



42. Each of four particles moves along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by:
particle 1: $x(t) = 3.5 - 2.7t^3$ particle 2: $x(t) = 3.5 + 2.7t^3$
particle 3: $x(t) = 3.5 + 2.7t^2$ particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$
Which of these particles have constant acceleration?
a) All four b) Only 1 and 2 c) Only 2 and 3 d) Only 3 and 4

43. If A=10 and B=6, the angle between them is 60°, the magnitude of the vector product $\vec{A} \times \vec{B} =$
a) 20 b) 30 c) 51.96 d) 60

44. A particle moves through a **displacement** $\vec{d} = (15m)\hat{i} - (12m)\hat{j}$ along a straight line while being acted on by a **force** $\vec{F} = (210N)\hat{i} - (150N)\hat{j}$. **The work** done on the particle by this force is:
a) 4950 J b) 1350 J c) 3150 J d) 1800 J

King Abdulaziz University
Faculty of Sciences
Physics Department

Final Exam - Phys 110

First Term
1432-1433 H

Date: 9/ 2/ 1433H

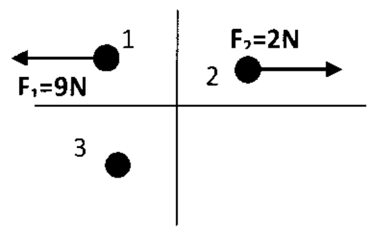
A

Name: **ID No:** **Section:**

1. A 0.4 kg ball is dropped from a window and landed on the street with speed 35 m/s, and then rebound with a speed 25 m/s. **The magnitude of the change of its momentum is:**

   a) 40 kg m/s b) 10 kg m/s c) 20 kg m/s d) 24 kg m/s

2. In the figure, **what is the magnitude of the force F_3** acting on particle 3 if the center of mass of the system is **stationary**?

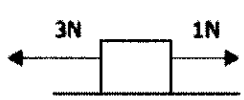


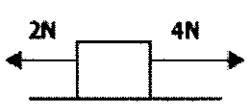
   a) 2 N b) - 9 N c) 7 N d) 10 N

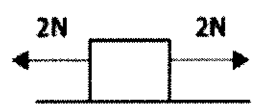
3. The **kinetic energy of a 2g** particle traveling at 500 m/s is:

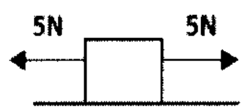
   a) 0.5 J b) 500 J c) 250 J d) 2500 J

4. A box slides to the right over a frictionless table, in **which figure the net force does a negative work?**

a)


b)


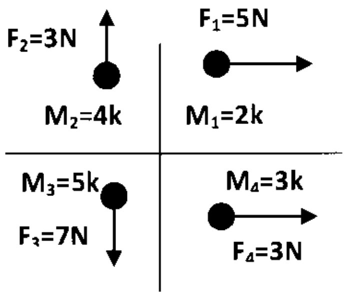
c)


d)


5. In which situation of the following **the work** done by the force is **positive** ?

a) The angle between F and d is 76^0
b) The angle between F and d is 100^0
c) $\vec{F} = 7\hat{i} + 9\hat{j}$ *and* $\vec{d} = -2\hat{i}$
d) $\vec{F} = 5\hat{i} - 10\hat{j}$ *and* $\vec{d} = 2\hat{j}$

6. In the figure, four objects are subjected to external forces. **The x and y components** of acceleration of the center of mass **a_x and a_y are:**

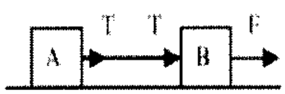


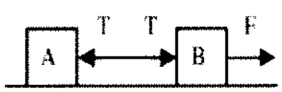
a) $a_{com,x}$= 0.14 m/s², $a_{com,y}$= 0.17 m/s²
b) $a_{com,x}$= 0.57 m/s², $a_{com,y}$= - 0.29 m/s²
c) $a_{com,x}$= 0.71 m/s², $a_{com,y}$= 0.24 m/s²
d) $a_{com,x}$= 0.19 m/s², $a_{com,y}$= - 0.51 m/s²

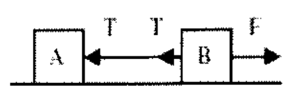
7. Which quantity of the following is **a scalar quantity** ?

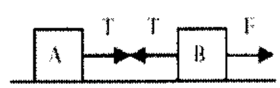
a) acceleration b) force c) work d) linear momentum

8. Which figure of the following give **the correct direction of the tension T** ?

a) 

b) 

c) 

d) 

9. A particle moves along an x axis, if the velocity of the particle changes from -3 m/s to 2 m/s, the **kinetic energy** of the particle

a) increase b) decrease c) remain constant d) zero

10. A body of mass of 10 kg and speed of 5 m/s, suddenly split into three bodies. **The momentum** of the body **before the split** is:

a) 50 kg m/s b) 25 kg m/s c) 15 kg m/s d) 10 kg m/s

11. **What is the y-coordinate** of the 4 kg particle in the table below, if the center of mass of the three particle system has the coordinates (- 0.33m , 1.33m)

Mass	x-coordinate	y-coordinate
2 kg	3 m	2 m
3 kg	1 m	- 4 m
4 kg	-3 m	

a) 2 m b) - 3 m (c) 5 m d) - 4 m

12. Two particles of masses 2 kg and 3 kg are located at 1 m and 2 m from the origin along the x axis respectively. **The position of the center of mass** is:

(a) 1.6 m b) 0 c) 1 m d) 2.7 m

13. **What velocity** a 5000 kg truck must have in order to have **the same momentum** of a 10000 kg truck whose velocity is 20 m/s ?

a) 20 m/s (b) 40 m/s c) 60 m/s d) 80 m/s

Use the following to answer questions 14-15:

If the kinetic energy of a particle of **mass 2 kg** is **initially 10 J** and there is a net energy transfer of **5 J to the particle**

14. **The final kinetic energy** of the particle is:

a) 25 J (b) 15 J c) 30 J d) zero

15. **The initial speed** of the particle is:

(a) 3.16 m/s b) 15 m/s c) 2.24 m/s d) 5 m/s

16. A force of 100 N acts on a box moving with a constant speed of 5 m/s along the positive x axis. **The power due to this force is :**

a) 5 W b) 50 W c) 250 W (d) 500 W

17. A 6 kg body moves with a constant acceleration starting from rest to a speed of 15 m/s. **The work done** on the body is:

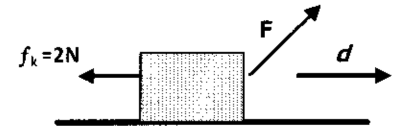
(a) 675 J b) 350 J c) 450 J d) 100 J

18. A force acts on a spring of length 30 cm and compressed it to a length of 25 cm, if the spring constant is 50 N/m. **The work done by the spring is:**

a) 11.38 J b) 3750 J c) 678 J (d) 0.69 J

Use the following to answer questions 19-21:

A force $\vec{F} = 5\hat{i} + 10\hat{j}$ is applied to a block that moves a distance $\vec{d} = 2\hat{i}$ on a surface as shown.



19. **The work done** on the block **by the normal force F_N is:**

a) F_N d cos 0^0 (b) F_N d cos 90^0 c) F_N d d) F_N d cos 180^0

20. **The work done** on the block **by the frictional force f_k is:**

a) - 3 J b) 2 J c) 1 J (d) - 4 J

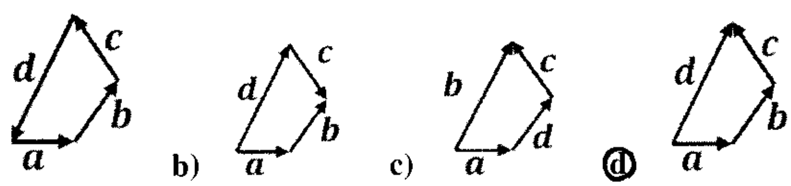
21. **The work done** on the block **by the force F** is:

a) 35 J b) 30 J c) 25 J (d) 10 J

22. **The magnitude of the centripetal force is:**

a) $F = m\frac{v^2}{R^2}$ (b) $F = m\frac{v^2}{R}$ c) $F = m\frac{v}{R}$ d) $F = \frac{v^2}{R}$

23. The vectors $\vec{a}, \vec{b}, \vec{c}$, and $\vec{d}$ are related by $\vec{a} + \vec{b} + \vec{c} = \vec{d}$. **Which diagram** below illustrates this relationship?



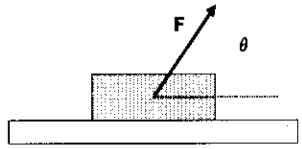
a) b) c) (d)

24. A particle travels in a circle of radius R with constant speed v. **The period of 3 revolutions is:**

a) $\frac{7\pi R}{v}$ b) $\frac{5\pi R}{v}$ (c) $\frac{6\pi R}{v}$ d) $\frac{2\pi R}{v}$

Use the following to answer questions 25-26:

In the figure a force F is applied to a block of mass m that slides along a floor, the coefficient of kinetic friction between the block and the floor is μ_K .



25. The x-component of the net force is:

a) $F\cos\theta - \mu_K F_N = 0$

b) $F\cos\theta - \mu_K F_N = ma_x$

c) $F\sin\theta - \mu_K = ma_x$

d) $F\sin\theta - mg = ma_x$

26. The y-component of the net force is:

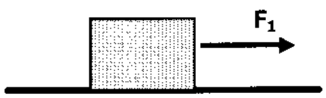
a) $F_N - mg = 0$

b) $F\sin\theta - mg = 0$

c) $F_N + F\cos\theta - mg = 0$

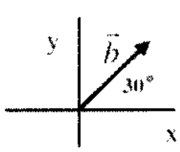
d) $F_N + F\sin\theta - mg = 0$

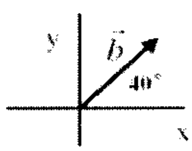
27. There are two horizontal forces acting on the 2 kg box but only one force F_1 = 20 N is shown in the figure, the box moves along the x axis with acceleration a = 20 m/s². **The second force F_2 =**

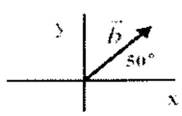


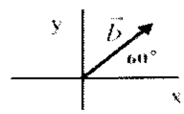
a) 20 N b) 10 N c) 30 N d) 50 N

28. In which figure of the following **b_x = 8.7 m** ? (b = 10 m)

a) 

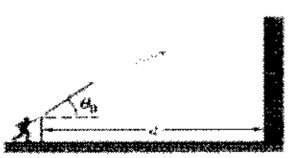
b) 

c) 

d) 

Use the following to answer questions 29-30:

You throw a ball toward a wall at speed 20 m/s and at angle $\theta_0 = 33^0$ above horizontal. It takes 0.8 s to hit the wall.



29. The vertical component of its velocity as it hits the wall is:

a) 0.31 m/s b) 31 m/s c) zero ⓓ 3.1 m/s

30. The horizontal component of its velocity as it hits the wall is:

a) zero b) 11 m/s ⓒ 16.8 m/s d) 30 m/s

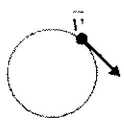
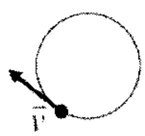
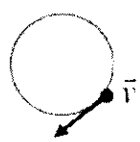
31. The components of $\vec{a}$ are: $a_x = 3$ m, and $a_y = 4$ m , the **direction** of $\vec{a}$ is:

ⓐ 53.13° b) 59° c) 63.4° d) 66.8°

32. If $\vec{D} = 5\hat{i} + 25\hat{j}$, then $\frac{2\vec{D}}{10}$ **equals:**

a) $\hat{i} - 5\hat{j}$ b) $5\hat{i} - \hat{j}$ ⓒ $\hat{i} + 5\hat{j}$ d) $5\hat{i} + \hat{j}$

33. In circular motion, which figure represents the velocity $\vec{v} = 400\hat{i} + 500\hat{j}$

ⓐ  b)  c)  d) 

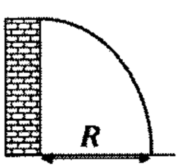
34. A particle undergoes a displacement $\Delta\vec{r} = 2\hat{i} - 3\hat{j} + 6\hat{k}$ **, The average velocity** of the particle **in 2 s is:**

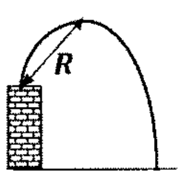
ⓐ $\hat{i} - 1.5\hat{j} + 3\hat{k}$ b) $\hat{i} - 3\hat{j} + 3\hat{k}$ c) $2\hat{i} - 3\hat{j} + 6\hat{k}$ d) $2\hat{i} - 3\hat{j} + 3\hat{k}$

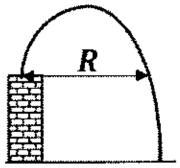
35. The range of a ball thrown at angle 30° above horizontal with velocity V_0 is

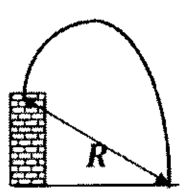
a) $\frac{V_0^{\,2}}{g}$ ⓑ $\frac{V_0^{\,2}}{g}\sin 60$ c) $\frac{V_0^{\,2}}{g}\sin 30$ d) $\frac{V_0^{\,2}}{g}\sin 120$

36. In which figure **R represents the range** of the projectile ?

a) 

b) 

ⓒ 

d) 

37. One Watt equals:

a) J/s b) J/s^2 c) $J.s^2$ d) J.s

38. The magnitude of $\vec{A} \times \vec{B} = 0$ **if the angle** between $\vec{A}$ and $\vec{B}$ is:

a) 45^0 b) 90^0 c) 270^0 d) 0^0

39. The magnitude of the vector $\vec{A} = 5\hat{k}$ is:

a) 0 b) 5 c) 10 d) 50

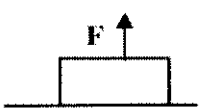
40. The base quantities of the SI units (m, kg, s) respectively are:

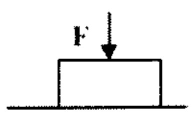
a) (force, mass, time)
b) (length, mass, time)
c) (mass, speed, time)
d) (length, weight, time)

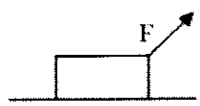
41. The position of a particle is given by: $x(t)= 10 + t^2$,the **instantaneous acceleration at t= 1 s** is:

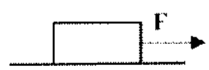
a) 8 m/s^2 b) 6 m/s^2 c) 2 m/s^2 d) 4 m/s^2

42. In which figure of the following the normal force on the block of mass m equals $F_N = mg$

a) 

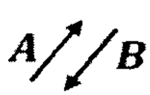
b) 

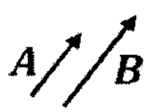
c) 

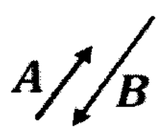
d) 

43. Which figure shows $\vec{A} = -\vec{B}$

a) 

b) 

c) 

d) 

44. A particle undergoes a displacement $\Delta\vec{r} = 2\hat{i} - 3\hat{j} + 6\hat{k}$ **, If** $\vec{r}_2 = 3\hat{j} - 4\hat{k}$ **then:**

a) $\vec{r}_1 = 2\hat{i} - 9\hat{j} + 10\hat{k}$ b) $\vec{r}_1 = 2\hat{i} + 2\hat{k}$ c) $\vec{r}_1 = 2\hat{i} + 10\hat{k}$ d) $\vec{r}_1 = -2\hat{i} + 6\hat{j} - 10\hat{k}$

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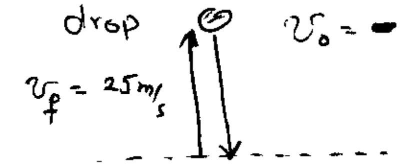
Q(1):

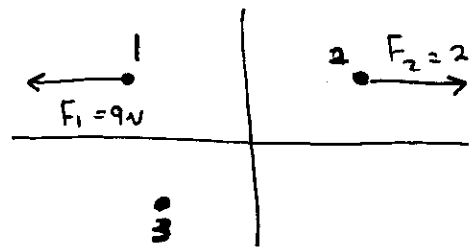
rebound = ارتدت



$$|\Delta P| = |P_f - P_i| = m|v_f - v_i|$$

$$= 0.4\,|25-(-35)| = 0.4\,|60| = 24\ kg \cdot m/s \quad (d)$$

Q(2) CoM is stationary



$$\sum F_x = 0$$

$$F_{1x} + F_{2x} + F_{3x} = 0$$

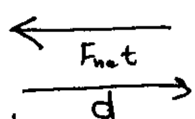
$$-9 + 2 + F_{3x} = 0 \Rightarrow F_{3x} = +7N \quad (c)$$

Q(3) $m = 2g = 2 \times 10^{-3}\ kg$ $\quad v = 500\ m/s \Rightarrow K.E = ??$

$$K.E = \frac{1}{2} m v^2 = \frac{1}{2}(2\times10^{-3})(500)^2 = 250\,J \quad (c)$$

Q(4) (a)

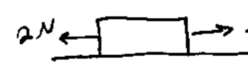
$F_{net} = \sum F_x = 1-3 = -2N$



$F \uparrow\downarrow d$ (anti-parallel) ✓

$\theta = 180 \Rightarrow W(-ve)$

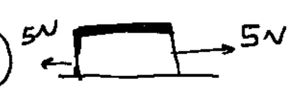
(c)



$F_{net} = 2-2 = 0$

$W = 0$

(d)

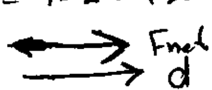


$F_{net} = 5-5 = 0$

$W = 0$

b (b)

$F_{net} = 4-2 = +2N$



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$W \Rightarrow +ve \quad 0 \leq \theta < 90$ or. $F \nearrow\nearrow d$ (Parallel

Q(5) a) $\theta = 76° < 90$ ← (a)

$\Rightarrow W(+ve)$

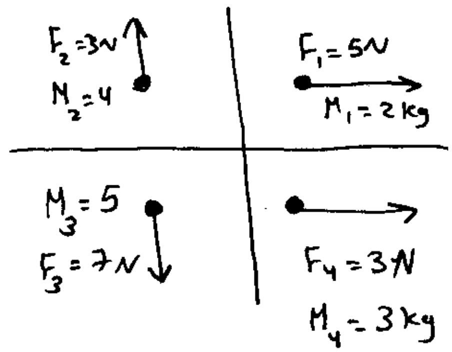
b) $\theta = 100 > 90 \Rightarrow W(-ve)$

c) $W = F \cdot d = 7 \times -2 + 0 = -14\,J \Rightarrow -ve$

d) $W = 0 - 10 \times 2 = -20\,J \Rightarrow -ve$

Q(6)

particle	mass	F_x	F_y
1	2	+5	0
2	4	0	+3
3	5	0	-7
4	3	+3	0
	M = 14		



$\Sigma F_x = M\, a_{com,x}$

$a_{com,x} = \frac{\Sigma F_x}{M} = \frac{F_{1x} + F_{2x} + F_{3x} + F_{4x}}{M}$

$= \frac{5 + 0 + 0 + 3}{14} = 0.57\, m/s$

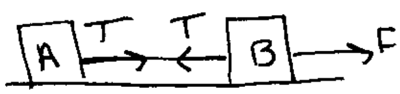
$\Sigma F_y = M\, a_{com}$

$a_{com,y} = \frac{\Sigma F_y}{M} = \frac{F_{1y} + F_{2y} + F_{3y} + F_{4y}}{M}$

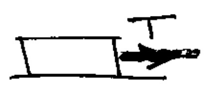
$= \frac{0 + 3 - 7 + 0}{14} = -0.29\, m/s^2$

(b)

Q(8) (d)



اتجاه شد الحبل (T) يخرج من
الجسم في اتجاه الحبل



Q(9) $v_i = -3\, m/s \qquad v_f = 2\, m/s$

$K_i = \frac{1}{2} m (-3)^2 \qquad K_f = \frac{1}{2} m (2)^2$

$= \frac{1}{2} m (9) \qquad = \frac{1}{2} m (4)$

or $\Delta K = K_f - K_i = \frac{1}{2} m (v_f^2 - v_i^2)$

$= \frac{1}{2} m (4 - 9) = -\frac{5}{2} m$

$-ve$ decrease

v : -3 to 2

$\Rightarrow v$ decrease

$\Rightarrow$ K. E decrease

(b)

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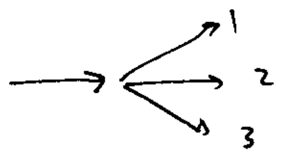
Q(10)

① $m = 10\,kg$, $v = +5\,m/s$



P initial P final

$P_p = mv = 10 \times 5 = 50\ Kg \cdot m/s$ ⓐ

Q(11) $(-0.33m,\ 1.33m)$
(x_{com}, y_{com})

Mass	X	y
2	3	2
3	1	-4
4	-3	$y_3 = ??$
M = 9	$x_{com} = -0.33$	$y_{com} = 1.33$

$y_{com} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3}{M}$

$1.33 = \frac{2\times 2 + 3\times -4 + 4\times y_3}{9}$

$9 \times 1.33 = 4 - 12 + 4y_3$

$4y_3 = 11.97 - 4 + 12 = 19.97$

$y_3 = \frac{19.97}{4} = 4.99 = 5\,m$ ⓒ

Q(12)

P.	M	X
1	2	1
2	3	2
	M=5	

$\Rightarrow$ Position $= x_{com} = \frac{2\times 1 + 3\times 2}{5} = \frac{2+6}{5}$.

