فيزياء ١١٠
Physics 110

اختبارات

الدوري الأول والثاني والنهائي

مهندس أشرف بركات

٠٥٠٤٥٩٠١٣٢

PHYS 110

اختبارات الدوري الأول

Ph110 | Ch 1 | (1)

0504590132

ملخص القوانين

	→		←
cm	÷ 100	m	× 100
mm	÷ 1000	m	× 1000
km	× 1000	m	÷ 1000
min	× 60	s	÷ 60
h	× 3600	s	÷ 3600
km/h	$\times \frac{1000}{3600}$	m/s	$\times \frac{3600}{1000}$
g	÷ 1000	kg	× 1000

Ch 1

(2)

$g/cm^3 \xrightarrow{\times 1000} kg/m^3$

$g/cm^3 \xleftarrow{\div 1000} kg/m^3$

$cm^2 \xrightarrow{\div (100)^2} m^2$

$mm^2 \xrightarrow{\div (1000)^2} m^2$

$cm^3 \xrightarrow{\div (100)^3} m^3$

$mm^3 \xrightarrow{\div (1000)^3} m^3$

$\mu m \xrightarrow{\times 10^{-6}} m$

$\mu m \xleftarrow{\div 10^{-6}} m$

$nm \xrightarrow{\times 10^{-9}} m$

$nm \xleftarrow{\div 10^{-9}} m$

$pm \xrightarrow{\times 10^{-12}} m$

$pm \xleftarrow{\div 10^{-12}} m$

ch 2 (3)

ملخص القوانين

x → (اشتقاق) → v → (اشتقاق) → a

السرعة اللحظية: $v = \frac{dx}{dt}$

التسارع اللحظي: $a = \frac{dv}{dt}$

average velocity = $v_{av} = \frac{x_2 - x_1}{t_2 - t_1}$

التسارع المتوسط

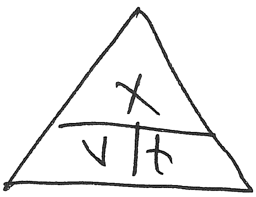
average acceleration = $a_{av} = \frac{v_2 - v_1}{t_2 - t_1}$

الإزاحة

Δx = displacement $\Delta x = x_2 - x_1$

$a = 0$ ⟸ إذا كانت السرعة ثابتة

average velocity = $v_{ave} = \frac{\Delta x}{\Delta t}$



average speed = $s_{ave} = \frac{\text{total distance}}{\Delta t}$

Ch 2 (4)

الإزاحة $x = x_2 - x_1$

حركة الجسم بتسارع ثابت

$$v = v_0 + at$$ (x)

$$x = v_0 t + \frac{1}{2} a t^2$$ (v)

$$v^2 = v_0^2 + 2at$$ (t)

$$x = \frac{v + v_0}{2} t$$ (a)

$$x = vt - \frac{1}{2} a t^2$$ (v_0)

* deceleration (تباطؤ) ⇒ a (−) سالبة
* starts from rest (بدأ من السكون) ⇒ $v_0 = 0$
* stopped = come to rest (يتوقف) ⇒ $v = 0$
* $$v_{av} = \frac{v + v_0}{2}$$ في حالة الحركة بتسارع ثابت

ch 2

(5)

السقوط الحر (الحركة الرأسية تحت تأثير الجاذبية الأرضية)

$x \longrightarrow y$

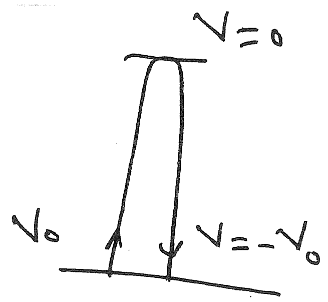
$a = -g = -9.8\ m/s^2$ دائماً في حالة الصعود أو الهبوط

magintude $|a| = g = 9.8\ m/s^2$ المقدار

upward لأعلى	downward لأسفل
v_0 (+)	v_0 (−)
v (+)	v (−)
y (+)	y (−)

* dropped $\Rightarrow v_0 = 0$
* at the highest point (at maximum height)

$\Rightarrow$ $\boxed{v = 0}$ السرعة عند أعلى نقطة = صفر



عندما يعود الجسم لنقطة القذف (البداية)

زمن الصعود = زمن الهبوط

الزمن الكلي = 2 × زمن الصعود

ملخص القوانين

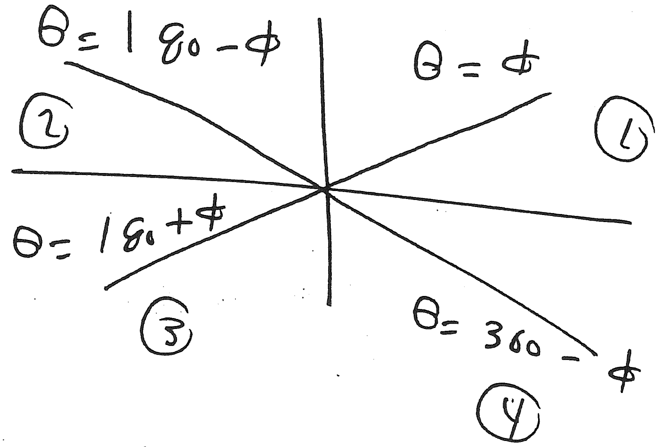
$$\vec{A} = A_x i + A_y j$$

A_x = x- component (المركبة x) = horizontal component (المركبة الأفقية)

A_y = y- component (المركبة y) = vertical component (المركبة الرأسية)

$$|\vec{A}| = \sqrt{A_x^2 + A_y^2} \qquad \theta = \tan^{-1}\left|\frac{A_y}{A_x}\right|$$