$x_{com} = 1.6\ m$ ⓐ

Q(13) $m_1 = 5000\,kg$ $v_1 = ??$
$m_2 = 10000\,kg$ $v_2 = 20\,m/s$

$P_1 = P_2$

$m_1 v_1 = m_2 v_2 \Rightarrow v = \frac{m_2 v_2}{m_1} = \frac{10000 \times 20}{5000} = 40\,m/s$ ⓑ

Q(14) $m = 2\,kg$ $K_i = 10\,J$ $W_{net} = \Delta K = +5\,J$ (to)

Q(14) $\Delta K = K_f - K_i$

$5 = K_f - 10 \Rightarrow K_f = 5 + 10 = 15\,J$ ⓑ

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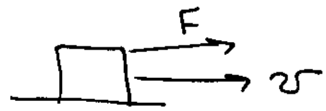
Q(15) $K = \frac{1}{2} m v^2 \Rightarrow K_i = \frac{1}{2} m v_i^2$

ⓐ

$10 = \frac{1}{2}(2) v_i^2 \Rightarrow v_i = \sqrt{10} = 3.16$ m/s

Q(16) $F = 100 N$ $\quad v = 5$ m/s



$P = F \cdot v = F v \cos\theta$

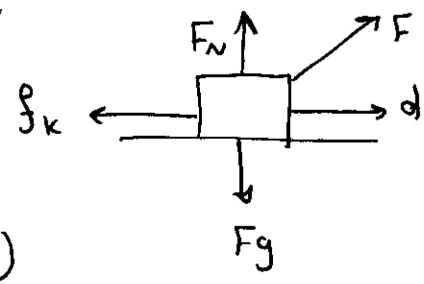
$= (100)(5) \cos(0) = 500$ Watt ⓓ

Q(17) $m = 6$ kg $\quad a$: const. $\quad v_i = 0 \quad v_f = 15$ m/s

$W = \Delta K = \frac{1}{2} m \left[v_f^2 - v_i^2 \right]$

$= \frac{1}{2}(6)\left[15^2 - 0\right] = 675 J$ ⓐ

Q(~~18~~) $\vec{F} = 5\hat{i} + 10\hat{j} \quad d = 2\hat{i}$



Q(19) $W_{F_N} = F_N d \cos 90 = 0$ ⓑ

Q(20) $W_f = -f d = -(2)(2) = -4 J$ ⓓ

Q(21) $W_F = F \cdot d = 5 \times 2 + 10 \times 0 = 10 J$ ⓓ

Q(18) $x_i = 30$ cm $\quad x_f = 25$ cm $\quad k = 50$ N/m

$= 30 \times 10^{-2}$ m $\quad = 25 \times 10^{-2}$ m

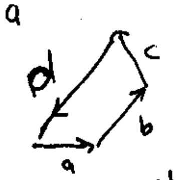
$W_s = \frac{1}{2} k (x_i^2 - x_f^2) = \frac{1}{2}(50)\left[(30\times10^{-2})^2 - (25\times10^{-2})^2\right] = 0.69 J$ ⓓ

Q(22) $|F_\perp| = m a_\perp = m \frac{v^2}{r}$ ⓑ

هنـــاء فرحان $\vec{a}+\vec{b}+\vec{c}=\vec{d}$

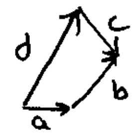
Q(23)

a



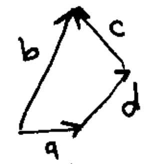
$a+b+c=-d$

(b)



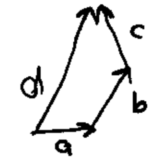
$a+b-c=d$

(c)



$a+d+c=b$

(d)



✓ $a+b+c=d$ (d)

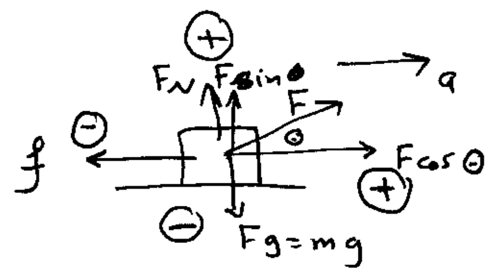
Q(24) 3 revolution = 3T

$T=\frac{\text{distance}}{\text{speed}}=\frac{2\pi r}{v}$ (محيط)

$T=\frac{2\pi R}{v}$

$t=3T=3\left(\frac{2\pi R}{v}\right)=6\frac{\pi R}{v}$ (c)

Q(25)



$\Sigma F_x=ma_x$

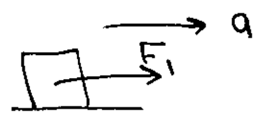
$\Sigma F_x=F\cos\theta-f_k=ma$

$F\cos\theta-\mu_k F_N=ma$ (b)

Q(26) $\Sigma F_y=0$

$F_N+F\sin\theta-mg=0$ (d)

Q(27) $a=+20\ m/s$



$\Sigma F_x=ma_x$

$F_{1x}+F_{2x}=+ma$

$F_{2x}=ma-F_{1x}=(2)(20)-(+20)=20N$ (a)

Q(28) $b_x=b\cos\theta$

a) $b_x=10\cos 30$
$=8.7m$

b) $b_x=10\cos 40$
$=7.7m$

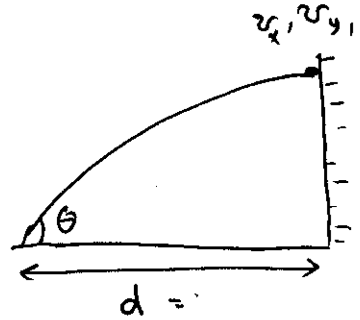
c) $b_x=10\cos 50$
$=6.4m$

d) $b_x=10\cos 60$
$=5m$

✓ (a)

هنـــاء فرحان

$v_o = 20\ m/s \qquad \theta_o = 33^\circ \qquad t = 0.8s$



Q(29) $v_y = v_{oy} - gt$

$= v_o \sin\theta_o - gt$

$= 20\sin(33) - 9.8(0.8) = 3.1\ m/s$ (d)

Q(30) $v_x = v_{ox} = v_o \cos\theta$

$= 20\cos(33) = 16.8\ m/s$ (c)

Q(31) $\theta = \tan^{-1}\frac{a_y}{a_x} = \tan^{-1}\frac{4}{3} = 53.13^\circ$ (a)

Q(32) $\vec{D} = 5\hat{i} + 25\hat{j}$

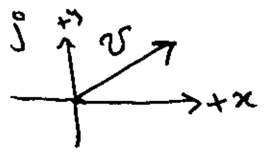
$\frac{2}{10} = \frac{1}{5}$

$\frac{2\vec{D}}{10} = \frac{2}{10}(5)\hat{i} + \frac{2}{10}(25)\hat{j} = \hat{i} + 5\hat{j}$ (c)

Q(33) $v = 400\hat{i} + 500\hat{j}$

$\downarrow \qquad \downarrow$

$+ \qquad +$



(a)

v متجهة في الربع الأول لأن $v_x \rightarrow (+)$, $v_y \rightarrow +$

Q(34) $\Delta r = 2\hat{i} - 3\hat{j} + 6k \qquad \Delta t = 2s$

$v_{avg} = \frac{\Delta r}{\Delta t} = \frac{2}{2}\hat{i} - \frac{3}{2}\hat{j} + \frac{6}{2}k = \hat{i} - 1.5\hat{j} + 3k$ (a)

Q(35) $R = \frac{v_i^2}{g}\sin 2\theta_o \qquad \theta_o = 30 \qquad 2\theta_o = 2\times 30 = 60$

$R = \frac{v_o^2}{g}\sin 60$

Q(36)

(c)

R هي المسافة بين بداية الانطلاق والعودة
الى نفس المستوى

هنــــاء فرحان

$P = \frac{W}{s}$

Q (37) $1 \text{ Watt} = \frac{J}{s}$ (a)

Q (38) $A \times B = AB \sin\phi$

$A \times B = 0 \Rightarrow \sin\phi = 0 \Rightarrow \phi = 0$ (d)

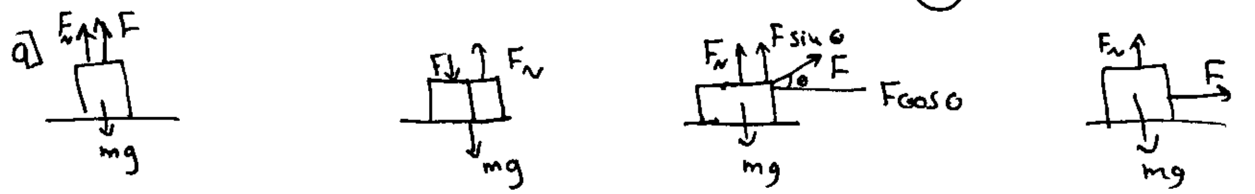
Q (39) $\vec{A} = 5\hat{k} \Rightarrow |A| = \sqrt{5^2} = 5$ (b)

Q (40) (m, kg, s)

(length, mass, time) (b)

Q (41) $x = 10 + t^2 \Rightarrow v = \frac{dx}{dt} = 2t \Rightarrow a = \frac{dv}{dt} = 2\ m/s^2$ at any time (c)

Q (42) a)



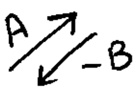
$F_N + F = mg$ | $F_N = mg + F$ | $F_N + F\sin\theta = mg$ | $F_N = mg$

$F_N = mg - F$ | | $F_N = mg - F\sin\theta$ |

(d)

Q (43) $A = -B$

A and B equals in mag. and oppose (dir.) (b)



Q (44) $\Delta r = 2\hat{i} - 3\hat{j} + 6\hat{k}$ $\qquad \Delta r = r_2 - r_1$

$r_2 = 3\hat{j} - 4\hat{k}$ $\qquad r_1 = r_2 - \Delta r$

$\Delta r = (\mp 2)\hat{i}\ (\pm 3)\hat{j}\ (\mp 6)\hat{k}$

$r_1 = -2\hat{i} + 6\hat{j} - 10\hat{k}$ (d)

Examples:

1. A 5 kg object moving at a speed of 6 m/s. Calculate its kinetic energy.

Solution

The kinetic energy is defined as

$$K = ½\ mv^2 = ½ \times 5 \times 6^2 = 90\ J$$

2. A car of mass 1000 kg accelerates at 2 m/s^2 for 10 s from an initial speed of 5 m/s. Determine the work done by the car.

Solution

The work is defined as the change in the kinetic energy. Therefore

$$W = \Delta K = K_2 - K_1 = ½\ m\ (v_2^2 - v_1^2)$$

We know the initial speed (v_1 = 5 m/s) but we have to find out the final speed (v_2) using the equation of motion. We know that

$$v_2 = v_1 + at$$

Therefore

$$v_2 = 5 + 2\times10 = 25\ m/s$$

Hence the work done by the car is

$$W = ½ \times 1000\times (25^2 - 5^2) = 3\times10^5\ J$$

3. A force, **F** = 2**i** -3**j** +**k** (N) is applied on a box. If the displacement of the box due to the force is **d** = **i** +3**k** (m), find the work done.

Solution

The work done by the force is the scalar product of the force and its displacement, such as

$$W_F = \mathbf{F.\,d} = (2\times1) + (-3\times0) + (1\times3) = 5\ \text{J}$$

4. A box is pulled across the floor by a horizontal force of magnitude 80 N. How much work does the force exert to pull the object 5 m?

Solution

The work done by the force is

$$W_F = F\ d\ \cos\theta$$

But the force and displacement are parallel; the angle between them is zero. Therefore

$$W_F = F\ d = 80 \times 5 = 400\ \text{J}$$

5. A box is dragged across the floor by a force of magnitude 50 N directed 60^o above the horizontal. Calculate the work done by the force to pull the object 6 m?

Solution

The work done by the force is

$$W_F = F\ d\ \cos\theta = 50 \times 6 \times \cos(60) = 150\ \text{J}$$

6. A horizontal force F is applied to move a 5 kg carton across the floor. If the acceleration of the carton is measured to be 2 m/s^2, how much work does F do in moving the carton 7 m?

Solution

While the force and displacement are parallel, the work done is

$$W_F = F\,d$$

The force can be determined from Newton's second law as

$$F = ma = 5\times2 = 10\ \text{N}$$

Therefore the work is

$$W_F = F\,d = 10\times 7 = 70\ \text{J}$$

7. A horizontal force **F** is applied to move a 6 kg carton across the floor. If the carton starts from rest and its speed after 3 sec is 6 m/s, how much work does F do in moving the carton 4 m?

Solution

While the force and displacement are parallel, the work done is

$$W_F = F\,d$$

However the force, F, can be determined from Newton's second law as

$$F = ma$$

The acceleration cab be found using the motion equation

$$v = v_0 + at$$

Since the carton starts its motion from rest ($v_0=0$), the acceleration is

$$a = v/t = 6/3 = 2\ \text{m/s}^2$$

Therefore the force is

$$F = ma = 6\times2 = 12\ \text{N}$$

Hence the work done by the force **F** is

$$W_F = F\,d = 12\times 4 = 48\ \text{J}$$

8. A 5.0-kg box is raised a distance of 2.5 m from rest by a vertical applied force of 90 N. Find (a) the work done on the box by the applied force, and (b) the work done on the box by gravity.

Solution

(a) Using the definition of work in which the force and displacement are in the same direction (parallel), we get

$$W_F = F\,d = 90 \times 2.5 = 225\ J$$

(b) Using the definition of work done by gravity for moving up object (the force and displacement are anti-parallel), we get

$$W_g = -mg\,d = -5 \times 9.8 \times 2.5 = -122.5\ J$$

9. A box rests on a horizontal, frictionless surface. Ali pushes on the box with a force of 18 N to the right and Dima pushes on the box with a force of 12 N to the left. The box moves 4.0 m to the right. Find the work done by (a) Ali, (b) Dima, and (c) the net force.

Solution

(a) While the force applied by Ali is in the same direction of displacement (their angle is zero), the work done by Ali is

$$W_{Ali} = F_{Ali}\,d = 18 \times 4 = 72\ J$$

(b) While the force applied by Dima is in the opposite direction of displacement (their angle is 180), the work done by Dima is

$$W_{Dima} = -F_{Dima}\,d = -12 \times 4 = -48\ J$$

(c) The net force is

$$F_{net} = F_{Ali} + F_{Dima} = 18 - 12 = 6\ N$$

We can also calculate the net force using the work concept where the net work is

$$W_{net} = F_{net}\, d$$

But the total (net) work is

$$W_{net} = W_{Ali} + W_{Dima} = 72 - 48 = 24 \text{ J}$$

Therefore we get

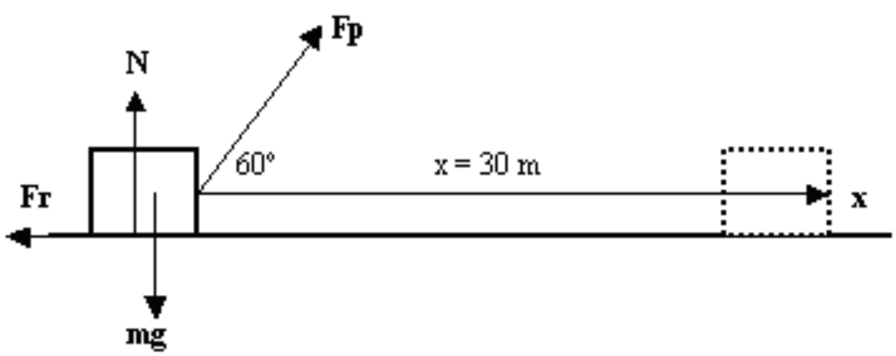
$$F_{net} = W_{net} / d = 24/4 = 6 \text{ N}$$

10. A 40 kg box is pulled 30 m on a horizontal floor by applying a force (F_p) of magnitude 100 N directed by an angle of 60° above the horizontal. If the floor exerts a friction force (f_r) of magnitude 20 N, calculate the work done by each one of these forces. Calculate the work done by the weight and the normal force. Calculate also the total work done on the box.

Solution

(a) The work done by the force is

$$W_F = F_p\, d \cos\theta = 100 \times 30 \times \cos 60 = 1500 \text{ J}$$



(b) The work done by the friction force is

$$W_f = f_r\, d \cos\theta = 20 \times 30 \times \cos 180 = -600 \text{ J}$$

Note that the angle between f_r and displacement is 180° because they point in opposite directions.

(c) The work done by the gravity force is

$$W_g = 0 \text{ J}$$

Note that the box is moving along x-axis and there is no displacement along the vertical direction, therefore its work is zero.

(c) The work done by the normal force is

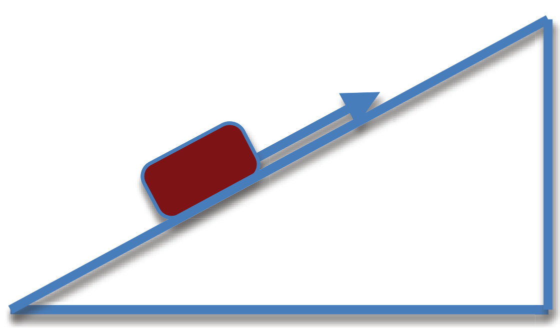
$$W_N = 0 \text{ J}$$

The normal force does no work because it is normal (perpendicular) to the displacement.

(d) The total work done on the box is

$$W_T = W_F + W_f + W_g + W_N = 1500 - 600 + 0 + 0 = 900 \text{ J}$$

11. A stationary block of 10 kg is pulled up along a smooth incline of length 10 m and height 5 m by applying an external force of 50 N parallel to the incline. At the end of incline, find (i) work done by the external force, (ii) work done by gravity, and (iii) speed of the block.



Solution

(i) The work done by the force is

$$W_F = F\, d \cos\theta = 50 \times 10 \times \cos 0 = 500 \text{ J}$$

Note that both the force and displacement are in the same direction.