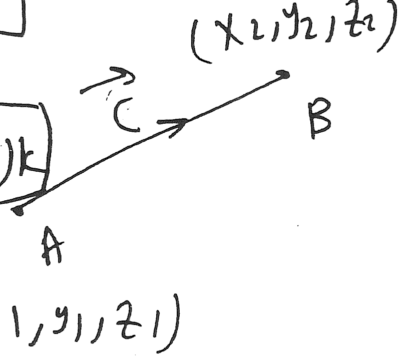
ϕ هي الزاوية المحسوبة بالآلة الحاسبة



$$A_x = |A| \cos\theta \qquad A_y = |A| \sin\theta$$

$$\boxed{\vec{A} = |\vec{A}| \cos\theta\, i + |\vec{A}| \sin\theta\, j}$$

$$\boxed{\vec{C} = \vec{AB} = (x_2 - x_1) i + (y_2 - y_1) j + (z_2 - z_1) k}$$

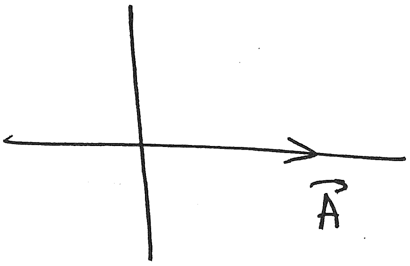


Ch 3

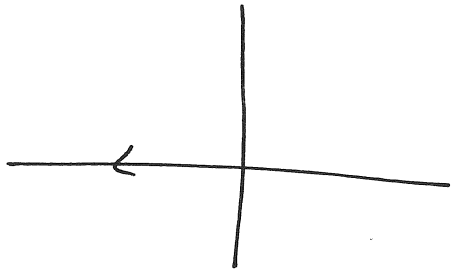
المحصلة

$$\text{Resultant} = \vec{R} = \vec{A} + \vec{B} + \vec{C}$$

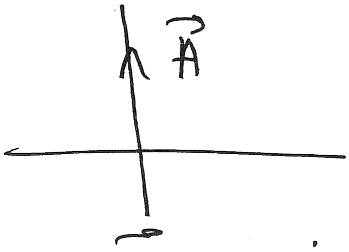
If $|\vec{A}| = 5$



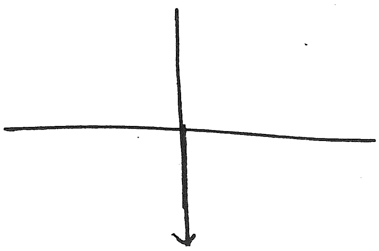
$\vec{A} = 5i$



$\vec{A} = -5i$



$\vec{A} = 5j$



$\vec{A} = -5j$

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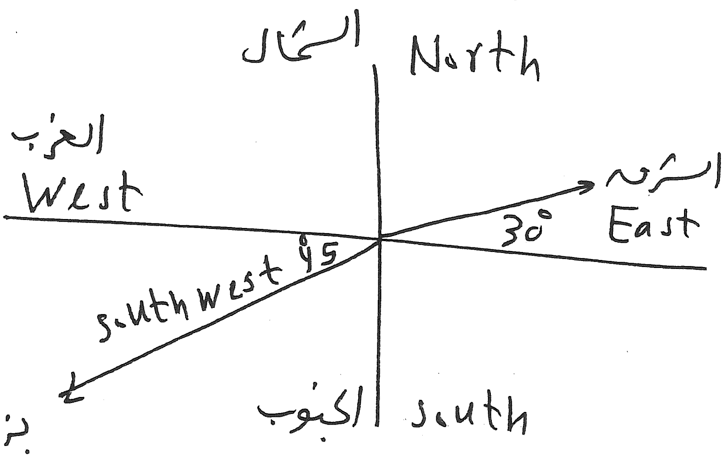
south west

الجنوب الغربي نحو 45 بين الجنوب والغرب

30° north of east

نبدأ من الشرق أولاً ثم نتجه نحو الشمال بزاوية 30°



ch 3

(8)

dot product
Scalar product
الضرب القياسي

$$\vec{A} = A_x i + A_y j + A_z k$$
$$\vec{B} = B_x i + B_y j + B_z k$$

$$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$$

$$\vec{A} \cdot \vec{B} = |\vec{A}|\,|\vec{B}| \cos\theta$$

θ = الزاوية بين المتجهين $\vec{A}, \vec{B}$

$$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}|\,|\vec{B}|}$$

ثم نوجد (الناتج) $\cos^{-1}$

If $\vec{A} \cdot \vec{B} = 0 \iff \vec{A} \perp \vec{B}$

$\theta = 90°$

$i \cdot i = 1$ $\quad j \cdot j = k$ $\quad k \cdot k = 1$

$i \cdot j = j \cdot i = 0$ $\quad j \cdot k = k \cdot j = 0$ $\quad i \cdot k = k \cdot i = 0$

If $\vec{A} = A_x i + A_y j + A_z k$

الزاوية مع محور X الموجب $\theta_x = \cos^{-1}\left(\frac{A_x}{|A|}\right)$, الزاوية مع محور X السالب $\theta = \cos^{-1}\left(\frac{-A_x}{|\vec{A}|}\right)$

الزاوية مع محور y الموجب $\theta_y = \cos^{-1}\left(\frac{A_y}{|\vec{A}|}\right)$ | الزاوية مع محور y السالب $\theta = \cos^{-1}\left(\frac{-A_y}{|\vec{A}|}\right)$

Ch 3

(9)

Vector Product (Cross Product)

الضرب الاتجاهي

$$\vec{A} = A_x i + A_y j + A_z k$$

$$\vec{B} = B_x i + B_y j + B_z k$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \overset{+}{i} & \overset{-}{j} & \overset{+}{k} \\ A_x & A_y & A_z \\ B_x & B_z & B_z \end{vmatrix}$$

$\vec{A} \times \vec{B}$ عمودي ع $\vec{A}, \vec{B}$ وعمودي ع مستويهما

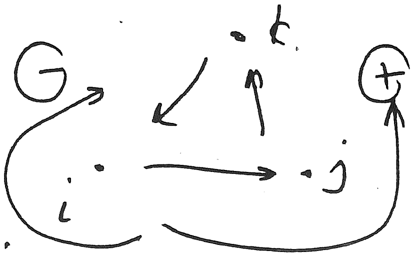
$$|\vec{A} \times \vec{B}| = |\vec{A}|\,|\vec{B}| \sin\theta$$

$$\vec{A} \times \vec{B} = 0 \implies \theta = 0^\circ \quad \text{or} \quad \theta = 180^\circ$$

$i \times i = 0$ $\quad j \times j = 0$ $\quad k \times k = 0$

$i \times j = k$ $\quad j \times k = i$ $\quad k \times i = j$

$j \times i = -k$ $\quad k \times j = -i$ $\quad i \times k = -j$



$$\theta = \tan^{-1}\left(\frac{|\vec{A} \times \vec{B}|}{\vec{A} \cdot \vec{B}}\right)$$

نستخدمه لإيجاد الزاوية θ بين المتجهين $\vec{A}, \vec{B}$ والمتجهين غير معلومين

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Physics 110

B

Test # 1	28/12/1435H	Time: 90 min.
Student Name:	Student no.	Section:

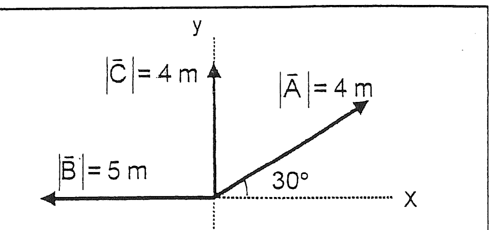


Figure (1)