(ii) The work done by the gravity force is

$$W_g = F_g\, d \cos\theta = F_g\, d \cos\theta = 2 \times 9.8 \times 5 \times \cos 180 = -98 \text{ J}$$

(iii) The total work done is

$$W_T = W_F + W_g = 500 - 98 = 402 \text{ J}$$

Therefore the change in the kinetic energy is

$$W = \Delta K = K_2 - K_1 = \tfrac{1}{2}\, m\, v_2^2$$

Where the initial speed is zero. Hence the final speed is

$$v_2^2 = 2\Delta K/m = 2 \times 402/10 = 80.4\ (\text{m/s})^2$$

$$v_2 = 9 \text{ m/s}$$

12. Maha slides a 1-kg toy for 3 m along the floor to her sister Reem. The toy is moving at 4 m/s when Maha lets go, and at 2 m/s when Reem catches it. (a) Find the work done by friction and (b) calculate the force of friction.

Solution

(a) We know that the total work done on a body equals the change in its kinetic energy. Since we have only a friction force, then the total work is due to it. Hence, we have

$$W_f = \Delta K = K_2 - K_1 = \tfrac{1}{2}\, m\, (v_2^2 - v_1^2) = \tfrac{1}{2} \times 1 \times (2^2 - 4^2) = -6 \text{ J}$$

(b) It is well known that the work done by the friction force is given by

$$W_f = -f_k\, d$$

Therefore the friction force is

$$f_k = -W_f/d = -(-6)/3 = 2 \text{ N}$$

13. An 8.0 kg block initially at rest is pulled to the right for 3.0 m with a force of 12 N over a surface. Determine its final speed if: (a) the surface has no friction and (b) the surface has a coefficient of kinetic friction of 0.15

Solution

(a) In the case of frictionless surface (no friction force), the total work of the system is only the work done by the external force. We have

$$W_T = W_F = F\,d = 12 \times 3 = 36\ \text{J}$$

Therefore the change in kinetic energy is equivalent to the total work. Hence the final speed of the block is

$$W_T = \Delta K = K_2 - K_1 = \tfrac{1}{2}\,m\,(v_2^2 - v_1^2)$$

But the block starts from rest; therefore its initial speed is zero. The final speed is then

$$W_T = \tfrac{1}{2}\,m\,v_2^2$$

Or

$$v_2^2 = 2\,W_T/m = 2 \times 36/8.0 = 9\ (\text{m/s})^2$$

Or

$$v_2 = 3\ \text{m/s}$$

(b) In the case of frictional surface (there is friction force), the total work of the system is the work done by the external force and friction force. We have

$$W_T = W_F + W_f = F\,d - f_k\,d$$

The friction force is defined (from the previous chapter) as:

$$f_k = \mu_k N = \mu_k mg = 0.15 \times 8 \times 9.8 = 11.76\ \text{N}$$

The total work, then, is

$$W_T = F\,d - f_k\,d$$

That gives

$$W_T = 12 \times 3 - 11.76 \times 3 = 0.72\ \text{J}$$

The final speed can be determined using the work-energy theorem as

$$W_T = \tfrac{1}{2}\, m\, v_2^2$$

Or

$$v_2^2 = 2\, W_T / m = 2 \times 0.76/8.0 = 0.18\ (\text{m/s})^2$$

Or

$$v_2 = 0.42\ \text{m/s}$$

14. A block of mass 1.6 kg resting on a frictionless surface is attached to a horizontal spring with a spring constant $k = 1.0 \times 10^3$ N/m. The spring is compressed to 2.0 cm and released from rest. Find the velocity of the block when released.

Solution

We know that the work done by a spring is given by

$$W_s = \tfrac{1}{2}\, k\, x^2 = \tfrac{1}{2} \times 1.0 \times 10^3 \times (0.02)^2 = 0.2\ \text{J}$$

The total work is (there is only one kind of work due to the spring)

$$W_T = W_s = 0.2\ \text{J}$$

Therefore the final speed is

$$W_T = \tfrac{1}{2}\, m\, v^2$$

That will give us the following value

$$v = 0.5\ \text{m/s}$$

15. A 5 kg ball is freely dropped from a height of 20 m above the ground. Calculate its speed when it hits the ground.

Solution

We know that the work done by the gravity is given by

$$W_g = mgd = 5 \times 9.8 \times 20 = 980 \text{ J}$$

The total work is (there is only gravity work)

$$W_T = W_g = 980 \text{ J}$$

Using the work-energy theorem, we get

$$W_T = ½\, m\, v^2$$

Or

$$v = (2W_T/m)^{½} = (2 \times 980/5)^{½} = \quad 19.8 \text{ m/s}$$

16. Zain does 240 J of work in pushing a box. If he does the work in 4 s, what is his power output?

Solution

The output power is defined as

$$P = W/t = 240/4 = 60 \text{ W}$$

17. Ahmad pushes a box along a smooth floor using a force of 210 N and a power output of 350 W. How long does it take Ahmad to push the box 20 m?

Solution

The output power is defined as

$$P = W/t$$

Therefore the time taken for this operation is

$$t = W/P$$

But the work is

$$W = F\,d = 210 \times 20 = 4200 \text{ J}$$

Hence the time is

$$t = W/P = 4200 / 350 = 12 \text{ s}$$

17. A box is lifted at a constant speed of 7.0 m/s by a machine. If the power of the machine is 21000 W, find the force applied.

Solution

The output power is defined as

$$P = \mathbf{F} \cdot \mathbf{v}$$

But the force and velocity are parallel (both upwards), the force is

$$F = P/ v = 21000/7.0 = 3000 \text{ N}$$

بسم الله الرحمن الرحيم

نموذج اختبار النصفي للفصل الدراسي الثاني

للعام ١٤٢٩/١٤٣٠ هـ

1. **A particle goes from x = –2 m, y = 3 m, z = 1 m to x = 3 m, y = –1 m, z = 4 m. Its displacement is:**

a) $(1\text{ m})\hat{i}+(2\text{ m})\hat{j}+(5\text{ m})\hat{k}$

b) $(5\text{ m})\hat{i}-(4\text{ m})\hat{j}+(3\text{ m})\hat{k}$

c) $-(5\text{m})\hat{i}+(4\text{m})\hat{j}-(3\text{m})\hat{k}$

d) $-(5\text{m})\hat{i}-(2\text{m})\hat{j}=(3\text{m})\hat{k}$

2. **A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. The distance from launching to landing points is:**

a) 40 m

b) 60 m

c) 80 m

d) 122.5 m

3. **A stone is tied to the end of a string and is swung with constant speed around a horizontal circle with a radius of 1.5 m. If it makes two complete revolutions each second, its acceleration is:**

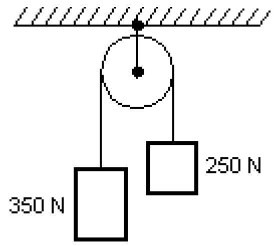
a) 0.24 m/s^2

b) 240.7 m/s^2

c) 2.4 m/s^2

d) 24m/ s^2

4. Two blocks weighting 250 N and 350 N respectively, are connected by a string that passes over a massless pulley as shown. The tension in the string is:



a) 210 N
b) 410 N
c) 290.8 N
d) 500 N

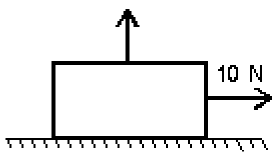
5. A 6-kg object is moving south. A net force of 12 N north on it result in the object having an acceleration of:

a) 2 m/s^2, north
b) 2 m/s^2, south
c) 18 m/s^2, north
d) 18 m/s^2, south

6. The "reaction" force does not cancel the "action" force because:

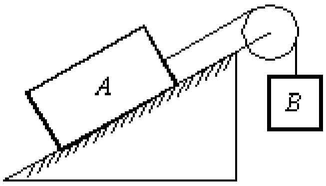
a) the action force is greater than the reaction force
b) they are in the same direction
c) the reaction force is greater than the action force
d) they act on different bodies

7. A box with a weight of 50 N rests on a horizontal surface with a coefficient of static friction is 0.4. If person pulls horizontally on it with a force of 10 N , then



a) the block will not move
b) the block will move to the left
c) the block will move to the right
d) the block will move upward

8. Block A, with a mass of 10 kg, rests on a 30□ incline. The coefficient of kinetic friction is 0.20. The attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. Block B, with a mass of 8.0 kg, is attached to the dangling end of the string. The acceleration of B is:



a) 0.69 m/s^2, up the plane

b) 0.69 m/s^2, down the plane

c) 2.6 m/s^2, up the plane

d) 2.6 m/s^2, down the plane

Answer key:

1-b

2-d

3-b

4-c

5-a

6-d

7-a

8-b

KING ABDULAZIZ UNIVERSITY

SCIENCE FACULTY

PHYSICS DEPARTMENT

Summer Term

Second Exam

A

Student Name:	Student Number:	Group:

<u>CHOOSE THE CORRECT ANSWER:</u>

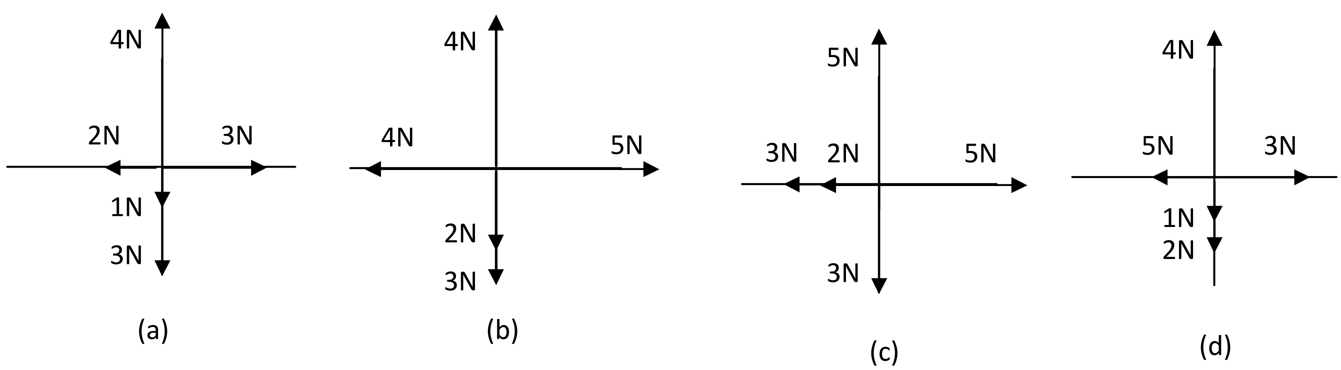
1. A Ball is thrown from ground level making an angle of 30◦ above the horizontal. The ball speed is 980 m/s. What is the of Range the projectile?
a) 4.3 x10^3 m b) 8.5 x10^3 m c) 43 x10^3 m d) 84.8x10^3 m

2. Acceleration is defined as:
   a) Rate of change of position with time.
   b) Distance divided by time.
   c) Rate of change of velocity with time.
   d) A position of an object.

3. Which of the following is a scalar quantity?
a) Speed b) Velocity c) Displacement d) Acceleration

4. A force of 1N is:
a) 1 kg/s b) 1 kg · m/s c) 1 kg · m/s^2 d) 1 kg · m^2/s

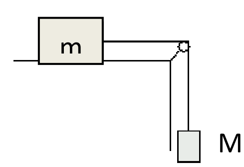
5. In which figure of the following the **Y- Component** of the net forces is Zero :



6. A block of mass m is connected to a block of mass M as shown , the normal force on block m is :

a) F_N = mg –T b) F_N = Mg – T

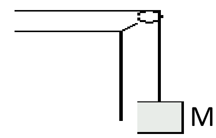
c) F_N = mg d) F_N = Mg



7. In the diagram, if we cut the cord, the acceleration of mass M is :

a) a = zero   b) a = - 9.8 m/s^2

c) a = 4.9 m/s^2 d) a = 735 m/s^2

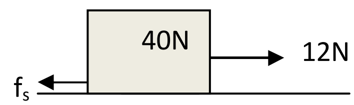


8. The coefficient of static friction μ_s = 0.4 between a 5 kg block and horizontal surface. The maximum horizontal force that can be applied to the block before it slips is:

a) 10 N   b) 19.6 N   c) 5.5 N   d) 8.7 N

9. A 40-N box rests on a rough horizontal floor. A 12 N horizontal force is then applied to it but the box does not move. What is the magnitude of the frictional force on the box?

a) 28N   b) 52N
c) 3.3N   d) 12N



10. The two physical quantities measured in the same units are;

a) velocity and acceleration   b) weight and force
c) mass and weight   d) force and mass

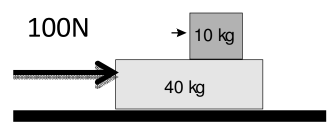
11. An 800 N person is standing in an elevator. If the normal force on the person is 600 N, the person is;

a) at rest   b) accelerating upward   c) accelerating downward
d) moving up at a constant speed

12. From the diagram; the acceleration of the two blocks is;

a) 1 m/s^2 b) 2 m/s^2

c) 30 m/s^2 d) 50 m/s^2

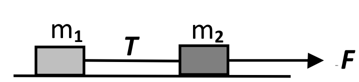


13. If the position of an object changes from $\vec{r}_1 = -2\hat{i} + 3\hat{j}$ to $\vec{r}_2 = \hat{i} - 2\hat{j}$, the displacement is:

a) $\Delta\vec{r} = 3\hat{i} + 5\hat{j}$ b) $\Delta\vec{r} = -\hat{\imath} - 5\hat{\jmath}$ c) $\Delta\vec{r} = -3\hat{i} - 5\hat{j}$ d) $\Delta\vec{r} = 3\hat{i} - 5\hat{j}$

14. Two masses m_1=2 kg, m_2= 4 kg situated on a frictionless horizontal surface are connected by a string. A force F = 12 N is exerted on m_2 as shown in fig. The acceleration of the system is

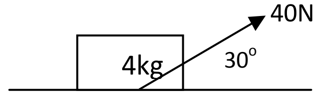
a) 4 m/s^2 b) 3 m/s^2
c) 2 m/s^2 d) 1 m/s^2



15. The position of a particle is given by $\vec{r}(t) = 25t\hat{\imath} + 4\,t^2\hat{\jmath}$, the instantaneous ***acceleration*** at t = 1 s is:

a) $(25\hat{\imath} + 8\hat{\jmath})$ m/s^2 b) $(25\hat{\imath} + 8t\hat{\jmath})$ m/s^2 c) 8 $\hat{\jmath}$ m/s^2 d) 2 m/s^2

16. A box, has mass of 4 kg, is pulled over a frictionless floor with a force of magnitude 40 N making an angle of 30^o above the horizontal. The normal force is:
a) 39.2 N b) 59.2 N
c) 19.2 N d) 40 N



17. If the net forces applied to a 5.0 kg box is 10 N, then the magnitude of the acceleration of the box is:
a) 0.50 m/s^2 b) 2.0 m/s^2 c) 2.8 m/s^2 d) 10 m/s^2

18. The angle that gives the maximum range for a projectile is:
a) $\theta=40^o$ b) $\theta=44^o$ c) $\theta=90^o$ d) $\theta=45^o$

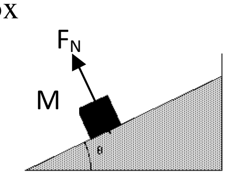
19. A 400 N steel ball is suspended by a light rope from the ceiling. The tension in the rope is:
a) 400N b) 800N c) zero d) 200N

20. Which law says that force is equal to mass times acceleration (F=MA)?
a) Newton's first law of motion b) Newton's third law of motion
c) Newton's second law of motion d) none

21. A particle's displacement is given by $r_x= 4t^2+2$ and $r_y= 2t^3$. The velocity components are:
a) $v_x=8t$, $v_y= 6t^2$ b) $v_x=-8t$, $v_y= 6t$
c) $v_x=8t+2$, $v_y= 6t^2$ d) $v_x=4t$, $v_y= 0$

22. As in Newton's second law, acceleration is always in the direction:
a) of the displacement b) of the final velocity
c) of the initial velocity d) of the net force

23. From the diagram; the magnitude of the normal force F_N acting on the box
a) Mg b) Mg cosθ
c) Mg sinθ d) M g tanθ



24. A car travels east at constant velocity. The net force on the car is;
a) east b) west c) up d) zero

25. The gravitational force of earth acting on a 1 kg is
a) 8.9N b) 9.8N c) 980N d) 1N

26. An 80 kg man stands on a scale in an elevator cab, if the cab accelerate upward with 1.2 m/s^2, the normal force (F_N) is;
a) 80 N b) 880 N c) zero N d) 680 N

27. Two forces act on a particle that moves with constant velocity, one of the forces is $\vec{F}_1 = 3\hat{i} - 5\hat{j}$ N, what is the other force?

a) $\vec{F}_2 = 3\hat{i} - 5\hat{j}$ b) $\vec{F}_2 = 5\hat{i} - 8\hat{j}$ c) $\vec{F}_2 = -3\hat{i} + 5\hat{j}$ d) $\vec{F}_2 = -5\hat{i} + 8\hat{j}$

28. A 10 N horizontal force pushes a block of weight 50 N to make it move with constant speed, the value of the coefficient of friction μ_k is;

a) 0.2 b) 0.4 c) 0.5 d) 0.10

29. A man of mass 72 kg stands on a scale in an elevator cab. What does the scale read if the cab is not moving?

a) 21 N b) 200 N c) 705.6 N d) 0

30. The y component of a vector **A;** (A_y) is given by:

a) A tan θ b) A sin θ c) A cos θ d) A cot θ

31. A ball in projectile motion at the highest point,

a) $v_y = 0$. and v_x= constant
b) v_y = constant and $v_x = 0$
c) v_y= constant and v_x= constant
d) $v_y = 0$. and $v_x = 0$

32. A girl weighs 489 N on Earth. Her mass is;

a) 489 kg b) 9.8 kg c) 0 kg d) 50 kg

33. In Newton's third law the action and reaction forces are;

a) Both forces are equal and opposite in direction.
b) Both are in the same direction.
c) The action force is greater than the reaction force.
d) The reaction force is greater than the action force.

King Abdulaziz University
Faculty of Sciences
Physics Department

Second Exam - Phys 110

First Term
1432-1433 H

Date: 10/ 1/ 1433H

A

Name: **ID No:** **Section:**

CHOOSE THE CORRECT ANSWER

1. A girl of mass 50 kg standing in a stationary elevator, her **weight** is:

   a) 490 N **b)** 550 N **c)** 245 N **d)** 392 N

2. Three forces act on a 2 kg object give it an acceleration $\vec{a} = -8\hat{i} + 6\hat{j}$. if $\vec{F}_1 = 30\hat{i} + 16\hat{j}$ and $\vec{F}_2 = -12\hat{i} + 8\hat{j}$ the **third force** is

   a) $\vec{F}_3 = 34\hat{i} + 12\hat{j}$
   b) $\vec{F}_3 = -34\hat{i} - 12\hat{j}$
   c) $\vec{F}_3 = -30\hat{i} - 6\hat{j}$
   d) $\vec{F}_3 = 8\hat{i} - 16\hat{j}$

3. A particle in uniform circular motion of radius r = 2m moved one period. **The distance that the particle travelled** in meters is:

   a) 4π **b)** 2π **c)** π **d)** 3π

4. A particle is said to be in uniform circular motion if

   a) its velocity has a constant magnitude
   b) its velocity has a constant direction
   c) its velocity is directed towards the center
   d) its velocity equals zero

5. 10.3 N is **equal to**

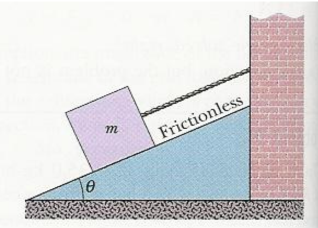
   a) $10.3\frac{kg.m}{s^2}$ **b)** $10.3\frac{kg.m^2}{s^2}$ **c)** $10.3\frac{kg^2.m^2}{s^2}$ **d)** $10.3\frac{kg.m}{s}$

6. At the maximum height of a projectile, **what of the following is correct**?

a) Its velocity is zero
b) Its y-component velocity is zero
c) Its x-component velocity is zero
d) Its acceleration is zero

Use the following to answer questions 7-9:

In the figure, a cord holds stationary a block of mass m = 8.5 kg on a frictionless plane that is inclined at an angle $\theta = 30^0$.