Q.1 In figure (1), the x-component of the vector $\bar{C}$ is:
(A) $8\hat{i}$ m (B) $4\hat{j}$ m (C) $4\hat{i}$ m (D) Zero (E) $-5\hat{i}$

Q.2 In figure (1), the vector $\bar{A}$ in unit vector notation is:
(A) $10\hat{i}+3\hat{j}$ (B) 4 (C) $3.5\hat{i}+2\hat{j}$ (D) $4\hat{i}-3\hat{j}$ (E) $5\hat{i}$

Q.3 In figure (1), the vector $\vec{A}+\vec{B}+\vec{C}$ is:
(A) -1 m (B) $(-1.5\hat{i}+6\hat{j})$ m (C) $5\hat{i}$ m (D) 9 m (E) $(-5\hat{i}+4\hat{j})$ m

Q.4 The angle between vectors $\bar{A} = 2\hat{i}+4\hat{j}$ and $\bar{B} = 8\hat{k}$ is:
(A) 90° (B) 30° (C) 45° (D) 120° (E) Zero

Q.5 Given two vectors $\bar{A} = 6\hat{i}-10\hat{j}+4\hat{k}$, $\bar{B} = 4\hat{i}-7\hat{j}+4\hat{k}$, then $\bar{A}-\bar{B}$ is:
(A) $10\hat{i}+3\hat{j}$ (B) $2\hat{i}-3\hat{j}$ (C) $9.5\hat{i}$ (D) $2\hat{i}+3\hat{j}$ (E) $-5+9.5\hat{i}$

Q.6 Given two vectors $\bar{a} = 6\hat{i}+10\hat{j}-4\hat{k}$, $\bar{b} = 4\hat{i}-7\hat{j}+5\hat{k}$, then $\bar{a}\bullet\bar{b}$ is:
(A) $10\hat{i}+3\hat{j}$ (B) 56 (C) -66 (D) $10\hat{i}-3\hat{j}$ (E) $10\hat{i}+3\hat{j}+\hat{k}$

Q.7 The unit vector of $\bar{A} = 3\hat{i}+4\hat{j}$ is:
(A) $\frac{4}{5}\hat{i}-\frac{3}{5}\hat{j}$ (B) $\frac{3}{5}\hat{i}-\frac{4}{5}\hat{j}$ (C) $\frac{3}{5}\hat{i}$ (D) $\frac{3}{5}\hat{i}+\frac{4}{5}\hat{j}$ (E) $\frac{4}{5}\hat{j}$

Q.8 If a stone starting from rest fall freely, the distance it will fall in 4.0 seconds?
(A) 15 m (B) 29 m (C) 44.1 m (D) 88 m (E) 78.4 m

Q.9 A car initially at rest travels 50 m in 5 s along a straight line with constant acceleration. The acceleration of the car is:
(A) 3.2 m/s^2 (B) 5 m/s^2 (C) 4.44 m/s^2 (D) 4 m/s^2 (E) 7 m/s^2

Q.10 If $\bar{A} = 2\hat{i}+4\hat{j}$, $\bar{B} = a_x\hat{i}-\hat{j}$ and $\bar{A}\times\bar{B} = -20\hat{k}$, then a_x is
(A) $3\hat{i}+4\hat{j}-5\hat{k}$ (B) 40 (C) 4.5 (D) $\hat{i}+2\hat{j}-5\hat{k}$ (E) 7

Q.11 A vector perpendicular to vector $\bar{A} = 2\hat{i}+4\hat{j}$ is:
(A) $3\hat{i}+4\hat{j}-5\hat{k}$ (B) $5\hat{k}$ (C) $3\hat{i}$ (D) $2\hat{i}-4\hat{j}$ (E) $4\hat{j}$

Q.12 Given $C=A^2B^2$ where C is in meter square and **B** in seconds. The unit of **A** is:
(A) m/s (B) m^2/s (C) Km/s^2 (D) m^3/s^2 (E) Kg.m/s^2

Q.13 An object starts from rest at the origin and moves along the x-axis with a constant acceleration. Its displacement as it goes from $x_1 = 4$ m to $x_2 = 12$ m is:
(A) 12 m (B) 8 m (C) 3 m (D) 16 m (E) - 8 m

B

Q.14 The acceleration due to gravity acts:
(A) upward (B) depending on the motion (C) downward (D) toward outer space (E) horizontal

Q.15 The angle between $\vec{c} = -15\hat{i} + 35\hat{j} + 5\hat{k}$ and the positive y-axis is:
(A) 97.5° (B) 120° (C) 82.5° (D) 24.3° (E) 113°

Q.16 The density of lead is 11.34 g/cm^3 . This value in SI-unit is:
(A) 1 kg/m^3 (B) 11 kg/m^3 (C) 1.34×10^{-3} kg/m^3 (D) 11.34 kg/m^3 (E) 11340 kg/m^3

Q.17 The result of $(\hat{j}\times\hat{k})\times\hat{j}$ is:
(A) zero (B) 3 (C) -1.0 (D) $\hat{k}$ (E) 1.0

Q.18 The distance (x) in meters travelled by a particle is related to time (t) in seconds by the equation of motion $x = 10t + 4t^2$. The velocity of the particle after 3 s is:
(A) 4 m/s (B) 6 m/s (C) 34 m/s (D) 10 m/s^2 (E) 43 m/s^2

Q.19 When an object is moving with constant velocity, its acceleration is:
(A) uniform (B) zero (C) non uniform (D) negative (E) positive

Q.20 A particle's position is described as $x(t)= 6t^2+2$. Its acceleration is:
(A) 12 m/s^2 (B) 40 m/s^2 (C) 15 m/s^2 (D) 6 m/s^2 (E) 24 m/s^2

Q.21 A Train is driving with a constant speed of 325 km/hr. This speed in SI-unit is:
(A) 450 m/s (B) 90.3 m/s (C) 45 m/s (D) 125 m/s (E) 25 m/s

Q.22 You throw a ball vertically upward from the ground with initial velocity of 20 m/s, the velocity when the ball is 10 m above your hand is:
(A) 15 m/s (B) 36 m/s (C) 14.3 m/s (D) Zero (E) 11.3 m/s

Q.23 The position of a particle moving along the x axis is given by $x = (21 + 22t - 6t^2)$ m, where t is in seconds. The displacement during the time interval t = 1.0 s to t = 3.0 s is:
(A) -6 m (B) 8 m (C) -8 m (D) -4 m (E) 4 m

Q.24 Which of the following quantities is not a vector quantity?
(A) Velocity (B) Weight (C) force (D) Displacement (E) Speed