7. The **tension in the cord T equals:**

a) 72.14 N b) 83.3 N c) 53.14 N d) 41.65 N

8. The **normal Force F_N** acting on the block is

a) 53.14 N b) 41.65 N c) 83.3 N d) 72.14 N

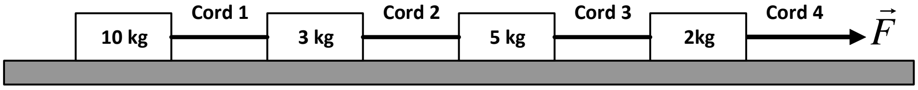
9. If the cord is cut, the magnitude of the **acceleration** of the block is

a) zero b) 4.9 m/s^2 c) 6 m/s^2 d) 4 m/s^2

10. A bag rests on a table, exerting a downward force on the table. The **reaction to this force is:**

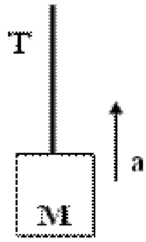
a) The force of Earth on the bag
b) The force of the table on the bag
c) The force of the Earth on the table
d) The force of the bag on Earth

11. The figure shows a train of four blocks being pulled across a frictionless floor by force $\vec{F} = 60N$, what is the **magnitude** of the system's **acceleration?**



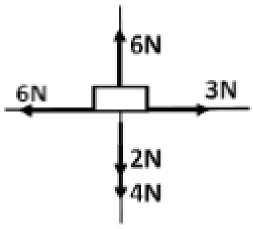
a) 3 m/s^2 **b)** 6 m/s^2 **c)** 12 m/s^2 **d)** 20 m/s^2

12. The cable in the figure is raising a box of mass M = 250 kg with an upward acceleration of 4 m/s^2. **The tension T** in the cable is



a) 863 N **b)** 1725 N **c)** 3450 N **d)** 6900

13. In the figure the **net force** on the block is:



a) 1 N -right **b)** 6 N -up **c)** 3 N -left **d)** 4 N -down

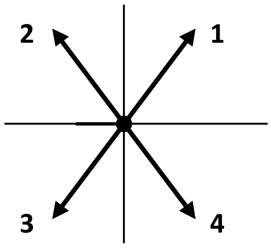
14. Ignoring air resistance, the **acceleration** of any projectile along the x-direction a_x in (SI units) is

a) 9.8 m/s^2 **b)** zero **c)** not constant **d)** less than zero

15. Three forces $\vec{F}_1 = 3\hat{i} - 4\hat{j}$, $\vec{F}_2 = -3\hat{i} + 4\hat{j}$ and $\vec{F}_3 = -6\hat{j}$ acting on a body, **the value of $F_{net,x}$** and **$F_{net,y}$** are:

a) $F_{net,x}$= 6 N and $F_{net,y}$ = -8 N
b) $F_{net,x}$= -6 N and $F_{net,y}$ = 8 N
c) $F_{net,x}$= 0 and $F_{net,y}$ = -6 N
d) $F_{net,x}$= 9 N and $F_{net,y}$ = 16 N

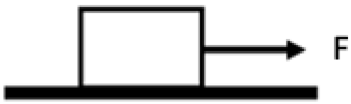
16. Two forces $\vec{F}_1 = 3\hat{i} - 4\hat{j}$ and $\vec{F}_2 = -3\hat{i} + 4\hat{j}$ acting on a body, from the free body diagram the vectors that represent $\vec{F}_1$ and $\vec{F}_2$ are



a) $\vec{F}_1$ is vector **1** , $\vec{F}_2$ is vector **3**
c) $\vec{F}_1$ is vector **3** , $\vec{F}_2$ is vector **1**
b) $\vec{F}_1$ is vector **2** , $\vec{F}_2$ is vector **4**
d) $\vec{F}_1$ is vector **4** , $\vec{F}_2$ is vector **2**

Use the following to answer questions 17-20:

A block lies on a floor as shown in the figure



17. The **magnitude of the frictional force** on it from the floor when **F = 0**

a) 0 **b)** 5 N **c)** 20 N **d)** 8 N

18. When F pulls the block to the right with an acceleration a_x , **The coefficient of Kinetic friction** μ_K is:

a) $\mu_k = \dfrac{F - ma_x}{F_N}$ **b)** $\mu_k = \dfrac{F_N}{F - ma_x}$ **c)** $\mu_k = \dfrac{ma_x}{F_N}$ **d)** $\mu_k = \dfrac{ma_x - F}{F_N}$

19. The **magnitude of the frictional force** on it from the floor when **F = 8 N** ,but the block does not move

a) 0 **b)** 5 N **c)** 20 N **d)** 8 N

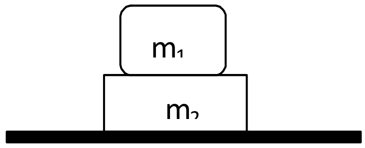
20. If the maximum static frictional force $f_{s,max}$= 20 N ,**the block will move to the right when F is equal to**

a) 21 N **b)** 15 N **c)** 19 N **d)** 12 N

21. A car moves in a circular road of radius r = 7.6 m with a speed 96.6 km/h, the car's **acceleration** is:

a) 18.4×10^3 km/h^2
b) 12.3×10^5 km/h^2
c) 20.7×10^3 km/h^2
d) 15.8×10^2 km/h^2

22. Two boxes m_1=10 kg and m_2=15 kg, **the gravitational force (Fg) on m_2** is



a) 25 N **b)** 245 N **c)** 2450 N **d)** 5 N

23. The position vector of a moving car in meters is: $\vec{r} = (3t^3)\hat{i} + (4t^2 + 3)\hat{j}$, its **acceleration** at **t = 1** s is:

a) $\vec{a} = 18\hat{i} + 8\hat{j}$ **b)** $\vec{a} = 8\hat{i} + 18\hat{j}$ **c)** $\vec{a} = 9\hat{i} + 18\hat{j}$ **d)** $\vec{a} = 9\hat{i} + 8\hat{j}$

24. The position of a moving particle is $\vec{r} = \hat{i} + 4t^2\ \hat{j} + t\ \hat{k}$, its **velocity** as a function of time is;

a) $\vec{v} = 8\hat{j}$ **b)** $\vec{v} = 8t\ \hat{j} + \hat{k}$ **c)** $\vec{v} = \hat{i} + 8t\ \hat{j} + \hat{k}$ **d)** $\vec{v} = 8t\ \hat{j}$

25. According to Newton's second law, the **force and acceleration** are:

a) in the opposite direction.
b) in the same direction.
c) perpendicular to each other.
d) scalar quantities.

26. The position of a particle was initially at $\vec{r} = 5\hat{i} - 6\hat{j} + 2\hat{k}$ and later at $\vec{r} = -2\hat{i} + 6\hat{j} + 2\hat{k}$. The particle's **displacement vector** is:

a) $\Delta\vec{r} = -7\hat{i} + 12\hat{j}$
b) $\Delta\vec{r} = 3\hat{i} + 4\hat{j}$
c) $\Delta\vec{r} = 7\hat{i} - 12\hat{j}$
d) $\Delta\vec{r} = 3\hat{i} + 12\hat{j} + 4\hat{k}$

27. A rabbit runs across a field. The coordinates of the rabbits position as a function of time are given by: $x = -2t^2 + 10t + 30$, and $y = t^2 - 5t + 10$ **at t = 10 s** the **position vector** $\vec{r}$ is:

a) $\vec{r} = 70\hat{i} - 60\hat{j}$ **c)** $\vec{r} = -60\hat{i} + 70\hat{j}$

b) $\vec{r} = 60\hat{i} - 70\hat{j}$ **d)** $\vec{r} = -70\hat{i} + 60\hat{j}$

Use the following to answer questions 28-30:

A ball rolls horizontally off the top of a building with a speed of 30 m/s. If the ball landed on the ground in a time t = 3.03 s

28. The **height of the building** from the ground is

a) 45 m **b)** 14.8 m **c)** 90 m **d)** 22 m

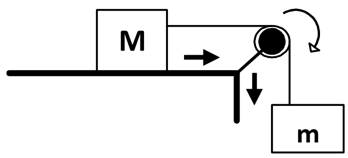
29. At what **horizontal distance** from the rolling point does the projectile strikes the ground

a) 9.9 m **b)** 90.9 m **c)** 0.9 m **d)** 99 m

30. What is the magnitude of **the vertical component of its velocity** as it strikes the ground

a) 2.9 m/s **b)** 0.31 m/s **c)** 3.2 m/s **d)** 29.7 m/s

31. A block of mass M is connected to a block of mass m as shown. The **normal force on block M** is:



a) F_N = M g **b)** F_N = M g - T **c)** F_N = m g - T **d)** F_N = m g

32. A particle moves from $\vec{r}_1 = (-10m)\hat{k}$ to $\vec{r}_2 = (24m)\hat{i}$ in 2 s. Its **average velocity** is:

a) $\vec{v}_{avg} = \left(24\frac{m}{s}\right)\hat{i} + \left(10\frac{m}{s}\right)\hat{k}$

b) $\vec{v}_{avg} = \left(12\frac{m}{s}\right)\hat{i} + \left(5\frac{m}{s}\right)\hat{k}$

c) $\vec{v}_{avg} = \left(-10\frac{m}{s}\right)\hat{i} + \left(24\frac{m}{s}\right)\hat{k}$

d) $\vec{v}_{avg} = \left(-5\frac{m}{s}\right)\hat{i} + \left(12\frac{m}{s}\right)\hat{k}$

33. A force F is applied to an object of mass m_1= 45 kg produces an acceleration of 2 m/s^2. The same force is applied to a second object of mass m_2 produces an acceleration of 1.5 m/s^2. **The value of m_2** is

a) 45 kg **b)** 60 kg **c)** 30 kg **d)** 67 kg

Answer Key

1. a
2. b
3. a
4. a
5. a
6. b
7. d
8. d
9. b
10. b
11. a
12. c
13. c
14. b
15. c
16. d
17. a
18. a
19. d
20. a
21. b
22. b
23. a
24. b
25. b
26. a
27. d
28. a
29. b
30. d
31. a
32. b
33. b

A

جامعة الملك عبد العزيز/ كلية العلوم/ قسم الفيزياء
اختبار الدوري الثاني للفيزياء 110 -- زمن الأختبار 90 دقيقة
1431/6/4هـ

أسم الطالب:	الرقم الجامعي:	الشعبة:

Q1-1. If the position of an object changes from $\vec{r}_1 = -2\hat{i} + 3\hat{j}$ to $\vec{r}_2 = \hat{i} - 2\hat{j}$, the displacement is:
A) $\Delta\vec{r} = 3\hat{i} + 5\hat{j}$ B) $\Delta\vec{r} = -\hat{\imath} - 5\hat{\jmath}$ C) $\Delta\vec{r} = -3\hat{i} - 5\hat{j}$ D) $\Delta\vec{r} = 3\hat{i} - 5\hat{j}$

Q2-A projectile is launched at an angle of 30^0 to the horizontal with a speed of 100 *m/s.* The maximum height of the projectile is :
A) 100m B) 127.55 m C) 250 m D) 44.0 m

Q3- Referring to Q2, the range of the projectile is:
A) 88.37 m B) 383 m C)8.8 m D) 883.69 m

Q4- Referring to Q2, its time of flight is:
A) 10.2 s B) 25.2 s C) 6.04 s D) 5.02 s

Q5. A man throws a stone horizontally off a cliff that is 40 m above the sea level. If the velocity of the stone is 30 m/s, the time it takes to hit the sea level is:
A) 3.49 s B) 4 s C) 2.85 s D) 6 s

Q6- An object was fired with an angle 30^0 with the horizontal with a speed of 80 m/s . The vertical component of the velocity is:
A) 40 m/s B) 4.0 m/s C) 15 m/s D) 35 m/s

Q7- An object is in equilibrium, the acceleration of the object is:
A) 9.8 m/s^2 B) -9.8 m/s^2 C) Zero D) Constant

Q8- If a body sliding down on an incline smooth plane. The force causing the body to slide is:
A) mg sin θ B) mg cos θ C) mg tan θ D) mg

Q9- An object weighing 600 N is pulled up a frictionless inclined plan of an angle of 30^0at a constant velocity. The force causing the motion is:
A) 200 N B) 245 N C) 520 N D) 300 N

Q10- A body moves in a circular orbit with constant velocity. Its acceleration is:
A) zero B) in the direction of the tangent
C) toward the center D) outward, of the center

Q11- A car travels in a circular track of 200 m in circumference at a constant velocity of 18 m/s . The radial acceleration of the car is:
A) 8.37 m/s^2 B) 12.8 m/s^2 C) 7.31 m/s^2 D) 10.2 m/s^2

Q.12 In figure(1) a block of mass m =1 kg hangs from the ceiling by means of two cords. The angle between each cord and the ceiling is 60^0. The tension in the right cord is:
A) 56.6 N B) 28.65 N C)20.63 N D)5.66N

A

A) 3.26 B) 1.25 C) 1.09 D) 1.9

Q14- A force of 50 N pulls a 5 kg crate up an inclined rough surface with angle30°. If the coefficient of friction $\mu_k = 0.5$, the acceleration of the crate is:

A) 0.6 m/s^2 B) 1.2 m/s^2 C) 0.86 m/s^2 D) 1.39 m/s^2

Q15- An object weighing 24 N is placed on a 30^0 slope as shown in figure (3). The normal force is:

A) 20.78 N B) 17.02N C) 23.02 N D) 24.78 N

Q16- Referring to Q15, the force preventing the object from moving is:

A) 8.38 N B) 12 N C) 10 N D) Zero

Q17- Weight of 50 N is supported by a rod and a cable as shown in figure (4). The tension (T_1) is:

A) 45.77 N B) 138.59 N C) 77.78 N D) 87.77 N

Q18- The coefficient of static friction μ_s of inclined plane depends on:

A) angle B) mass C)velocity D) acceleration

Q19- A projectile is fired with a velocity of 80 m/s at an angle of θ to the horizontal. If the vertical component of the initial velocity was 60 m/s, the angle θ is:

A) 48.6^0 B) 54.5^0 C) 32.23^0 D) 20^0

Q20- A bullet is fired horizontally from the roof of a building with a velocity of 850 m/s. Its height in 3.0 s is:

A) 29.4 m B) - 44.1 m C) -100 m D) 19.60 m

Q21- Referring to Q21, If the building is 100 m height, the time for the bullet to reach the ground is:

A) 3.13 s B) 81.32 s C) 4.52 s D) 20.41 s

Q22- A ball kicked with a velocity of 15 m/s and with an angle of θ from the horizontal. The maximum range is:

A) 25.85 m B) 40.82m C) 50.20 m D) 22.96 m

Q23- A man weighing 800 N is standing in an elevator moving with a constant velocity. The force exerted by the man on the floor of the elevator is:

A) less than 80 N B) 800 N C)between 80 and 800 N D) more than 800 N

Q24- A 25 kg box is pushed across a frictionless horizontal floor with a force of 30 N, directed 20° below the horizontal. The acceleration of the box is:

A) 1.13 m/s^2 B)1 .5 m/s^2 C) 2.82 m/s^2 D) 0.75 m/s^2

Q25- Referring to Q24, the normal force acting on the ground by the box is:

A) 108.26 N B) 25 N C) 255.26 N D) 125 N

Q26- A car moves in a circular road of radius 120 m. If μ_s= 0.5, then the maximum speed of the car without sliding is:

A)24.25 m/s B) 22.1m/s C)19.79 m/s D) 17.15 m/s

Q27- A car of mass 1050 kg is traveling at 72 km/h on a curved road with radius of 60 m. The force of friction needed to prevent the car from sliding is:

A) 6800 N B) 5124.1 N C) 7000 N D) 6600 N

A

Q28- A block of mass 80 kg is moving along a rough horizontal surface with a coefficient of kinetic friction equal 0.2. If its initial speed is14 m/s, the block will stop after covering a distance:

A) 57.39 m B) 50.0 m C) 106.3 m D) 33.33 m

Q29- Two masses m_1=2 kg, m_2 = 4 kg situated on a frictionless horizontal surface are connected by a string. A force F = 12 N is exerted on m_2 as shown in fig. (5). The acceleration of the system is

A) 4 m/s^2 **B)** 3 m/s^2 C) 2 m/s^2 D) 1 m/s^2

Q 30- A 25 kg block moves with an initial velocity of 25 m/s on a frictionless surface. The block came to rest by the effect of an external force F=-235i N. The distance the block moved is:

A) 76.1 m B) 266.66 m C) 33.24 m D) 14.6 m

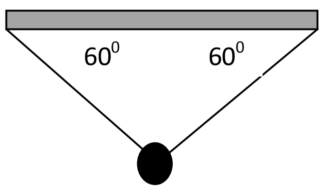


Fig (1)

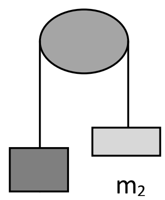


Fig. 2

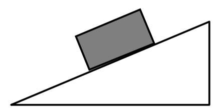


Fig. (3)

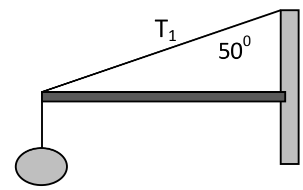


Fig. (4)

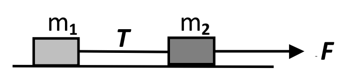


Fig. 5

Referring	العودة الى	Tension	الشد	Ceiling	سقف
Skier	متزلج على الثلج	Launched	اطلقت	Hang	معلق
Vertically	عامودي	Elevator	مصعد	Prevent	يمنع
Circumference	محيط الدائرة	Circular	دائري	Tangent	مماس
Crate	صندوق	Rough	خشن	Cliff	جرف بحري
Radius	نصف قطر	Coefficient	معامل	Friction	الاحتكاك
Sliding	ينزلق	Static	السكوني	causing	المسبب للحركة
Radial	دائري	Kinetic	الحركي	equilibrium	متزن
Support	يدعم	Rod	قضيب	Situated	موضوع على

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الدوري الثاني/ زمن الاختبار ساعة و نصف 1431/1/14هـ

1- In the projectile motion, the y-component of the velocity at the maximum height is:
(a)Zero (b) constant (c) the maximum value (d) Negative

2- In the projectile motion, the x-component of the velocity is:
(a) $v_0 \sin\theta$ (b) $-v_0 \sin\theta$ (c) $v_0 \cos\theta$ (d) $-v_0 \tan\theta$

3- In the projectile motion, the angle for the maximum range is:
(a)90^0 (b) 75^0 (c) 180^0 (d) 45^0

4- In the projectile motion, the maximum range is:
(a) $\frac{v_0^2}{g}(\cos 2\theta)$ (b) $\frac{v_0^2}{g}$ (c) $\frac{v_0}{g}$ (d) $\frac{v_0^2}{g}(\cos\theta)^2$

5-A body move with a velocity $\vec{v} = 2\hat{i} - 3\hat{j}\ \ m/s$ and acceleration $\vec{a} = 2\hat{i} + \hat{j}\ \ m/s^2$.The velocity after 2s (in SI unit) is:
(a) $\vec{v} = 6\hat{i} - \hat{j}$ (b) $\vec{v} = 6\hat{i} + \hat{j}$ (c) $\vec{v} = -6\hat{i} - \hat{j}$ (d) $\vec{v} = +6\hat{i} + \hat{j}$

6-A ball is thrown with a velocity of 15 m/s at an angle of 30^0. The y-component of the velocity is :
(a)30 m/s (b) 7.5 m/s (c)15 m/s (d) 13m/s

7- In question (6), the x-component of the velocity is:
(a)30 m/s (b) 7.5 m/s (c)15 m/s (d) 13m/s

8- In question (6), the maximum height is :
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9- In question (6), the range is:
(a) 19.88 m (b)198.8 m (c) 1988 m (d) 1.988 m

10- In question (6), the time of flight is:
(a)0.015 s (b)0.15 s (c) 15 s (d) 1.5 s

11- A boy hold a rope of 30 cm long, from one end and the other end a stone, he rotate the stone in a horizontal circle with speed of 3 m/s. The acceleration of the stone is:
(a) 0.03 m/s^2 (b) 30 m/s^2 (c)3.0 m/s^2 (d) 300 m/s^2

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The value of mass is:
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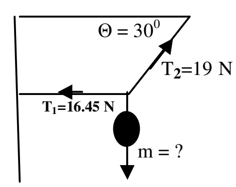
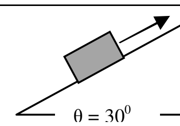


14- The force needed to keep the mass (m=20 kg) at rest , as shown in the figure, the force is:
(a) 98 N (b)980 N (c)9.8 N (d)0.98 N



15- In question (14), the normal force on the body is:
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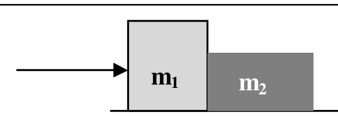
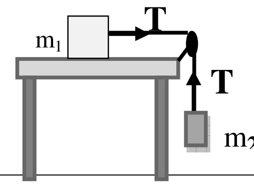
16- From the figure m_1=20kg and m_2 =10 kg. The force acting to accelerate the two bodies by 2 m/s^2, the force is:
(a) 60 N (b) 6.0 N (c)600 N (d)0.06 N



17- A racing car of mass 600 kg moves is decelerated by 4.5 m/s^2 using the brakes, the frictional force is:
(a) 225 N (b)0.225 N (c)2700 N (d) 2.25 N

18- In the figure shown, if m_1=5kg and the system move with acceleration of 2 m/s^2 and the tension in the rope was 10 N. The value of m_2 is:

(a)2.5 kg (b)1.28 kg (c)8.0 kg (d)50 kg

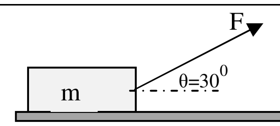


19- In question (18), the normal force on the m_1 is:

(a) 0.49 N (b) 490 N (c) 4.9 N (d) 49 N

20- A block of mass 10 kg, was pulled by a force 30 N, the block was going with a constant speed (as shown in the figure) on a rough surface. The friction force is:

(a)25.98 N (b)259.8 N (c) 2.598 N (d) 0.2598N



21- A space satellite moves in a circular orbit around the earth, at altitude of 530 km and with speed of 8.2 km/s. The acceleration of the satellite is: (the earth radius 6.37×10^6m)

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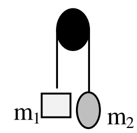
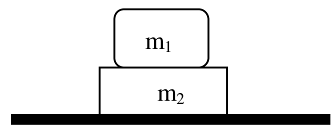
22- In the figure shown two bodies are hung by a rope over a frictionless pulley. If m_1=3 kg and m_2= 1.5 kg. the acceleration of the two bodes is:

(a) 2.7 m/s^2 (b) 0.327 m/s^2 (c) 7.27 m/s^2 (d)3.27 m/s^2



23- Two boxes m_1=10 kg and m_2=15 kg, the gravitational force on m_2 is

(a)25 N (b)245 N (c)2450 N (d)5 N



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27- A box stands on rough incline plane of 30^0, when just about to move, the static coefficient of friction is:

(a) 1.00 (b) 5.8 (c) Zero (c) 0.58

28- A box stands on rough incline plane of θ, the box is moving with a constant velocity, the frictional force is:

(a) mg sin θ (b) mg tan θ (c) mg cos θ (d) mg

29- A box of mass 5 kg is sliding down with a constant velocity on a rough incline surface at an angle 20^0 with the horizontal. The kinetic friction coefficient is:

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30- A car was going in a circular road with a radius of 50m with constant velocity of 25 m/s, the static friction coefficient is:

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Referring	العودة الى	Initial	ابتدائي	Hitting	اصطدم
Thrown	قذف	altitude	إرتفاع عن سطح الارض	Magnitude	القيمة العددية
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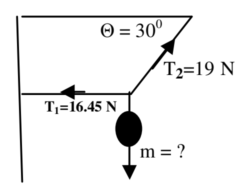

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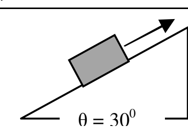

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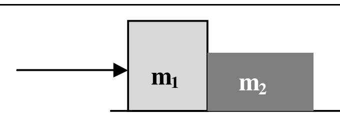

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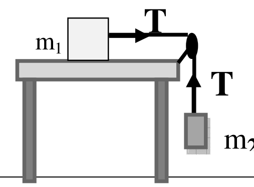

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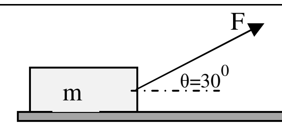

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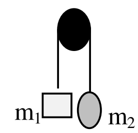

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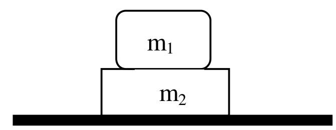

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King Abdulaziz University
Faculty of Sciences
Physics Department

Second Exam - Phys 110

Second Term
1432-1433 H

Date: 2 / 6 / 1433H

A

Name: **ID No:** **Section:**

CHOOSE THE CORRECT ANSWER

1. A projectile is fired from the ground level with an initial velocity 283 m/s with an angle of 60^0 with the horizontal. **The maximum height** the projectile reached

   A) 8957.4 m **B)** 3064.6 m **C)** 2245.9 m **D)** 1598.6 m

2. A car goes from $\vec{v}_i = 2\hat{i} + 4\hat{j}$ to $\vec{v}_f = 3\hat{i} + 9\hat{j}$ in 5 s. **The average acceleration** of the car

   A) $\vec{a}_{avg} = \hat{i} - 6\hat{j}$ **B)** $\vec{a}_{avg} = 0.2\hat{i} + \hat{j}$ **C)** $\vec{a}_{avg} = 3\hat{i}$ **D)** $\vec{a}_{avg} = \hat{i} - \hat{j}$

3. An objects move at a constant speed of 5 m/s on a circular path of radius 10 m. The **period** in seconds is:

   A) $3\pi^3$ **B)** 4π **C)** 20 **D)** π

4. The **horizontal range** is the horizontal distance the projectile has traveled when it returns to

   A) its maximum height **B)** its initial height **C)** the origin **D)** the start point

Use the following to answer questions 5-6:

The coordinates of a particle's position vector as a function of time are given by $x = 5t^2 + 16$**, and** $y = -t^3 + 5$**, with** x **and** y **in meters and** t **in seconds:**

5. The **velocity** as a function of time is:

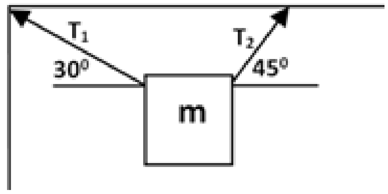
   A) $10t\ \hat{i} - 3t^2\ \hat{j}$ **B)** $10\ \hat{i} - 6t^2\ \hat{j}$ **C)** $5t\ \hat{i} - 6\ \hat{j}$ **D)** $t\ \hat{i} + 6t\ \hat{j}$

6. The position vector $\vec{r}$ at t =2 s is

A) $26\,\hat{i}\ -7\ \hat{j}$ **B)** $36\,\hat{i}\ -3\ \hat{j}$ **C)** $81\,\hat{i}\ +3\ \hat{j}$ **D)** $15\,\hat{i}\ -5\ \hat{j}$

Use the following to answer questions 7-9:

A block of mass m = 5 kg is hanging by two ropes as shown in the figure:



7. From the figure, $\mathbf{F}_{\mathbf{net,x}}$ on the block is:

A) T_1 cos 45 -T_2 cos30 = 0

B) -T_1 cos 30 + T_2 cos45 = 0

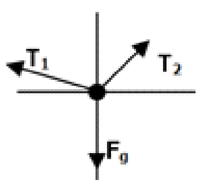
C) T_1 cos45– T_2 cos30 = ma_x

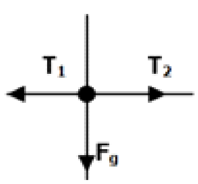
D) T_1 cos 30 – T_2 cos45= ma_x

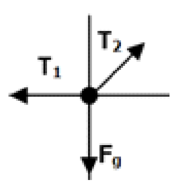
8. The **magnitude of weight (W)** in Newtons is equal to:

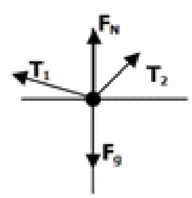
A) 9.8 N **B)** - 9.8 N **C)** - 49 N **D)** 49 N

9. The **free body diagram** representing the forces on m is:

A) 

B) 

C) 

D) 

10. The **coefficient of static friction** (μ_s):

A) has a magnitude of exactly 1

B) is dimensionless

C) is in the direction of the normal force

D) is in the direction of motion

11. In the projectile motion ,the vertical component of the velocity at any time in the y-direction is equal to

A) $v_y = v_o(\cos\theta)t$ **B)** $v_y = v_o(\sin\theta)t$ **C)** $v_y = v_o\sin\theta$ - g t **D)** $v_y = v_o\sin\theta$ +g t

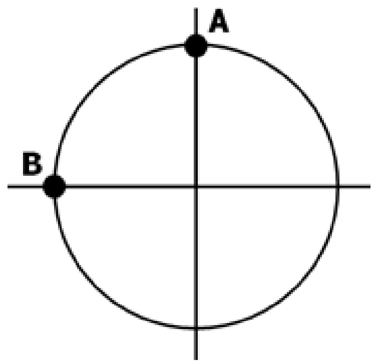
12. Two forces $\vec{F}_1 = 7\hat{i} - 5\hat{j}$ and $\vec{F}_2 = -3\hat{i} + 4\hat{j}$ acting on a body that can move over frictionless floor, the **magnitude of the net force** is :

A) 7.14 N **B)** 4.12 N **C)** 13.2 N **D)** 10 N

13. A 0.15 kg particle moves along an $x-$axis with acceleration $a(t) = 8 - 18t$ with a in m/s^2 and t in seconds. The **net force** in Newtons acting on the particle at t = 3.40s is

A) -7.98 $\hat{i}$ **B)** 12.4 $\hat{i}$ **C)** -5.21 $\hat{i}$ **D)** 8.52 $\hat{i}$

14. In the figure, a car moves at constant speed around the circle path in a horizontal xy plane, with the center at the origin. When it is at point A its coordinates are $x = 0$, $y = 3$m and its velocity is (6 m/s) $\hat{i}$. When it is **at point B its velocity and acceleration** are:



A) $\vec{v} = +6\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively

B) $\vec{v} = -6\hat{j}$ and $\vec{a} = +12\hat{j}$, respectively

C) $\vec{v} = +6\hat{i}$ and $\vec{a} = -12\hat{i}$, respectively

D) $\vec{v} = +4\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively

15. A 12 kg object is moving with a net force of 7 N north on it. The object having an **acceleration** of:

A) 0.58 m/s^2 north **B)** 1.71 m/s^2 south **C)** 1.71 m/s^2 north **D)** 0.58 m/s^2 south

16. The position vector for an airplane initially is $\vec{r} = 5\hat{i} - 6\hat{j} + 2\hat{k}$ and then 10s later is $\vec{r} = -2\hat{i} + 8\hat{j} - 2\hat{k}$, all in meters, its **average velocity ($\vec{v}_{avg}$)** in unit vector notation is

A) $-0.3\,\hat{i} - 1.4\,\hat{j} + 0.6\,\hat{k}$

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

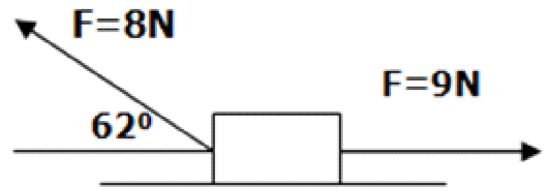
C) $4.7\,\hat{i} - 1.4\,\hat{j} + 0.9\,\hat{k}$

D) $-5\,\hat{i} + 2.4\,\hat{j} + 0.4\,\hat{k}$

17. A 980 kg car is traveling at constant speed 28 m/s around circular track of radius R = 230 m. The **magnitude of the frictional force** on the car is

A) 4141.5 N **B)** 1245.7 N **C)** 3340.5 N **D)** 6241.6 N

18. From the figure, the **acceleration of the block** of mass 3 kg moving along an $x-$axis on a frictionless table is:



A) 2.45 m/s² **B)** 1.75 m/s² **C)** - 2.3 m/s² **D)** 3 m/s²

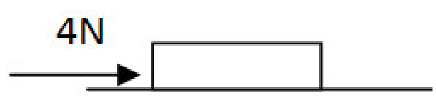
19. A particle is projected with an initial velocity $\vec{v}_0 = 5.0\hat{i} + 4.0\hat{j}$ in meters per second. The **horizontal component of its velocity at the maximum height** is:

A) 7 m/s **B)** 12 m/s **C)** 2 m/s **D)** 5 m/s

20. A bomb (قنبلة) is fired from a cannon and has initial horizontal and vertical components of velocity equal to 23 m/s and 54 m/s, respectively .The **angle** the bomb fired with the horizontal is

A) 49^0 **B)** 67^0 **C)** 85^0 **D)** 33^0

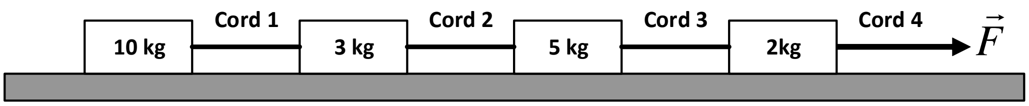
21. A horizontal force of 4N pushes a block of weight 10N to make it move with constant velocity, the value of the **coefficient of kinetic friction** (μ_k) is :



A) 0.8 **B)** 0.6 **C)** 0.3 **D)** 0.4

Use the following to answer questions 22-23:

The figure shows a train of four blocks being pulled across a frictionless floor by force $\vec{F}$, with an acceleration equal to 3 m/s²



22. The **magnitude of force** $\vec{F}$ on the four blocks is

A) 40 N **B)** 30 N **C)** 20 N **D)** 60 N

23. The **total mass accelerated to the right by Cord 3** is

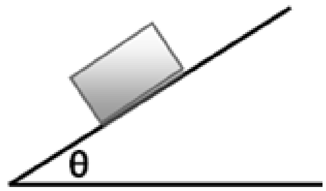
A) 18 kg **B)** 20 kg **C)** 10 kg **D)** 13 kg

24. A man of mass 75 kg stand on an elevator, if the elevator is going downward with acceleration of 1.7 m/s^2, the **normal force** on the man from the elevator is:

A) 523.4 N **B)** 700.5 N **C)** 323.9 N **D)** 607.5 N

Use the following to answer questions 25-26:

In the figure, a block of mass m = 25 kg is sliding down on a frictionless plane inclined at θ = 60^0



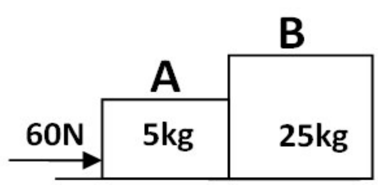
25. The **normal force** ($\vec{F}_N$) on the block is:

A) mg **B)** ma **C)** mg cosθ **D)** mg sinθ

26. The **magnitude of the force** that causes the block sliding down is

A) 212.17 N **B)** 150 N **C)** 90.44 N **D)** 311 N

27. In the figure, two blocks slide over a frictionless surface along an $x-$axis with an acceleration equals 2 m/s^2. The force F on block A from block B is:



A) 50 N **B)** 60 N **C)** 57 N **D)** 40 N

28. When a person is standing on a scale in an elevator, the scale reads higher than the normal weight of the person if the elevator is :

A) accelerating upward
B) accelerating downward
C) moving up with constant velocity.
D) stationary

29. A ball is shot at an angle of 25^0 above the horizontal with an initial speed of v_0 . If the range it reaches is 140 m, what its **initial speed**?

A) 80 m/s **B)** 20 m/s **C)** 40 m/s **D)** 42.3 m/s

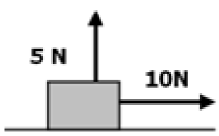
30. The **force that always perpendicular to the surface** is called

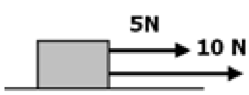
A) Gravitational force **B)** Tension **C)** Friction **D)** Normal force

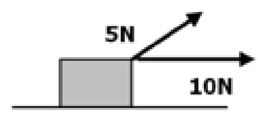
31. Two objects having masses of 1Kg and 2Kg moving around a circle of radius r = 1 m and with v = 1 m/s. Their **accelerations** are related by:

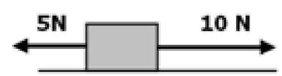
A) $\frac{a_1}{a_2}=\frac{1}{2}$ **B)** $\frac{a_1}{a_2}=2$ **C)** $a_1=a_2$ **D)** $a_1=a_2=0$

32. Two forces, have magnitudes 5 N and 10 N, are applied to an object moving along an $x-$axis. In **which figure** of the following the magnitude of the acceleration of the object is the least ?

A)


B)


C)


D)


33. The coefficient of static friction between a 5 kg block and horizontal surface is 0.4. The **maximum horizontal force** that can be applied to the block before it slips (ينزلق) is:

A) 25.4 N **B)** 19.6 N **C)** 45.8 N **D)** 10.3 N

Answer Key

1. B
2. B
3. B
4. B
5. A
6. B
7. B
8. D
9. A
10. B
11. C
12. B
13. A
14. A
15. A
16. B
17. C
18. B
19. D
20. B
21. D
22. D
23. A
24. D
25. C
26. A
27. A
28. A
29. D
30. D
31. C
32. D
33. B

4. Motion in 2 and 3 dimensions: A. Z. ALZAHRANI

1.

At the maximum height, what of the followings is correct?

Its velocity is zero

Its y-component velocity is zero

Its x-component velocity is zero

Its acceleration is zero

2.

To have the maximum range, a projectile must be launched at an angle of

25

35

45

60

3.

Ignoring air resistance, the acceleration of any projectile along the x-direction is (SI units)

9.8

0

varied from one to another

less than zero

4.

Ignoring air resistance, the acceleration of any projectile along the y-direction is (SI units)

9.8

0

varied from one to another

less than zero

5.

A projectile is fired at an angle of 30 above the horizontal with an initial speed of v. If the maximum range it reaches is 140 m, what its initial speed?

20 m/s

40 m/s

60 m/s

80 m/s

6.