Q.25 If $\bar{A}$ and $\bar{B}$ are vectors with the magnitudes 5 and 4 respectively and the magnitude of their vector product is 17.32 ,then the angle between $\bar{A}$ and $\bar{B}$ is:
(A) 30° (B) 45° (C) 180° (D) 60° (E) 90°

Q.26 SI unit of velocity is:
(A) m/s (B) cm/s^2 (C) km/h^2 (D) m/s^2 (E) cm/s

Q.27 A car is traveling at 30 m/s. The speed of this car is equal to.
(A) 120 km/h (B) 108 km/h (C) 100 km/h (D) 20 km/h (E) 72 Km/h

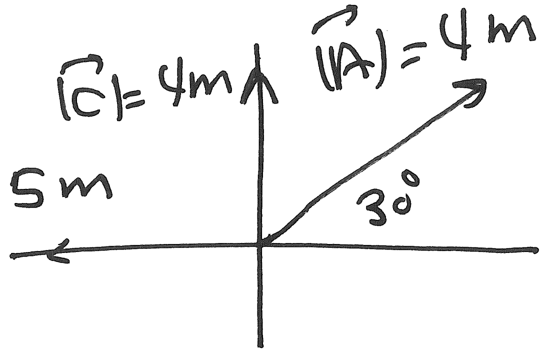
Q.28 In order to determine the velocity you must know.
(A) distance (B) acceleration (C) time (D) both A and C (E) both B and A

Q.29 A stone is dropped from a building at a height of 30 m. When the speed of the stone is 13.6 m/s its height from the ground is:
(A) 23 m (B) -8.1 m (C) 12.3 m (D) 20.6 m (E) 16.4

Q.30 A man has a mass of 80 kg. His weight is:
(A) 300 watt (B) 650 N.m (C) 650 N (D) 784 g.cm/s (E) 784 Kg.m/s^2

Suppose	افترض	Negative	سالب	Common	مشتركه	Angle	زاوية
Shot	قذف	Object	جسم	due to	بسبب	Absence	غياب
Thrown	رمي	Parallel	موازي	Equivalent to	تساوي	Appropriate	المناسبة
Towards	باتجاه	particle	جسيم	Exerted	تؤثر	Air resistance	مقاومة الهواء
Traveling	يسير	respectively	على التوالي	Height	ارتفاع	Ball	كره
Upwards	للاعلي	Projected	قذف	kicked	ركلت	Block	كتله
Vertically	راسياً	Reaches	يصل	Means	يعني	Carte	صندوق
Walk	مشى	Rocket	صاروخ			Component	مركبة

(1)



$C_x = 0$ لأنه المتجه في اتجاه +y

(D)

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(2) $|\vec{A}| = 4m$ $\theta = 30°$

$\vec{A} = |\vec{A}| \cos\theta \, i + |\vec{A}| \sin\theta \, j$

$\vec{A} = 4\cos 30 \, i + 4\sin 30 \, j$

$\vec{A} = 3.5 i + 2 j$ (C)

---

(3) $\vec{A} = 3.5 i + 2 j$

$\vec{B} = -5 i + 0$ في اتجاه -x

$\vec{C} = 0 + 4 j$ في اتجاه +y

$\vec{A} + \vec{B} + \vec{C} = -1.5 i + 6 j$ (B)

(2)

(4) $\vec{A} = 2i + 4j + 0$

$\vec{B} = 0 + 0 + 8k$

$\vec{A} \cdot \vec{B} = 0 + 0 + 0 = 0$

$\vec{A} \cdot \vec{B} = 0 \Longrightarrow \theta = 90^\circ$ (A)

---

(5) $\vec{A} = 6i - 10j + 4k$

$\vec{B} = 4i - 7j + 4k$

$\vec{A} - \vec{B} = 2i - 3j$ (B)

---

(6) $\vec{a} = 6i + 10j - 4k$

$\vec{b} = 4i - 7j + 5k$

$\vec{a} \cdot \vec{b} = 24 - 70 - 20 = -66$ (C)

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(7) $\vec{A} = 3i + 4j$

$|\vec{A}| = \sqrt{(3)^2 + (4)^2} = \sqrt{9+16} = 5$

متجه الوحدة باتجاه $\vec{A}$: $\vec{U}_A = \frac{\vec{A}}{|\vec{A}|} = \frac{3i + 4j}{5} = \frac{3}{5}i + \frac{4}{5}j$ (D)

(8) $v_0 = 0$ $a = -9.8\ m/s^2$

$t = 4\ s$ $y = ?$

$y = v_0 t + \frac{1}{2} a t^2 = 0(4) + \frac{1}{2}(-9.8)(4)^2$

$y = -78.4\ m$

distance $= |y| = 78.4\ m$ (E)

---

(9) $v_0 = 0$ $x = 50 m$

$t = 5 s$ $a = ?$

$x = v_0 t + \frac{1}{2} a t^2$

$50 = 0(5) + \frac{1}{2} a (5)^2 \Rightarrow$

$a = 4\ m/s^2$ (D)

---

(10) $\vec{A} = 2i + 4j$ $\vec{B} = a_x i - j$

$\vec{A} \times \vec{B} = -20k$ $a_x = ??$

(4)

$$\vec{A} \times \vec{B} = \begin{vmatrix} \overset{+}{i} & \overset{-}{j} & \overset{+}{k} \\ 2 & 4 & 0 \\ a_x & -1 & 0 \end{vmatrix}$$

$$= 0i - 0j + k(-2 - 4a_x) = -20k$$ معطى

$$-2 - 4a_x = -20$$

$$-4a_x = -20 + 2$$

$$-4a_x = -18$$

$$a_x = \frac{-18}{-4} = 4.5 \quad \text{(C)}$$

---

(11) $\vec{A} = 2i + 4j$

لا يحتوي على k

الاتجاه العمودي عليه في k فقط وهو 5k (B)

(12) $C = A^2 B^2$

$A^2 = \frac{C}{B^2} \Rightarrow \frac{m^2}{s^2}$ "$\sqrt{\ }$"

m/s (A)

---

(13) $v_0 = 0$ $x_1 = 4m$ $x_2 = 12m$

displacement $= \Delta x = x_2 - x_1 = 12 - 4$

$= 8m$ (B)

---

(14) (C) $\downarrow a = -g$

---

(15) $\vec{C} = -15\hat{i} + 35\hat{j} + 5\hat{k}$

$|\vec{C}| = \sqrt{(15)^2 + (35)^2 + (5)^2} = 38.4$

$\theta = \cos^{-1}\left(\frac{C_y}{|\vec{C}|}\right) = \cos^{-1}\left(\frac{35}{38.4}\right) =$

$= 24.3^\circ$ (D)

(6)

(16) $g/cm^3 \xrightarrow{\times 1000} kg/m^3$

$11.34 \times 1000 = 11340 \ kg/m^3$ (E)