A projectile is fired with an angle Q above the horizontal. It takes 15 s to reach its range of 135 m. What is its speed at the highest point?
9 m/s
10 m/s
11 m/s
12 m/s

7.
A projectile is fired horizontally from a height of 100 m above the ground. If it takes 2 sec to hit the ground, what is its initial speed?
20.2 m/s
30.2 m/s
40.2 m/s
50.2 m/s

8.
A projectile is fired horizontally from a building of height of 100 m above the ground. If it hits the ground at a point 20 m away from the edge of the building, what is its initial speed?
4.4 m/s
6.4 m/s
8.4 m/s
10 m/s

9.
A projectile is fired with initial speed of v at an angle Q above the horizontal. ITwo seconds later, the velocity of the projectile is determined to be v(t)=18.2 i - 11.15 j (m/s). What is its initial speed ?
20 m/s
30 m/s
40 m/s
50 m/s

10.
A projectile is fired with initial speed of v at an angle Q above the horizontal. ITwo seconds later, the velocity of the projectile is determined to be v(t)=18.2 i - 11.15 j (m/s). What is angle Q ?
15
25
35
45

5-6. Force & Motion : A. Z. ALZAHRANI

1.
Force is a scalar quantity. Is it right?
Yes
No

2.
If the body moves with a constant acceleration, the net force is zero. Is it right?
Yes
No

3.
If the body moves with a constant velocity, the net force is zero. Is it right?
Yes
No

4.
Two forces F and P act on a body, the body will move in the direction of the
force F
force P
net force

5.
Static force on a body equals the net force if the body
moves with a constant speed
moves with a constant acceleration
just starts its motion
does not move

6.
The direction of kinetic friction force is always in the
direction of the greater force
direction of the net force
opposite direction of the net force
opposite direction of the normal force

7.

The reaction 'normal' force is always equivalent to the weight of the body. Is it right?
Yes
No

8.
The direction of the acceleration of moving system is in the direction of
its velocity
its net force
its displacement
its weight

9.
If the summation of total forces acting on a body is zero, the body is in
static equilibrium
kinetic equilibrium
both are correct
none is correct

10.
Two blocks of masses M= 40.0 kg and m, are connected by a light string that passes over a massless pulley. If the tension in the string is T = 300 N. Find the value of m. (Ignore friction)
24.8 kg
40 kg
30.5 kg
28.6 kg

11.
A 10 kg box is lowered with a downward acceleration of 1.8 m/s^2 by means of a rope. The tension in the rope is
116 N
18 N
80 N
98 N

12.
Ali (super strong man) is pushing his car (1000 kg) with a uniform acceleration of 0.5 m/s^2 by applying a force F at an angle 20 with the horizontal. if the coefficient of kinetic friction between the tyre and road is 0.65, the magnitude of

F is
980 N
9576 N
12564 N
500 N

13.
A car (1000 kg) is moving in a round-about with a constant speed of 40 km/h. If the radius of the round is 10 m, the force acting on the car is
980 N
12345 N
160000 N
200000 N

14.
A car orbits a circular road of diameter 40 m. If the acceleration is 20 m/s^2, the speed of the car is
28.28 m/s
20 m/s
15 m/s
10 m/s

15.
A car takes 4 min to complete 6 turns around 25-m radius road. The speed of the car is
60 km/hr
34 km/hr
14 km/hr
10 km/hr

16.
The direction of the acceleration due to a circular motion is
towards the centre of the circle
outwards the centre of the circle
tangent to the circle
none

17.
An 8-kg box is pulled over a frictionless floor with a horizontal force F=50 N. If the box starts its motion from the rest, its speed after 2 sec is

8 m/s
12.5 m/s
15.2 m/s
18.6 m/s

18.
An 8-kg box is pulled over a rough floor (kinetic friction coefficient is 0.25) with a horizontal force F=50 N. If the box starts its motion from the rest, its speed after 2 sec is
12.5 m/s
10.3 m/s
9.5 m/s
7.6 m/s

19.
A 5-kg box is pulled up an inclined plane (angle =30) with a horizontal force F=50 N. If the box moves with a constant speed, what is the coefficient of kinetic friction?
0.17
0.27
0.37
0.47

20.
An 80-kg box is affected by a force of 500 N with an angle of 40 with the horizontal. If the box is started its motion from rest and covered 8 m in 2 sec, what is the kinetic friction coefficient?
0.24
0.14
0.34
0.44

1. convert 15.0 in. to meter. 1 in= 2.54 cm

a) 0.37 m　　b) 3.7 m　　c)6.1 m　　d) 0.61m　　e) 0.2.54 m

2. Assuming that the density (mass/ volume) of water is exactly 1 g/cm^3 , express the density of water in kilograms per cubic meter (kg/m^3).

a) 10^6 kg/m^3　　b) 0.001kg/m^3　　c)1000kg/m^3　　d) 100kg/m^3　　e) 2000kg/m^3

3. Suppose that it take 20 h to drain a container of 7200 m^3 of water. What is the '' mass flow rate'' in kilograms per second, of water from t he container?

a) 36 kg/s　　b) 144 kg/s　　c)72 kg/s　　d) 1000kg/s　　e) 100 kg/s

4. the maximum highway speed is 70 mi/h in some places. What is the speed in kilometre per hour ?

a) 50 m/s　　b) 70km/h　　c)110.9km/h　　d) 112.7 km/h　　e) 120 km/ h

5. Aluminum has a density of 2.70 g/cm3, express the mass of Aluminum for a piece of volume 2m^3 In kg.

a) 5400kg　　b) 6000kg　　c)2700kg　　d) 1350kg　　e) 270kg

6. The speed for small racing airplane increase from 35 m s^{-1} to 75 m s^{-1} in 4 s. determine the acceleration of the plane during this interval

a) 10 m/s^2　　b) 40 m/s^2　　c)110 m/s^2　　d) 30 m/s^2　　e) 5 m/s^2

7. An object moving with constant acceleration changes its speed from 30 m/s to 50 m/s in 2.0 s. How far did it move in this time?

a) 40 m　　b) 160 m　　c)50 m　　d) 80m　　e) 200 m

8. A ball thrown straight up takes 2.0 s to reach a height of 40 m. Find Its initial speed

a) 29.8 m/s　　b) 20.2m/s　　c)9.8 m/s　　d) 24.9　　e) 35.7 m

9. A ball is thrown down vertically with an initial speed of 20 m/s from a height of 60 m. Find its speed just before it strikes the ground and

a) 27.9m/s　　b) 0m/s　　c)39.7m/s　　d) 60m/s　　e) 1576 m/s

10. three vectors $\vec{A} = 2\hat{\imath} + 3\hat{\jmath}$ and $\vec{B} = 4\hat{\imath} + 6\hat{\jmath}$ and $\vec{C}$ is unknown , the resultant $\vec{A} + \vec{B} + \vec{C} = 0$, then the vector $\vec{C}$ is

a) $5\hat{\imath} + 6\hat{\jmath}$　　b) $6\hat{\imath} + 9\hat{\jmath}$　　c) $-6\hat{\imath} - 9\hat{\jmath}$　　d) $-9\hat{\jmath}$　　e) 0 $-6\hat{\imath}$

11. referring to question 10 the angle between $\vec{B}$ and the positive x-axis is:

a) 37.5°　　b) 62.7°　　c) 0°　　d) 90°　　e) 56.3°

12. $\vec{A} = 4\hat{\imath} - \hat{\jmath}$ and $\vec{B} = 2\hat{\jmath} + 2\hat{k}$, then $\vec{A} \times \vec{B}$ is

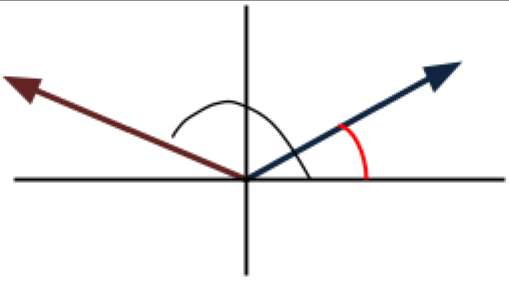
a) 6	b) $-2\hat{\imath} - 8\hat{\jmath} + 8\hat{k}$	c) $8\hat{\imath} - 2\hat{\jmath} + 8\hat{k}$	d) -2	e) $-2\hat{\imath} - 6\hat{\jmath} + 8\hat{k}$

13. referring to question 12 the angle of vector $\bar{A}$ is

a) 45° b) 0° c)14° d) 345.9° e) 59°

14. and

a) $12\hat{i} - 9\hat{j} + 8\hat{k}$ b) $-12\hat{i} - 9\hat{j} - 8\hat{k}$ c) -18 d) $-10\hat{i} + 9\hat{j} - 18\hat{k}$ e) +6



A

B

40

15

0

0

0

15. Find the scalar product of the two vectors in the figure.
The magnitude of the vectors are A= 4.00, and B = 5.00.

a) 5.9 b) -6.8 c)20 d) 5 e) 4

King Abdulaziz University
Faculty of Sciences
Physics Department

Second Exam - Phys 110

Second Term
1432-1433 H

Date: 2 / 6 / 1433H

B

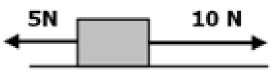
Name: **ID No:** **Section:**

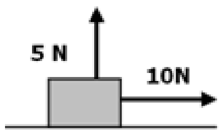
CHOOSE THE CORRECT ANSWER

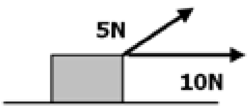
1. In the projectile motion ,the vertical component of the velocity at any time in the y-direction is equal to

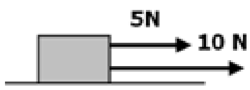
A) $v_y = v_o \sin\theta + g\,t$ **B)** $v_y = v_o \sin\theta - g\,t$ **C)** $v_y = v_o (\cos\theta)t$ **D)** $v_y = v_o (\sin\theta)t$

2. Two forces, have magnitudes 5 N and 10 N, are applied to an object moving along an $x-$axis. In **which figure** of the following the magnitude of the acceleration of the object is the least ?

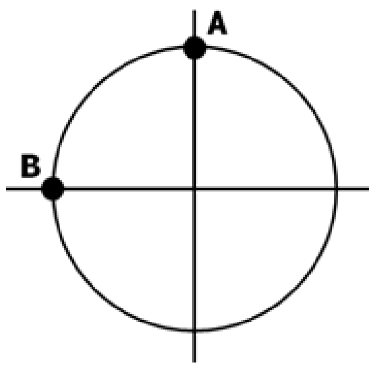
A)


C)


B)


D)


3. In the figure, a car moves at constant speed around the circle path in a horizontal xy plane, with the center at the origin. When it is at point A its coordinates are $x = 0$, $y = 3$m and its velocity is (6 m/s) $\hat{i}$. When it is **at point B its velocity and acceleration** are:



A) $\vec{v} = +4\,\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively
C) $\vec{v} = +6\,\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively
B) $\vec{v} = +6\hat{i}$ and $\vec{a} = -12\hat{i}$, respectively
D) $\vec{v} = -6\,\hat{j}$ and $\vec{a} = +12\,\hat{j}$, respectively

4. A projectile is fired from the ground level with an initial velocity 283 m/s with an angle of 60^0 with the horizontal. **The maximum height** the projectile reached

A) 2245.9 m **B)** 1598.6 m **C)** 3064.6 m **D)** 8957.4 m

5. A 12 kg object is moving with a net force of 7 N north on it. The object having an **acceleration** of:

A) 1.71 m/s^2 south **B)** 0.58 m/s^2 south **C)** 0.58 m/s^2 north **D)** 1.71 m/s^2 north

6. When a person is standing on a scale in an elevator, the scale reads higher than the normal weight of the person if the elevator is :

A) accelerating downward
B) moving up with constant velocity.
C) stationary
D) accelerating upward

7. The coefficient of static friction between a 5 kg block and horizontal surface is 0.4. The **maximum horizontal force** that can be applied to the block before it slips (ينزلق) is:

A) 45.8 N **B)** 25.4 N **C)** 10.3 N **D)** 19.6 N

8. Two objects having masses of 1Kg and 2Kg moving around a circle of radius r = 1 m and with v = 1 m/s. Their **accelerations** are related by:

A) $\frac{a_1}{a_2}=2$ **B)** $a_1=a_2$ **C)** $a_1=a_2=0$ **D)** $\frac{a_1}{a_2}=\frac{1}{2}$

9. A 0.15 kg particle moves along an $x-$axis with acceleration $a(t)=8-18t$ with a in m/s^2 and t in seconds. The **net force** in Newtons acting on the particle at t = 3.40s is

A) -5.21 $\hat{i}$ **B)** -7.98 $\hat{i}$ **C)** 8.52 $\hat{i}$ **D)** 12.4 $\hat{i}$

10. The **coefficient of static friction** (μ_s):

A) is in the direction of motion
B) has a magnitude of exactly 1
C) is dimensionless
D) is in the direction of the normal force

11. Two forces $\vec{F}_1=7\hat{i}-5\hat{j}$ and $\vec{F}_2=-3\hat{i}+4\hat{j}$ acting on a body that can move over frictionless floor, the **magnitude of the net force** is :

A) 10 N **B)** 7.14 N **C)** 4.12 N **D)** 13.2 N

12. The **force that always perpendicular to the surface** is called

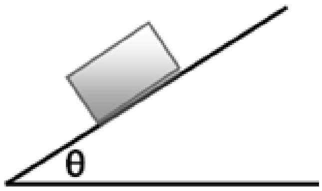
A) Friction **B)** Normal force **C)** Tension **D)** Gravitational force

13. The **horizontal range** is the horizontal distance the projectile has traveled when it returns to

A) its initial height **B)** the origin **C)** the start point **D)** its maximum height

Use the following to answer questions 14-15:

In the figure, a block of mass m = 25 kg is sliding down on a frictionless plane inclined at θ = 60^0



14. The **normal force** ($\vec{F}_N$) on the block is:

A) mg cosθ **B)** mg **C)** mg sinθ **D)** ma

15. The **magnitude of the force** that causes the block sliding down is

A) 150 N **B)** 90.44 N **C)** 311 N **D)** 212.17 N

Use the following to answer questions 16-17:

The coordinates of a particle's position vector as a function of time are given by $x = 5t^2 + 16$, and $y = -t^3 + 5$, with x and y in meters and t in seconds:

16. The **velocity** as a function of time is:

A) $t\,\hat{i} + 6\,t\,\hat{j}$ **B)** $10t\,\hat{i} - 3\,t^2\,\hat{j}$ **C)** $10\,\hat{i} - 6\,t^2\,\hat{j}$ **D)** $5t\,\hat{i} - 6\,\hat{j}$

17. The position vector $\vec{r}$ at t=2 s is

A) $15\,\hat{i} - 5\,\hat{j}$ **B)** $81\,\hat{i} + 3\,\hat{j}$ **C)** $26\,\hat{i} - 7\,\hat{j}$ **D)** $36\,\hat{i} - 3\,\hat{j}$

18. An objects move at a constant speed of 5 m/s on a circular path of radius 10 m. The **period** in seconds is:

A) π **B)** $3\pi^3$ **C)** 4π **D)** 20

19. A man of mass 75 kg stand on an elevator, if the elevator is going downward with acceleration of 1.7 m/s^2, the **normal force** on the man from the elevator is:

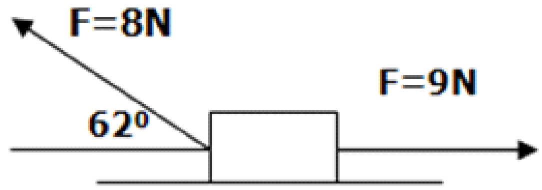
A) 607.5 N **B)** 323.9 N **C)** 523.4 N **D)** 700.5 N

20. The position vector for an airplane initially is $\vec{r} = 5\hat{i} - 6\hat{j} + 2\hat{k}$ and then 10s later is $\vec{r} = -2\hat{i} + 8\hat{j} - 2\hat{k}$, all in meters, its **average velocity ($\vec{v}_{avg}$)** in unit vector notation is

A) $-0.7\,\hat{i} + 1.4\,\hat{j} - 0.4\,\hat{k}$ **C)** $-0.3\,\hat{i} - 1.4\,\hat{j} + 0.6\,\hat{k}$

B) $-5\,\hat{i} + 2.4\,\hat{j} + 0.4\,\hat{k}$ **D)** $4.7\,\hat{i} - 1.4\,\hat{j} + 0.9\,\hat{k}$

21. From the figure, the **acceleration of the block** of mass 3 kg moving along an $x-$axis on a frictionless table is:



A) 1.75 m/s² **B)** 3 m/s² **C)** 2.45 m/s² **D)** - 2.3 m/s²

22. A ball is shot at an angle of 25^0 above the horizontal with an initial speed of v_0 . If the range it reaches is 140 m, what its **initial speed**?

A) 40 m/s **B)** 80 m/s **C)** 42.3 m/s **D)** 20 m/s

23. A car goes from $\vec{v}_i = 2\hat{i} + 4\hat{j}$ to $\vec{v}_f = 3\hat{i} + 9\hat{j}$ in 5 s. **The average acceleration** of the car

A) $\vec{a}_{avg} = \hat{i} - \hat{j}$ **B)** $\vec{a}_{avg} = 3\hat{i}$ **C)** $\vec{a}_{avg} = \hat{i} - 6\hat{j}$ **D)** $\vec{a}_{avg} = 0.2\hat{i} + \hat{j}$

24. A 980 kg car is traveling at constant speed 28 m/s around circular track of radius R = 230 m. The **magnitude of the frictional force** on the car is

A) 6241.6 N **B)** 3340.5 N **C)** 4141.5 N **D)** 1245.7 N

25. A bomb (قنبلة) is fired from a cannon and has initial horizontal and vertical components of velocity equal to 23 m/s and 54 m/s, respectively .The **angle** the bomb fired with the horizontal is

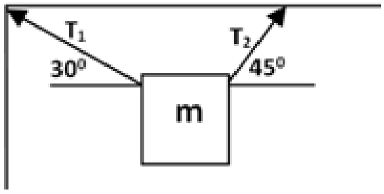
A) 85^0 **B)** 49^0 **C)** 33^0 **D)** 67^0

26. A particle is projected with an initial velocity $\vec{v}_0 = 5.0\hat{i} + 4.0\hat{j}$ in meters per second. The **horizontal component of its velocity at the maximum height** is:

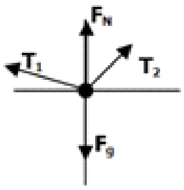
A) 5 m/s **B)** 7 m/s **C)** 12 m/s **D)** 2 m/s

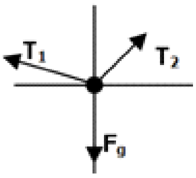
Use the following to answer questions 27-29:

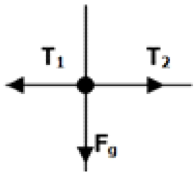
A block of mass m = 5 kg is hanging by two ropes as shown in the figure:

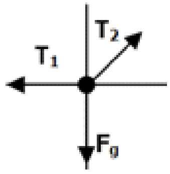


27. The **free body diagram** representing the forces on m is:

A) 

B) 

C) 

D) 

28. The **magnitude of weight (W)** in Newtons is equal to:

A) - 49 N **B)** 9.8 N **C)** 49 N **D)** - 9.8 N

29. From the figure, $\mathbf{F_{net,x}}$ on the block is:

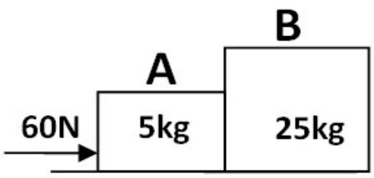
A) $T_1 \cos45 - T_2 \cos30 = m a_x$

B) $T_1 \cos 30 - T_2 \cos45 = m a_x$

C) $-T_1 \cos 30 + T_2 \cos45 = 0$

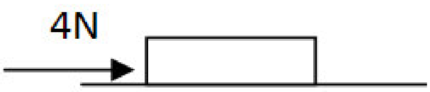
D) $T_1 \cos 45 - T_2 \cos30 = 0$

30. In the figure, two blocks slide over a frictionless surface along an $x-$axis with an acceleration equals 2 m/s^2. The force F on block A from block B is:



A) 40 N **B)** 50 N **C)** 60 N **D)** 57 N

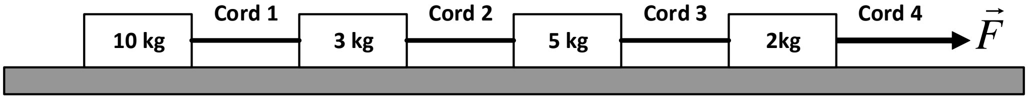
31. A horizontal force of 4N pushes a block of weight 10N to make it move with constant velocity, the value of the **coefficient of kinetic friction** (μ_k) is :



A) 0.6 **B)** 0.4 **C)** 0.8 **D)** 0.3

Use the following to answer questions 32-33:

The figure shows a train of four blocks being pulled across a frictionless floor by force $\vec{F}$, with an acceleration equal to 3 m/s^2



32. The **magnitude of force** $\vec{F}$ on the four blocks is

A) 20 N **B)** 60 N **C)** 30 N **D)** 40 N

33. The **total mass accelerated to the right by Cord 3** is

A) 20 kg **B)** 13 kg **C)** 18 kg **D)** 10 kg

Answer Key

1. B
2. A
3. C
4. C
5. C
6. D
7. D
8. B
9. B
10. C
11. C
12. B
13. A
14. A
15. D
16. B
17. D
18. C
19. A
20. A
21. A
22. C
23. D
24. B
25. D
26. A
27. B
28. C
29. C
30. B
31. B
32. B
33. C

King Abdulaziz University
Faculty of Sciences
Physics Department

Second Exam - Phys 110

Second Term
1432-1433 H

Date: 2 / 6 / 1433H

C

Name: **ID No:** **Section:**

CHOOSE THE CORRECT ANSWER

1. A 980 kg car is traveling at constant speed 28 m/s around circular track of radius R = 230 m. The **magnitude of the frictional force** on the car is

   A) 4141.5 N **B)** 6241.6 N **C)** 3340.5 N **D)** 1245.7 N

2. A particle is projected with an initial velocity $\vec{v}_0 = 5.0\hat{i} + 4.0\hat{j}$ in meters per second. The **horizontal component of its velocity at the maximum height** is:

   A) 2 m/s **B)** 7 m/s **C)** 5 m/s **D)** 12 m/s

3. The **force that always perpendicular to the surface** is called

   A) Normal force **B)** Gravitational force **C)** Tension **D)** Friction

4. The coefficient of static friction between a 5 kg block and horizontal surface is 0.4. The **maximum horizontal force** that can be applied to the block before it slips (ينزلق) is:

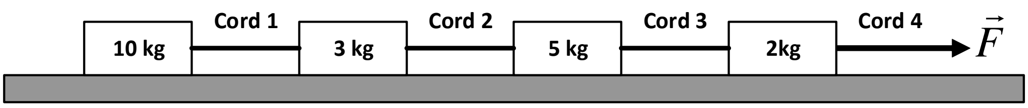
   A) 25.4 N **B)** 10.3 N **C)** 45.8 N **D)** 19.6 N

5. A ball is shot at an angle of 25^0 above the horizontal with an initial speed of v_0 . If the range it reaches is 140 m, what its **initial speed**?

   A) 40 m/s **B)** 80 m/s **C)** 42.3 m/s **D)** 20 m/s

Use the following to answer questions 6-7:

The figure shows a train of four blocks being pulled across a frictionless floor by force $\vec{F}$, with an acceleration equal to 3 m/s^2



6. The **total mass accelerated to the right by Cord 3** is

A) 20 kg B) 18 kg C) 10 kg D) 13 kg

7. The **magnitude of force** $\vec{F}$ on the four blocks is

A) 60 N B) 40 N C) 30 N D) 20 N

8. In the projectile motion ,the vertical component of the velocity at any time in the y-direction is equal to

A) $v_y = v_o \sin\theta + g\,t$ B) $v_y = v_o \sin\theta - g\,t$ C) $v_y = v_o (\cos\theta)t$ D) $v_y = v_o (\sin\theta)t$

9. The **coefficient of static friction** (μ_s):

A) is in the direction of the normal force
B) is in the direction of motion
C) is dimensionless
D) has a magnitude of exactly 1

Use the following to answer questions 10-11:

The coordinates of a particle's position vector as a function of time are given by $x = 5t^2 + 16$, and $y = -t^3 + 5$, with x and y in meters and t in seconds:

10. The position vector $\vec{r}$ at t =2 s is

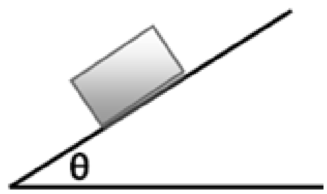
A) $81\hat{i} + 3\hat{j}$ B) $36\hat{i} - 3\hat{j}$ C) $26\hat{i} - 7\hat{j}$ D) $15\hat{i} - 5\hat{j}$

11. The **velocity** as a function of time is:

A) $t\,\hat{i} + 6t\,\hat{j}$ B) $10t\,\hat{i} - 3t^2\,\hat{j}$ C) $10\,\hat{i} - 6t^2\,\hat{j}$ D) $5t\,\hat{i} - 6\,\hat{j}$

Use the following to answer questions 12-13:

In the figure, a block of mass m = 25 kg is sliding down on a frictionless plane inclined at θ = 60^0



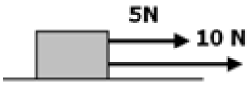
12. The **normal force** ($\vec{F}_N$) on the block is:

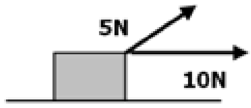
A) mg cosθ B) mg C) mg sinθ D) ma

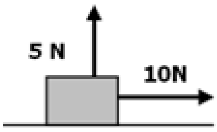
13. The **magnitude of the force** that causes the block sliding down is

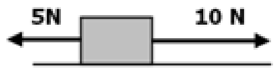
A) 311 N **B)** 90.44 N **C)** 212.17 N **D)** 150 N

14. Two forces, have magnitudes 5 N and 10 N, are applied to an object moving along an $x-$axis. In **which figure** of the following the magnitude of the acceleration of the object is the least ?

A) 

C) 

B) 

D) 

15. A car goes from $\vec{v}_i = 2\hat{i} + 4\hat{j}$ to $\vec{v}_f = 3\hat{i} + 9\hat{j}$ in 5 s. **The average acceleration** of the car

A) $\vec{a}_{avg} = \hat{i} - \hat{j}$ **B)** $\vec{a}_{avg} = 3\hat{i}$ **C)** $\vec{a}_{avg} = \hat{i} - 6\hat{j}$ **D)** $\vec{a}_{avg} = 0.2\hat{i} + \hat{j}$

16. A projectile is fired from the ground level with an initial velocity 283 m/s with an angle of 60^0 with the horizontal. **The maximum height** the projectile reached

A) 8957.4 m **B)** 2245.9 m **C)** 3064.6 m **D)** 1598.6 m

17. A man of mass 75 kg stand on an elevator, if the elevator is going downward with acceleration of 1.7 m/s^2, the **normal force** on the man from the elevator is:

A) 523.4 N **B)** 323.9 N **C)** 700.5 N **D)** 607.5 N

18. A bomb (قنبلة) is fired from a cannon and has initial horizontal and vertical components of velocity equal to 23 m/s and 54 m/s, respectively .The **angle** the bomb fired with the horizontal is

A) 67^0 **B)** 49^0 **C)** 85^0 **D)** 33^0

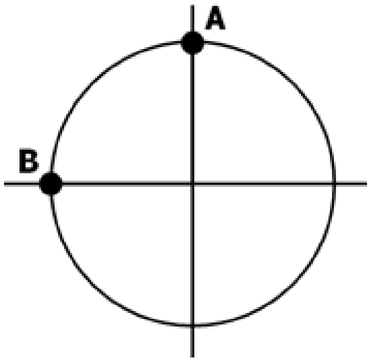
19. A 12 kg object is moving with a net force of 7 N north on it. The object having an **acceleration** of:

A) 0.58 m/s^2 north **B)** 1.71 m/s^2 south **C)** 0.58 m/s^2 south **D)** 1.71 m/s^2 north

20. In the figure, two blocks slide over a frictionless surface along an $x-$axis with an acceleration equals 2 m/s². The force F on block A from block B is:

A) 40 N **B)** 50 N **C)** 60 N **D)** 57 N

21. In the figure, a car moves at constant speed around the circle path in a horizontal xy plane, with the center at the origin. When it is at point A its coordinates are $x=0$, $y=3$m and its velocity is (6 m/s) $\hat{i}$. When it is **at point B its velocity and acceleration** are:



A) $\vec{v}=+6\,\hat{j}$ and $\vec{a}=+12\hat{i}$, respectively

B) $\vec{v}=-6\,\hat{j}$ and $\vec{a}=+12\,\hat{j}$, respectively

C) $\vec{v}=+4\,\hat{j}$ and $\vec{a}=+12\hat{i}$, respectively

D) $\vec{v}=+6\hat{i}$ and $\vec{a}=-12\hat{i}$, respectively

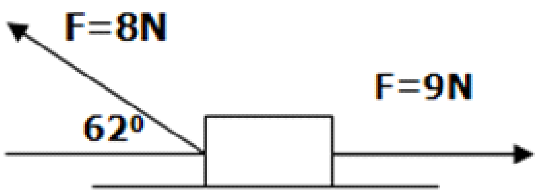
22. The **horizontal range** is the horizontal distance the projectile has traveled when it returns to

A) its initial height **B)** the origin **C)** the start point **D)** its maximum height

23. Two forces $\vec{F}_1=7\hat{i}-5\,\hat{j}$ and $\vec{F}_2=-3\hat{i}+4\,\hat{j}$ acting on a body that can move over frictionless floor, the **magnitude of the net force** is :

A) 4.12 N **B)** 10 N **C)** 7.14 N **D)** 13.2 N

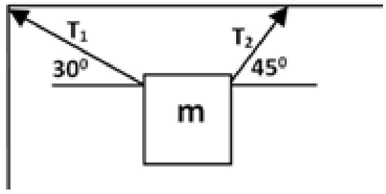
24. From the figure, the **acceleration of the block** of mass 3 kg moving along an $x-$axis on a frictionless table is:



A) 1.75 m/s² **B)** 2.45 m/s² **C)** - 2.3 m/s² **D)** 3 m/s²

Use the following to answer questions 25-27:

A block of mass m = 5 kg is hanging by two ropes as shown in the figure:



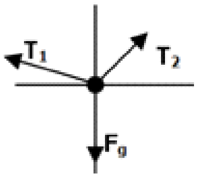
25. The **magnitude of weight (W)** in Newtons is equal to:

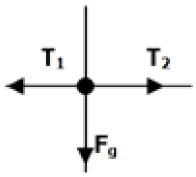
A) 49 N **B)** - 49 N **C)** 9.8 N **D)** - 9.8 N

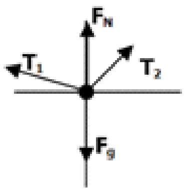
26. From the figure, $\mathbf{F}_{net,x}$ on the block is:

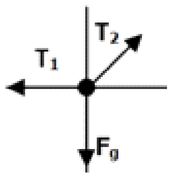
A) $-T_1 \cos 30 + T_2 \cos 45 = 0$
B) $T_1 \cos 45 - T_2 \cos 30 = 0$
C) $T_1 \cos 45 - T_2 \cos 30 = m a_x$
D) $T_1 \cos 30 - T_2 \cos 45 = m a_x$

27. The **free body diagram** representing the forces on m is:

A) 

B) 

C) 

D) 

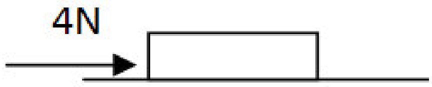
28. A 0.15 kg particle moves along an $x-$axis with acceleration $a(t) = 8 - 18t$ with a in m/s^2 and t in seconds. The **net force** in Newtons acting on the particle at t = 3.40s is

A) $8.52\,\hat{i}$ **B)** $12.4\,\hat{i}$ **C)** $-5.21\,\hat{i}$ **D)** $-7.98\,\hat{i}$

29. The position vector for an airplane initially is $\vec{r} = 5\hat{i} - 6\hat{j} + 2\hat{k}$ and then 10s later is $\vec{r} = -2\hat{i} + 8\hat{j} - 2\hat{k}$, all in meters, its **average velocity (**$\vec{v}_{avg}$**)** in unit vector notation is

A) $-5\,\hat{i} + 2.4\,\hat{j} + 0.4\,\hat{k}$
B) $-0.7\,\hat{i} + 1.4\,\hat{j} - 0.4\,\hat{k}$
C) $4.7\,\hat{i} - 1.4\,\hat{j} + 0.9\,\hat{k}$
D) $-0.3\,\hat{i} - 1.4\,\hat{j} + 0.6\,\hat{k}$

30. A horizontal force of 4N pushes a block of weight 10N to make it move with constant velocity, the value of the **coefficient of kinetic friction** (μ_k) is :



A) 0.6 **B)** 0.8 **C)** 0.3 **D)** 0.4

31. An objects move at a constant speed of 5 m/s on a circular path of radius 10 m. The **period** in seconds is:

A) π **B)** $3\pi^3$ **C)** 4π **D)** 20

32. Two objects having masses of 1Kg and 2Kg moving around a circle of radius r = 1 m and with v = 1 m/s. Their **accelerations** are related by:

A) $a_1 = a_2 = 0$ **B)** $a_1 = a_2$ **C)** $\frac{a_1}{a_2} = \frac{1}{2}$ **D)** $\frac{a_1}{a_2} = 2$

33. When a person is standing on a scale in an elevator, the scale reads higher than the normal weight of the person if the elevator is :

A) accelerating downward
B) stationary
C) accelerating upward
D) moving up with constant velocity.

Answer Key

1. C
2. C
3. A
4. D
5. C
6. B
7. A
8. B
9. C
10. B
11. B
12. A
13. C
14. D
15. D
16. C
17. D
18. A
19. A
20. B
21. A
22. A
23. A
24. A
25. A
26. A
27. A
28. D
29. B
30. D
31. C
32. B
33. C

King Abdulaziz University
Faculty of Sciences
Physics Department

Second Exam - Phys 110

Second Term
1432-1433 H

Date: 2 / 6 / 1433H

D

Name: **ID No:** **Section:**

CHOOSE THE CORRECT ANSWER

1. A 12 kg object is moving with a net force of 7 N north on it. The object having an **acceleration** of:

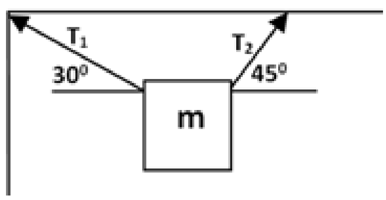
   A) 1.71 m/s^2 north **B)** 0.58 m/s^2 north **C)** 1.71 m/s^2 south **D)** 0.58 m/s^2 south

2. A car goes from $\vec{v}_i = 2\hat{i} + 4\hat{j}$ to $\vec{v}_f = 3\hat{i} + 9\hat{j}$ in 5 s. **The average acceleration** of the car

   A) $\vec{a}_{avg} = 3\hat{i}$ **B)** $\vec{a}_{avg} = \hat{i} - 6\hat{j}$ **C)** $\vec{a}_{avg} = 0.2\hat{i} + \hat{j}$ **D)** $\vec{a}_{avg} = \hat{i} - \hat{j}$

Use the following to answer questions 3-5:

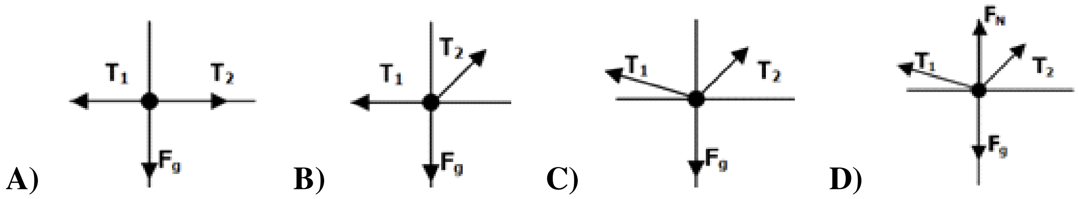
A block of mass m = 5 kg is hanging by two ropes as shown in the figure:



3. The **magnitude of weight (W)** in Newtons is equal to:

   A) - 9.8 N **B)** 9.8 N **C)** 49 N **D)** - 49 N

4. The **free body diagram** representing the forces on m is:



5. From the figure, $\mathbf{F_{net,x}}$ on the block is:

A) $T_1 \cos 45 - T_2 \cos 30 = 0$
B) $T_1 \cos 30 - T_2 \cos 45 = m a_x$
C) $-T_1 \cos 30 + T_2 \cos 45 = 0$
D) $T_1 \cos 45 - T_2 \cos 30 = m a_x$

6. A bomb (قنبلة) is fired from a cannon and has initial horizontal and vertical components of velocity equal to 23 m/s and 54 m/s, respectively .The **angle** the bomb fired with the horizontal is

A) 49^0 B) 33^0 C) 67^0 D) 85^0

7. The position vector for an airplane initially is $\vec{r} = 5\hat{i} - 6\hat{j} + 2\hat{k}$ and then 10s later is $\vec{r} = -2\hat{i} + 8\hat{j} - 2\hat{k}$, all in meters, its **average velocity ($\vec{v}_{avg}$)** in unit vector notation is

A) $-0.3\,\hat{i} - 1.4\,\hat{j} + 0.6\,\hat{k}$
B) $4.7\,\hat{i} - 1.4\,\hat{j} + 0.9\,\hat{k}$
C) $-5\,\hat{i} + 2.4\,\hat{j} + 0.4\,\hat{k}$
D) $-0.7\,\hat{i} + 1.4\,\hat{j} - 0.4\,\hat{k}$

8. A 980 kg car is traveling at constant speed 28 m/s around circular track of radius R = 230 m. The **magnitude of the frictional force** on the car is

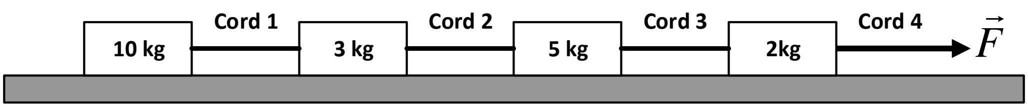
A) 3340.5 N B) 1245.7 N C) 6241.6 N D) 4141.5 N

9. A man of mass 75 kg stand on an elevator, if the elevator is going downward with acceleration of 1.7 m/s^2, the **normal force** on the man from the elevator is:

A) 700.5 N B) 523.4 N C) 607.5 N D) 323.9 N

Use the following to answer questions 10-11:

The figure shows a train of four blocks being pulled across a frictionless floor by force $\vec{F}$, with an acceleration equal to 3 m/s^2



10. The **magnitude of force** $\vec{F}$ on the four blocks is

A) 30 N B) 60 N C) 20 N D) 40 N

11. The **total mass accelerated to the right by Cord 3** is

A) 10 kg B) 20 kg C) 13 kg D) 18 kg

12. An objects move at a constant speed of 5 m/s on a circular path of radius 10 m. The **period** in seconds is:

A) 4π **B)** 20 **C)** $3\pi^3$ **D)** π

13. In the figure, two blocks slide over a frictionless surface along an $x-$axis with an acceleration equals 2 m/s^2. The force F on block A from block B is:

A) 57 N **B)** 40 N **C)** 50 N **D)** 60 N

14. A ball is shot at an angle of 25^0 above the horizontal with an initial speed of v_0 . If the range it reaches is 140 m, what its **initial speed**?