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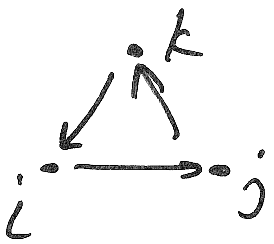
(17) $(\hat{j} \times \hat{k}) \times \hat{j}$

$\downarrow$

$= \hat{i} \times \hat{j} = k$ (D)



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(18) $x = 10t + 4t^2$

نشتق

$v = 10 + 8t$

$t = 3s \Rightarrow v = 10 + 8(3) = 34 \ m/s$ (C)

---

(19) Constant velocity $\Rightarrow a = 0$ (B)

---

(20) $x = 6t^2 + 2$

نشتق

$v = 12t$

نشتق

$a = 12 \ m/s^2$ (A)

(21) 325 km/h

km/h $\xrightarrow{\times \frac{1000}{3600}}$ m/s

$325\ km/h \times \frac{1000}{3600} = 90.3\ m/s$

(B)

---

(22) $v_0 = 20\ m/s$ $a = -9.8\ m/s^2$

$y = 10m$ $v = ?$

$v^2 = v_0^2 + 2ay = (20)^2 + 2(-9.8)(10)$

$v = 14.3\ m/s$ (c)

---

(23) $x = 21 + 22t - 6t^2$

$\Delta x = x_2 - x_1$

$t_1 = 1s \Rightarrow x_1 = 21 + 22 - 6 = 37m$

$t_2 = 3s \Rightarrow x_2 = 21 + 22(2) - 6(4) = 41m$

$\Delta x = x_2 - x_1 = 41 - 37 = 4m$ (b)

(24) not vector ⇒ scalar

speed (E)

---

(25) $|\vec{A}| = 5$ $|\vec{B}| = 4$

$|\vec{A} \times \vec{B}| = 17.32$ $\theta = ??$

$|\vec{A} \times \vec{B}| = \vec{A} \times |\vec{B}| \sin\theta$

$17.32 = 5(4) \sin\theta$

$\sin\theta = 0.866$

$\theta = \sin^{-1}(0.866) = 60^\circ$ (D)

---

(26) m/s (A)

---

(27) m/s $\xrightarrow{\times \frac{3600}{1000}}$ km/h

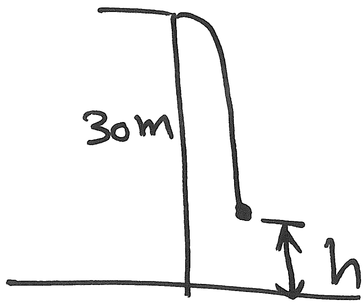
$30 \times \frac{3600}{1000} = 108$ km/h (B)

9

(28) $v = \frac{x}{t}$ (x → distance, t → time) (D)

---

(29) dropped ⇒



$v_0 = 0$ $a = -9.8\ m/s$

$y = ??$ $v = -13.6\ m/s$

$$v^2 = v_0^2 + 2ay$$

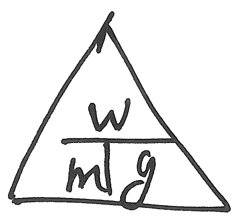
$$(-13.6)^2 = 0 + 2(-9.8)y \Rightarrow y = -9.4\ m$$

$$\text{height} = h = 30 - |y| = 30 - 9.4$$

$$= 20.6\ m$$ (D)

---

(30) $m = 80\ kg$



$$W = mg = 80 \times 9.8$$

$$= 784\ N$$

$$= 784\ kg.m^2/s^2$$ (E)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

D

First Term Exam	2/12/1434 H	**Time:90** min.
Student Name:	Student no.:	Section:

Q.1 The **SI** unit of length is:
(A) m (B) s (C) m/s (D) kg

Q.2 A man has a mass of 90 kg. The mass of the man in grams is:
(A) 9×10^1 g (B) 9×10^2 g (C) 9×10^3 g (D) 9×10^4 g

Q.3 A cube with side length of 60 mm, its volume in **SI** unit is: (volume = length^3)
(A) 7.29×10^{-4} m^3 (B) 5.12×10^{-4} m^3 (C) 3.43×10^{-4} m^3 (D) 2.16×10^{-4} m^3

Q.4 Which unit of these is used to measure the acceleration?
(A) kg (B) m/s^2 (C) m (D) m/s

Q.5 A train moves with a speed of 54 mile per hour. The speed in **SI** units is: (Hint: 1 mile=1610 m)
(A) 29.52 m/s (B) 27.28 m/s (C) 24.15 m/s (D) 18.78 m/s

Q.6 A squire classroom has a length of 500 cm. its area in **SI** units is:
(A) 25 m^2 (B) 250 m^2 (C) 2500 m^2 (D) 25000 m^2

Q.7 A car moves along the x-axis with constant speed, the acceleration of the car is:
(A) Decreasing (B) 9.8 m/s^2 (C) Zero (D) Increasing

Q.8 A bicycle travels 14 km in 30 min. Its average speed is:
(A) 34 km/h (B) 28 km/h (C) 22 km/h (D) 14 km/h

Q.9 A particle movies along the x-axis according to the equation $x = 2t + 3t^2$, where x is in meters and t is in seconds. The instantaneous speed at t = 3 sec. is:
(A) 14 m/s (B) 20 m/s (C) 26 m/s (D) 32 m/s

Q.10 A car moving with constant acceleration covers the distance between two points 80 m apart in 4 seconds. If its speed as it passes the second point is 20 m/s, its speed at the first point is:
(A) 20 m/s (B) 15 m/s (C) 10 m/s (D) 5 m/s

Q.11 A car uniformly changes its speed from 20 m/s to 5 m/s in 5 s. Its acceleration is:
(A) - 4 m/s^2 (B) - 3 m/s^2 (C) - 2 m/s^2 (D) - 1 m/s^2

Q.12 A ball thrown straight up from a bridge would have acceleration with magnitude of:
(A) Zero (B) more than 9.8 m/s^2 (C) less than 9.8 m/s^2 (D) 9.8 m/s^2

Q.13 An object falling toward the earth's surface will have velocity that its magnitude is: (Ignore air resistance)
(A) Increasing (B) Zero (C) 9.8 m/s^2 (D) Decreasing

Q.14 The position of a ball thrown vertically upward is given by the equation $y = 1.00 + 12.0\ t - 5.00\ t^2$ (SI units), the height at t = 0 is:
(A) 4 m (B) 3 m (C) 2 m (D) 1 m

Q.15 A ball is thrown vertically upward to reach a maximum height of 30 m. The initial speed is:
(A) 28.0 m/s (B) 24.2 m/s (C) 19.8 m/s (D) 14.0 m/s