A) 42.3 m/s **B)** 20 m/s **C)** 80 m/s **D)** 40 m/s

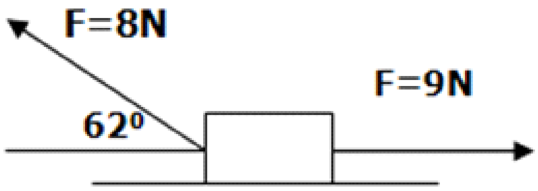
15. The **force that always perpendicular to the surface** is called

A) Friction **B)** Normal force **C)** Gravitational force **D)** Tension

16. A 0.15 kg particle moves along an $x-$axis with acceleration $a(t)=8-18t$ with a in m/s^2 and t in seconds. The **net force** in Newtons acting on the particle at t = 3.40s is

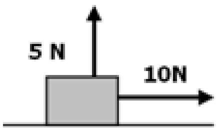
A) $-7.98\,\hat{i}$ **B)** $-5.21\,\hat{i}$ **C)** $8.52\,\hat{i}$ **D)** $12.4\,\hat{i}$

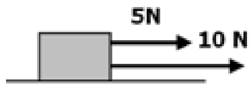
17. From the figure, the **acceleration of the block** of mass 3 kg moving along an $x-$axis on a frictionless table is:

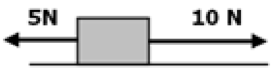


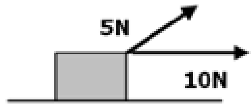
A) 3 m/s^2 **B)** - 2.3 m/s^2 **C)** 1.75 m/s^2 **D)** 2.45 m/s^2

18. Two forces, have magnitudes 5 N and 10 N, are applied to an object moving along an $x-$axis. In **which figure** of the following the magnitude of the acceleration of the object is the least ?

A) 

C) 

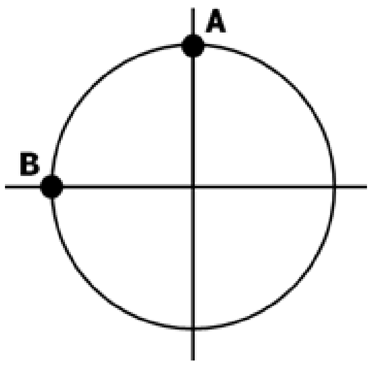
B) 

D) 

19. A particle is projected with an initial velocity $\vec{v}_0 = 5.0\hat{i} + 4.0\hat{j}$ in meters per second. The **horizontal component of its velocity at the maximum height** is:

A) 5 m/s **B)** 12 m/s **C)** 7 m/s **D)** 2 m/s

20. In the figure, a car moves at constant speed around the circle path in a horizontal xy plane, with the center at the origin. When it is at point A its coordinates are $x = 0$, $y = 3$m and its velocity is (6 m/s) $\hat{i}$. When it is **at point B its velocity and acceleration** are:



A) $\vec{v} = +4\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively

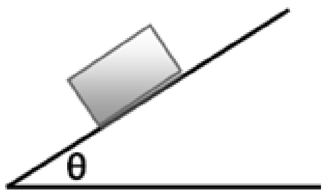
B) $\vec{v} = +6\hat{j}$ and $\vec{a} = +12\hat{i}$, respectively

C) $\vec{v} = +6\hat{i}$ and $\vec{a} = -12\hat{i}$, respectively

D) $\vec{v} = -6\hat{j}$ and $\vec{a} = +12\hat{j}$, respectively

Use the following to answer questions 21-22:

In the figure, a block of mass m = 25 kg is sliding down on a frictionless plane inclined at θ = 60^0



21. The **magnitude of the force** that causes the block sliding down is

A) 90.44 N **B)** 212.17 N **C)** 150 N **D)** 311 N

22. The **normal force** ($\vec{F}_N$) on the block is:

A) mg **B)** ma **C)** mg cosθ **D)** mg sinθ

Use the following to answer questions 23-24:

The coordinates of a particle's position vector as a function of time are given by $x = 5t^2 + 16$, and $y = -t^3 + 5$, with x and y in meters and t in seconds:

23. The **velocity** as a function of time is:

A) $5t\ \hat{i} - 6\ \hat{j}$ **B)** $t\ \hat{i} + 6\,t\ \hat{j}$ **C)** $10t\ \hat{i} - 3\,t^2\ \hat{j}$ **D)** $10\ \hat{i} - 6\,t^2\ \hat{j}$

24. The position vector $\vec{r}$ at t =2 s is

A) $15\hat{i}\ - 5\ \hat{j}$ **B)** $81\hat{i}\ + 3\ \hat{j}$ **C)** $36\hat{i}\ - 3\ \hat{j}$ **D)** $26\hat{i}\ - 7\ \hat{j}$

25. A horizontal force of 4N pushes a block of weight 10N to make it move with constant velocity, the value of the **coefficient of kinetic friction** (μ_k) is :

A) 0.4 **B)** 0.3 **C)** 0.6 **D)** 0.8

26. In the projectile motion ,the vertical component of the velocity at any time in the y-direction is equal to

A) $v_y = v_o(\cos\theta)t$ **B)** $v_y = v_o\sin\theta + g\,t$ **C)** $v_y = v_o(\sin\theta)t$ **D)** $v_y = v_o\sin\theta - g\,t$

27. A projectile is fired from the ground level with an initial velocity 283 m/s with an angle of 60^0 with the horizontal. **The maximum height** the projectile reached

A) 2245.9 m **B)** 1598.6 m **C)** 8957.4 m **D)** 3064.6 m

28. The **horizontal range** is the horizontal distance the projectile has traveled when it returns to

A) its maximum height **B)** its initial height **C)** the origin **D)** the start point

29. The coefficient of static friction between a 5 kg block and horizontal surface is 0.4. The **maximum horizontal force** that can be applied to the block before it slips (ينزلق) is:

A) 10.3 N **B)** 19.6 N **C)** 25.4 N **D)** 45.8 N

30. When a person is standing on a scale in an elevator, the scale reads higher than the normal weight of the person if the elevator is :

A) accelerating upward
B) accelerating downward
C) moving up with constant velocity.
D) stationary

31. The **coefficient of static friction** (μ_s):

A) is dimensionless
B) is in the direction of the normal force
C) has a magnitude of exactly 1
D) is in the direction of motion

32. Two objects having masses of 1Kg and 2Kg moving around a circle of radius *r* = 1 m and with *v* = 1 m/s. Their **accelerations** are related by:

A) $a_1 = a_2$ **B)** $\frac{a_1}{a_2} = 2$ **C)** $a_1 = a_2 = 0$ **D)** $\frac{a_1}{a_2} = \frac{1}{2}$

33. Two forces $\vec{F}_1 = 7\hat{i} - 5\hat{j}$ and $\vec{F}_2 = -3\hat{i} + 4\hat{j}$ acting on a body that can move over frictionless floor, the **magnitude of the net force** is :

A) 13.2 N **B)** 7.14 N **C)** 4.12 N **D)** 10 N

Answer Key

1. B
2. C
3. C
4. C
5. C
6. C
7. D
8. A
9. C
10. B
11. D
12. A
13. C
14. A
15. B
16. A
17. C
18. B
19. A
20. B
21. B
22. C
23. C
24. C
25. A
26. D
27. D
28. B
29. B
30. A
31. A
32. A
33. C

بسم الله الرحمن الرحيم
نموذج اختبار

1. A particle goes from $x = -2$ m, $y = 3$ m, $z = 1$ m to $x = 3$ m, $y = -1$ m, $z = 4$ m. Its displacement is:

a) $(1\text{ m})\hat{i} + (2\text{ m})\hat{j} + (5\text{ m})\hat{k}$
b) $(5\text{ m})\hat{i} - (4\text{ m})\hat{j} + (3\text{ m})\hat{k}$
c) $-(5\text{ m})\hat{i} + (4\text{ m})\hat{j} - (3\text{ m})\hat{k}$
d) $-(5\text{ m})\hat{i} - (2\text{ m})\hat{j} = (3\text{ m})\hat{k}$

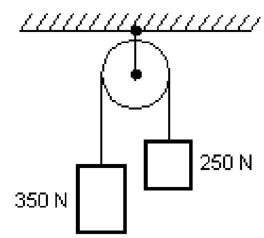
2. A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. The distance from launching to landing points is:

a) 40 m
b) 60 m
c) 80 m
d) 122.5 m

3. A stone is tied to the end of a string and is swung with constant speed around a horizontal circle with a radius of 1.5 m. If it makes two complete revolutions each second, its acceleration is:

a) 0.24 m/s^2
b) 240.7 m/s^2
c) 2.4 m/s^2
d)24m/ s^2

4. Two blocks weighting 250 N and 350 N respectively, are connected by a string that passes over a massless pulley as shown. The tension in the string is:



a) 210 N
b) 410 N
c) 290.8 N
d) 500 N

5. A 6-kg object is moving south. A net force of 12 N north on it result in the object having an acceleration of:

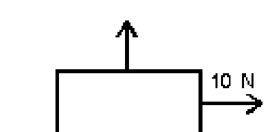
a) 2 m/s^2, north
b) 2 m/s^2, south
c) 18 m/s^2, north
d) 18 m/s^2, south

6. The "reaction" force does not cancel the "action" force because:

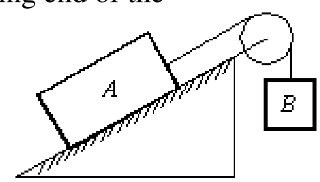
a) the action force is greater than the reaction force
b) they are in the same direction
c) the reaction force is greater than the action force
d) they act on different bodies

7. A box with a weight of 50 N rests on a horizontal surface with a coefficient of static friction is 0.4. If person pulls horizontally on it with a force of 10 N , then

a) the block will not move
b) the block will move to the left
c) the block will move to the right
d) the block will move upward



8. Block A, with a mass of 10 kg, rests on a 30° incline. The coefficient of kinetic friction is 0.20. The attached string is parallel to the incline and passes over a massless, frictionless pulley at the top. Block B, with a mass of 8.0 kg, is attached to the dangling end of the string. The acceleration of B is:



a) 0.69 m/s^2, up the plane
b) 0.69 m/s^2, down the plane
c) 2.6 m/s^2, up the plane
d) 2.6 m/s^2, down the plane

Answer key:
1-b
2-d
3-b
4-c
5-a
6-d
7-a
8-b

King Abdulaziz University ……… Faculty of Science ……… Department of Physics

PHYSICS 110 Final Exam A. Z ALZAHRANI

1. The volume of a sphere of radius r is given by $V=4/3\pi r^a$. The value of the power a is:

(a) 1 (b) 2 (c) 3 (d) 4

---

2. A dimensionless quantities A is described as $A = kvl$, where v and l are velocity and length, respectively. The SI unit of k is:

(a) s/m^2 (b) m/s^2 (c) m/s (d) s

---

3. Given a formula of force as $F = \alpha\beta + \lambda$. The unit of λ is:

(a) Dimensionless (b) N.s (c) $kg.m/s^2$ (d) N

---

4. The velocity of a particle in terms of its acceleration is given by $v = ka$, the unit of k is:

(a) m/s (b) m (c) m.s (d) s

---

5. The acceleration of a car, starting its motion with a speed of 5 m/s, is given by the equation $a(t)=2t$ (m/s^2). The average acceleration of the car in the interval t=1s and t= 2s is:

(a) 3 m/s^2 (b) 2 m/s^2 (c) 6 m/s^2 (d) 4 m/s^2

---

6. The position of a particle is given by the equation $x = 1.5t^2 - t^4$ (m), the speed of the ball when its acceleration vanishes is:

(a) 0.5 m/s (b) 1.0 m/s (c) 1.5 m/s (d) 2.0 m/s

---

7. A car moves with a constant speed of 12 m/s. If the driver uniformly increases the speed in which it covers 240 m in 12 s, the acceleration of the car is:

(a) 5.3 m/s^2 (b) 3.3 m/s^2 (c) 1.3 m/s^2 (d) 13 m/s^2

---

8. A particle moves along the x-axis with constant acceleration of 3 m/s^2. If its initial position is 1.2 m and initial speed is 2.1 m/s, its position at t=2 s is:

(a) 9.4 m (4) 10.4 m (c) 11.4 m (d) 12.4 m

---

9. A stone is thrown vertically upwards from the top of a tall building with a speed of 19.6 m/s. The height of the building if the stone took 12 s to hit the ground is:

(a) 490 m (b) 470.4 m (c) 380 m (d) 19.6 m

---

10. A ball is thrown vertically upwards. If the ball takes 2 s to pass a window of height 1.2 m located at 10 m above the ground, the maximum height of the ball is:

(a) 10.4 m (b) 11.2 m (c) 13.5 m (d) 15.5 m

---

11. A rock is thrown down at 2 m/s from a height of 25.8 m above the ground. The rock will take:

(a) 1.2 s (b) 2.1 s (c) 4.2 s (d) 5 s

12. For vectors $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - \hat{k}$, the length of the vector $\vec{A} - \vec{B}$ is:

(a) 2 (b) 3 (c) 4 (d) 5

13. The angle that the vector $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ makes with the positive x-axis is:

(a) 42^0 (b) 58^0 (c) 98^0 (d) 109^0

14. The vector that is normal to both vectors $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - \hat{k}$ is:

(a) $-5\hat{i} + 5\hat{j} + 5\hat{k}$ (b) $5\hat{i} - 5\hat{j} + 5\hat{k}$ (c) $5\hat{i} + 5\hat{j}$ (d) $-5\hat{i}$

15. If vector $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ is perpendicular to vector $\vec{D} = x\hat{i} + 2\hat{j}$, the value of x will be:

(a) 1 (b) 2 (c) 3 (d) 4

16. The result of $(\hat{i} \times \hat{k}) \times \hat{j}$ is:

(a) -1 (b) $-\hat{j}$ (c) 0 (d) $\hat{j}$

17. For non-zero vectors $\vec{A}$ and $\vec{B}$, $\vec{A} \cdot \vec{B} = \frac{4}{5}|\vec{A} \times \vec{B}|$ when the angle between them is:

(a) 0^0 (b) 36.7^0 (c) 51.3^0 (d) 90^0

18. Vector $\vec{a}$ is added to vector $\vec{b}$, the result is $2\hat{i} + 2\hat{j}$. If $\vec{b}$ is subtracted from $\vec{a}$, the result is $-8\hat{i} + 6\hat{j}$. The magnitude of $\vec{a}$ is:

(a) 5.4 (b) 5 (c) 4 (d) 3.2

19. A particle starts from origin with initial speed of 5 m/s along the positive x-axis. If its acceleration is $\vec{a} = 2\hat{i} - 4\hat{j}$ (m/s^2), the position vector of the particle at t=1 s is:

(a) $6\hat{i} - 2\hat{j}$ (b) $2\hat{i} + 6\hat{j}$ (c) $\hat{i} - 2\hat{j}$ (d) $6\hat{i}$

20. A ball is kicked at an angle of 50^0 above the horizontal with an initial speed of 24 m/s. The maximum height of the ball is:

(a) 57.9 m (b) 34.5 m (c) 28.9 m (d) 17.3 m

21. A projectile is fired to achieve a maximum range of 140 m, the speed of the projectile must be:

(a) 17 m/s (b) 27 m/s (c) 37 m/s (d) 45 m/s

22. A projectile is fired at an angle θ above the horizontal. It takes 15 s to reach its range of 140 m. Its speed at the highest point is:

(a) 9.3 m/s (b) 15.2 m/s (c) 19.6 m/s (d) 22 m/s

23. A projectile is fired in such a way that its horizontal range equals three times its maximum height, the launch angle is:

(a) 82.1^0 (b) 60.9^0 (c) 53.1^0 (d) 65.8^0

24. An object having a speed of 1.256 m/s rotates in a circular path. If it completes two revolutions in 5 s, the centripetal acceleration is:

(a) 2.51 m/s^2 (b) 3.16 m/s^2 (c) 4.4 m/s^2 (d) 6 m/s^2

25. A force of 20 N is applied to move a stationary body of mass 5 kg. The speed of the body after 4 s will be:

(a) 1.25 m/s (b) 12.5 m/s (c) 16 m/s (d) 18 m/s

26. A force of 10 N is applied to move a stationary body. If the speed of the body after 2 s is 4 m/s, the mass of the body is:

(a) 2 kg (b) 5 kg (c) 8 kg (d) 10 kg

27. A box, has mass of 4 kg, is pulled over a frictionless floor with a force of magnitude 40 N making an angle of 30^0 above the horizontal. The normal force is:

(a) 39.2 N (b) 59.2 N (c) 19.2 N (d) 40 N

28. A box, has weigh of 98 N, is pulled over a rough, flat surface with a horizontal force of magnitude 50 N. If the box moves with constant speed of 2 m/s, the coefficient of kinetic friction is:

(a) 0.51 (b) 0.31 (c) 0.22 (d) 0.15

29. A car rotates a circular path of radius 200 m with constant speed of 25 m/s. The car's mass if it has a centripetal force of 2500 N is:

(a) 600 kg (b) 700 kg (c) 800 kg (d) 1000 kg

30. A block of mass 4.2 kg is pulled up a frictionless inclined plane of angle 30^0 by a horizontal force. If the block moves with constant speed of 2.6 m/s, the magnitude of the force is:

(a) 23.8 N (b) 71.3 N (c) 42.2 N (d) 13.9 N

31. A 5 kg body is horizontally moving with constant speed of 6 m/s. The work done to increase the speed of the body to 10 m/s is:

(a) 64 J (b) 128 J (c) 160 J (d) 192 J

32. An 40 N crate slides with constant speed a distance of 4 m downward along a rough slope that makes an angle of 30^0 with the horizontal. The work done by the gravity is:

(a) 80 J (b) 0 J (c) 160 J (d) 200 J

33. An 40 N crate slides with constant speed a distance of 4 m downward along a rough slope that makes an angle of 30^0 with the horizontal. The work done by the normal force is:

(a) 80 J (b) 0 J (c) 160 J (d) 200 J

34. A person lifts a 100 N weight 2 m above the ground during 2 s. The power required is:

(a) 40 W (b) 60 W (c) 80 W (d) 100 W

35. A 2 kg block is released from rest 8 m above the ground. Its kinetic energy when it has fallen 6 m is:

(a) 80 J (b) 117.6 J (c) 176.2 J (d) 185.3 J

---

36. A block attached to a spring with a spring constant of 80 N/m oscillates on a horizontal frictionless floor. If the total mechanical energy is 0.1 J, the greatest extension of the spring from its equilibrium length is:

(a) 0.02 m (b) 0.03 m (c) 0.025 m (d) 0.05 m

---

37. Three particles of masses m_1=3 kg, m_2=5 kg, and m_3=2 kg are located in *xy* plane as (0,0), (1,2), and (2,0), respectively. The coordinates of the center of mass are

(a) 0.9, 0.9 (b) 0.9, 1.0 (c) 1.0, 0.9 (d) 1.0, 1.0

---

38. A car has a kinetic energy of 72000 J and a momentum of 12000 kg.m/s. The car's speed is:

(a) 12 m/s (b) 15 m/s (c) 16 m/s (d) 18 m/s

---

39. In a perfectly inelastic collision, a car of mass 800 kg moving with a speed of 20 m/s collides with another stationary car of mass 1200 kg. If they move together after the collision, their speed is:

(a) 12 m/s (b) 10 m/s (c) 8 m/s (d) 6 m/s

---

40. A 0.075 kg bullet moving at 250 m/s strikes a wooden block that is initially at rest. If the bullet embeds the block and move together with a speed of 17 m/s, the mass of the block is:

(a) 1.03 kg (b) 1.25 kg (c) 1.4 kg (d) 1.9 kg