Q.16 A stone is falling down from rest at a height of 15 m above the ground. It reaches the ground after:
(A) 1.01 s (B) 1.43 s (C) 1.75 s (D) 2.02 s

Q.17 A boy shot a football vertically up with an initial speed v_o. When the ball was 2 m above the ground, the speed was 0.7 of the initial speed. The initial speed is :
(A) 14.36 m/s (B) 10.43 m/s (C) 8.77 m/s (D) 6.56 m/s

Q.18 A ball is thrown vertically upward at speed of 13 m/s. The time will take to reach its maximum height is:
(A) 0.61 s (B) 0.82 s (C) 1.12 s (D) 1.33 s

Q.19 Which of the following quantities is not a vector quantity?
(A) Distance (B) Velocity (C) Mass (D) Acceleration

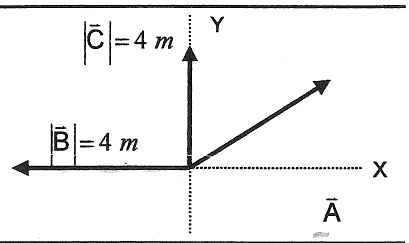
Q.20 The components of vector $\bar{A}$ are given as A_x = 5.2 m and A_y = - 5.6 m. The magnitude of vector $\bar{A}$ is:
(A) 4.46 m (B) 6.30 m (C) 7.64 m (D) 9.19 m

Q.21 Given $\bar{A}=2\hat{i}+\hat{j}+3\hat{k}$, $\bar{B}=2\hat{i}-6\hat{j}+7\hat{k}$, $\bar{C}=2\hat{i}-\hat{j}+4\hat{k}$. Then the vector $\bar{D}=2\bar{A}-\bar{B}-\bar{C}$ is:
(A) $4\hat{i}-12\hat{j}+13\hat{k}$ (B) $-3\hat{j}+2\hat{k}$ (C) $-4\hat{i}+14\hat{j}-15\hat{k}$ (D) $9\hat{j}-5\hat{k}$

Q.22 Given $\bar{a}=4\hat{i}+\hat{j}+\hat{k}$, $\bar{b}=\hat{i}-2\hat{j}+2\hat{k}$, Then $(\bar{a}\bullet\bar{b})$ is:
(A) $4\hat{i}-2\hat{j}+2\hat{k}$ (B) 4 (C) $4\hat{i}+2\hat{j}+2k$ (D) -16

Q.23 The result of $\hat{i}\bullet\hat{j}$ is:
(A) $\hat{i}$ (B) $\hat{k}$ (C) Zero (D) $\hat{j}$

Q.24 In figure, if $\bar{A}+\bar{B}-\bar{C}=2\hat{i}$ then the vector $\bar{A}$ in unit vector notation is:



(A) $4\hat{i}+2\hat{j}$ (B) $9\hat{i}+4\hat{j}$ (C) $6\hat{i}+4\hat{j}$ (D) $5\hat{i}-4\hat{j}$

Q.25 Given $\bar{c}=2\hat{i}+3\hat{j}+2\hat{k}$ and $\bar{d}=\hat{i}-2\hat{j}+3\hat{k}$,then the angle between vector $\bar{c}$ and $\bar{d}$ is:
(A) 90° (B) 83° (C) 75° (D) 53°

Q.26 If $\bar{A}\bullet\bar{B}=0$,the angle between the vectors $\bar{A}$ and $\bar{B}$ is: (Hint: $\bar{A}$ and $\bar{B}$ are non-zero vectors)
(A) 360° (B) 270° (C) 180° (D) 90°

Q.27 If $\bar{A}$ and $\bar{B}$ are vectors with magnitudes 5 and 4, respectively, and the magnitude of their cross product is 13.3, then the angle between $\bar{A}$ and $\bar{B}$ is:
(A) 34° (B) 37° (C) 42° (D) 50°

Q.28 Given that $\bar{a}=\hat{i}+2\hat{j}+2\hat{k}$ and $\bar{b}=2\hat{i}-\hat{j}+2\hat{k}$,then $\bar{a}\times\bar{b}$ is:
(A) $2\hat{i}-2\hat{j}+4\hat{k}$ (B) $2\hat{i}+2\hat{j}+4\hat{k}$ (C) $6\hat{i}+2\hat{j}-5\hat{k}$ (D) 4

Q.29 The result of $(\hat{i}\times\hat{j})\times\hat{i}$ is:
(A) $\hat{j}$ (B) $\hat{i}$ (C) Zero (D) $\hat{k}$

Q.30 The result of $(\hat{k}\times\hat{i})\bullet\hat{j}$ is:
(A) $\hat{i}$ (B) $\hat{j}$ (C) 1 (D) $\hat{k}$

Words Meanings:

Above	فوق	Decreasing	يتناقص	Man	رجل	Side	ضلع
Acceleration	تسارع	Distance	إزاحة	Mass	كتله	Speed	سرعة
According	طبقاً لـ	Down	تحت	Maximum	حد أقصى	Stone	حجر
After	بعد	Earth	أرض	Measure	يقيس	Straight	مستقيم
Along	على طول	Equation	معادلة	Meter	متر	Squire	مربع
Angle	زاوية	Falling	يسقط	Mile	ميل	Surface	سطح
Area	مساحة	Figure	رسم بياني	Move	يتحرك	Thrown	قذف
Average	متوسط	Following	التالي	Notation	صيغه	Time	زمن
Ball	كره	Football	كرة قدم	Object	جسم	Toward	بإتجاه
Between	بين	Given	معطى	Particle	جسيم	Train	قطار
Bicycle	دراجة	Gram	جرام	Point	نقطة	Travel	يرحل
Boy	ولد	Ground	سطح الارض	Position	موضع	Uniformly	بانتظام
Bridge	جسر	Height	إرتفاع	Product	ناتج	Unit	وحدة
Car	سيارة	Hour	ساعة	Quantity	كمية	Up	فوق
Classroom	فصل دراسي	Ignore	أهمل	Reach	يصل	Upward	نحو الأعلى
Change	تغير	Increasing	تزايد	Resistance	مقاومة	Used	يستعمل
Component	مركبة	Initial	ابتدائي	Respectively	على التوالى	Vector	متجه
Constant	ثابت	Instantaneous	لحظي	Result	نتيجة	Velocity	سرعة
Cover	يغطي	Length	طول	Second	ثانية	Vertically	عمودياً
Cross	ضرب اتجاهي	Level	مستوى	Shot	يقذف	Volume	حجم
Cube	مكعب	Magnitude	مقدار	SI	نظام دولي	x-axis	محور السينات

Some Used Formula:

$\Delta x = x_2 - x_1.$	$a_x = a\cos\theta$ and $a_y = a\sin\theta.$
$v_{avg} = \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1}.$	$a = \sqrt{a_x^2 + a_y^2}$ and $\tan\theta = \frac{a_y}{a_x}.$
$s_{avg} = \frac{\text{total distance}}{\Delta t}.$	$\vec{a}\cdot\vec{b} = ab\cos\phi,$
$v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}.$	$\vec{a}\cdot\vec{b} = a_x b_x + a_y b_y + a_z b_z.$
$a_{avg} = \frac{\Delta v}{\Delta t}.$	
$a = \frac{dv}{dt} = \frac{d^2x}{dt^2}.$	$\vec{a}\times\vec{b} = ab\sin\phi,$

$$\vec{a}\times\vec{b} = (a_y b_z - b_y a_z)\hat{i} + (a_z b_x - b_z a_x)\hat{j} + (a_x b_y - b_x a_y)\hat{k}.$$

$$v = v_0 + at,$$

$$x - x_0 = v_0 t + \tfrac{1}{2}at^2,$$

$$v^2 = v_0^2 + 2a(x - x_0),$$

$$x - x_0 = \tfrac{1}{2}(v_0 + v)t,$$

$$x - x_0 = vt - \tfrac{1}{2}at^2.$$

for free full $a = -g = -9.8 \text{ m/s}^2$

قسم الفيزياء يتمنى لكم دوام التوفيق ،،،

(1) (A)

---

(2) $90 \times 1000 = 90000 = 9 \times 10^4\ g$ (D)

---

(3) $60\ m \Rightarrow \frac{60}{1000} = 0.06\ m$

$\text{Volume} = (\text{length})^3 = (0.06)^3$

$= 2.16 \times 10^{-4}\ m^3$ (D)

---

(4) m/s^2 (B)

---

(5) $1\ \text{mile} = 1610\ m$

$54\ \text{mile} \Rightarrow 54 \times 1610$

$1h = 3600\ s$

$54\ \text{mile}/h = \frac{54 \times 1610}{3600} = 24.15\ m/s$

(C)

(6) $cm \xrightarrow{\div 100} m$

$$500cm = \frac{500}{100} = 5m$$

$$Area = (length)^2 = (5)^2 = 25\,m^2$$ (A)

---

(7) Constant speed $\Rightarrow a = 0$ (C)

---

(8) $x = 14\,km$ $t = 30\,min = \frac{30}{60}$

$= 0.5h$

$$v = \frac{x}{t} = \frac{14}{0.5} = 28\,km/h$$ (B)

---

(9) $x = 2t + 3t^2$

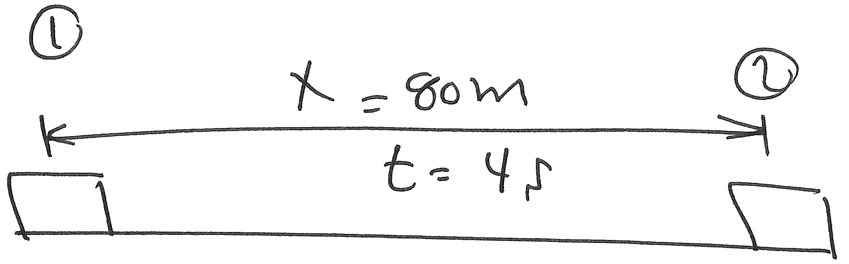
$$v = \frac{dx}{dt} = 2 + 6t$$

$t = 3\,sec \Rightarrow v = 2 + 6(3) = 20\,m/s$

(B)

③

⑩



$v_0 = ??$ $v = 20$ m/ث

$$x = \frac{v + v_0}{2} t$$

$$80 = \frac{20 + v_0}{2} (4)$$

$v_0 = 20$ m/ث (A)

---

⑪ $v_0 = 20$ m/ث $v = 5$ m/ث

$t = 5$ ث $a = ?$

$v = v_0 + at \Rightarrow 5 = 20 + a(5)$

$5 - 20 = 5a$ $-15 = 5a \xRightarrow{\div 5}$

$a = -3$ m/ث² (B)

---

⑫ $a = -9.8$ m/ث² في حالة السقوط الحر

$|a| = 9.8$ m/ث² (D)

(13) نحو الأرض

toward the earth

increasing يزداد مقدار السرعة

(A)

---

(14) $y = 1 + 12t - 5t^2$

$t = 0 \Rightarrow y = 1 + 0 - 0 = 1m$

height $= |y| = 1m$ (D)

---

(15) $v_0 = ?$ $a = -9.8 m/s^2$

$y = 30m$ $v = 0$ (maximum height)

$v^2 = v_0^2 + 2ay$

$0 = v_0^2 + 2(-9.8)(30)$

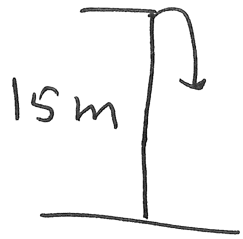
$0 = v_0^2 - 588$

$v_0^2 = 588$ "$\sqrt{\ }$"

$v_0 = 24.2 m/s$ (B)

(16) from rest $\Rightarrow v_0 = 0$

$y = -15\,m$ (هبوط) $\quad t = ?$



$a = -9.8\,m/s^2$

$y = v_0 t + \frac{1}{2} a t^2 \Rightarrow -15 = 0 + \frac{1}{2}(-9.8)t^2$

$-15 = -4.9t^2 \Rightarrow t^2 = \frac{15}{4.9} = 3.061$ "ث"

$t = 1.75\,s$ (C)

---

(17) $v_0 \qquad y = 2\,m$

$v = 0.7 v_0 \qquad a = -9.8\,m/s^2$

$v^2 = v_0^2 + 2ay$

$(0.7 v_0)^2 = v_0^2 + 2(-9.8)(2)$

$0.49 v_0^2 = v_0^2 - 39.2$

$0.49 v_0^2 - v_0^2 = -39.2$

$-0.51 v_0^2 = -39.2 \Rightarrow v_0^2 = \frac{39.2}{0.51}$

$v_0^2 = 76.86 \xrightarrow{\text{"ث"}} v_0 = 8.77\,m/s$ (C)

(18) $v_0 = 13 m/s$ $t = ?$

maximum height $\Rightarrow v = 0$ $a = -9.8 m/s^2$

$v = v_0 + at \Rightarrow 0 = 13 - 9.8t$

$9.8t = 13 \Rightarrow t = 1.33 s$ (D)

---

(19) (A), (C)

---

(20) $A_x = 5.2 m$ $A_y = -5.6 m$

$|\vec{A}| = \sqrt{A_x^2 + A_y^2} = \sqrt{(5.2)^2 + (5.6)^2}$
$= 7.64 m$ (C)

---

(21) $\vec{A} = 2i + j + 3k$ $\vec{B} = 2i - 6j + 7k$
$\vec{C} = 2i - j + 4k$

$2\vec{A} = 4i + 2j + 6k$
$\vec{B} = 2i - 6j + 7k$
$\vec{C} = 2i - j + 4k$

$\vec{D} = 2\vec{A} - \vec{B} - \vec{C} = 9j - 5k$ (D)

7

(22)

$\vec{a} = 4i + j + k$

$\vec{b} = i - 2j + 2k$

$\vec{a} \cdot \vec{b} = 4 - 2 + 2 = 4$ (B)

---

(23) $i \cdot j = 0$ (C)

---

(24) $|\vec{B}| = 4m$ in $-x$

$\boxed{\vec{B} = -4i}$

$|\vec{C}| = 4m$ in $+y$ $\Rightarrow \boxed{\vec{C} = 4j}$

$\vec{A} + \vec{B} - \vec{C} = 2i$

$\vec{A} - 4i - 4j = 2i$

$\vec{A} = 2i + 4i + 4j$

$\boxed{\vec{A} = 6i + 4j}$ (C)

(25)

$$\vec{c} = 2i + 3j + 2k$$

$$\vec{d} = i - 2j + 3k$$

$$\vec{c} \cdot \vec{d} = 2 - 6 + 6 = 2$$

$$|\vec{c}| = \sqrt{(2)^2 + (3)^2 + (2)^2} = \sqrt{17}$$

$$|\vec{d}| = \sqrt{(1)^2 + (2)^2 + (3)^2} = \sqrt{14}$$

$$\cos\theta = \frac{\vec{c} \cdot \vec{d}}{|\vec{c}||\vec{d}|} = \frac{2}{\sqrt{17}\sqrt{14}} = 0.1296$$

$$\theta = \cos^{-1}(0.1296) = 82.55^\circ \simeq 83^\circ$$ (B)

---

(26) $\vec{A} \cdot \vec{B} = 0 \Rightarrow \vec{A} \perp \vec{B} \Rightarrow \theta = 90^\circ$ (D)

---

(27) $|\vec{A}| = 5$ $|\vec{B}| = 4$

$|\vec{A} \times \vec{B}| = 13.3$ $\theta = ?$

$$|\vec{A} \times \vec{B}| = |\vec{A}||\vec{B}| \sin\theta \Rightarrow 13.3 = (5 \times 4) \sin\theta$$

$$\sin\theta = \frac{13.3}{20} = 0.665 \Rightarrow \theta = \sin^{-1}(0.665) \simeq 42^\circ$$ (C)

(28) $\vec{a} = i + 2j + 2k \qquad \vec{b} = 2i - j + 2k$

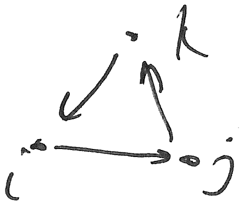
$$\vec{a} \times \vec{b} = \begin{vmatrix} \overset{+}{i} & \overset{-}{j} & \overset{+}{k} \\ 1 & 2 & 2 \\ 2 & -1 & 2 \end{vmatrix}$$

$$= i\left((2)(2) - (2)(-1)\right) - j\left((1)(2) - 2(2)\right) + k\left((1)(-1) - 2(2)\right)$$

$$= 6i + 2j - 5k$$ (C)

---

(29) $(i \times j) \times i = k \times i = j$ (A)



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(30) $(k \times i) \cdot j = j \cdot j = 1$ (C)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

B

Test 1	30/11/1433 H	**Time:90** min.
Student Name:	Student no.:	Section:

Q.1 One nanometer is equal to:
(A) 10^{-9} m (B) 10^{-8} m (C) 10^{-5} m (D) 10^{-6} m (E) 10^{-12} m

Q.2 The prefix (micro) means:
(A) 0.01 (B) 0.01 (C) 0.001 (D) 0.000001 (E) 0.1

Q.3 The fundament unit which is common in MKS and FPS system is:
(A) foot (B) kilogram (C) meter (D) pound (E) second

Q.4 What is the appropriate SI unit of Mass:
(A) gram (B) inch (C) foot (D) meter (E) kilogram

Q.5 A car is traveling at 36 km/h. The speed of this car is equivalent to:
(A) 10 m/s (B) 20 m/s (C) 5 m/s (D) 36 m/s (E) 11 m/s

Q.6 A train changes its speed from 20 m/s to 5 m/s in 6 s. The distance it moved in the sixth second is:
(A) 75 m (B) 68.75 m (C) 80 m (D) 31.25 m (E) 6.25 m

Q.7 Plane lands with a speed of 96 m/s and accelerates at -8 m/s^2. The distance covered to come to stop is:
(A) 576 m (B) 765 m (C) 686 m (D) 150 m (E) 628 m

Q.8 A particle moves in the x-direction with a constant acceleration of 3 m/s^2. If its initial speed is 2.2 m/s then its speed at t=3.6 s is:
(A) 11.6 m/s (B) 13 m/s (C) 7.8 m/s (D) 8.8 m/s (E) 9.9 m/s

Q.9 The speed of a car moving on a straight road is given (m/s) as a function of time t in second by the following equation $v(t)=24+t^3$, the acceleration of the car at t=2 s is:
(A) 3 m/s^2 (B) 12 m/s^2 (C) 6 m/s^2 (D) 24 m/s^2 (E) 15 m/s^2

Q.10 A stone is dropped from a height of 28.5 m above the ground. The stone reaches ground after:
(A) 2.41 s (B) 1.1 s (C) 3.0 s (D) 2.29 s (E) 3.5 s

Q.11 A ball is thrown vertically from ground level to rise to a maximum height of 45 m. The initial speed is:
(A) 245 m/s (B) 100 m/s (C) Zero (D) 31.3 m/s (E) 29.70 m/s

Q.12 A boy walks 180 meters due east and then turns around and walks 30 meters due west. The boy's displacements is:
(A) 30 m east (B) 150 m east (C) 120 m east (D) 180 m west (E) 180 m east

Q.13 A boy walks 150 meters due east and then turns around and walks 40 meters due west. The boy walked a distance of:
(A) 190 m (B) 150 m (C) 110 m (D) 180 m (E) 330 m

Q.14 Suppose you increase your walking speed from 2 m/s to 5 m/s in a period of 2 s. your acceleration is:
(A) 6 m/s^2 (B) 4 m/s^2 (C) 1.5 m/s^2 (D) 1 m/s^2 (E) 3 m/s^2

Q.15 In order to determine speed you must know.
(A) time (B) distance (C) mass (D) both A and B (E) both B and C

Q.16 In the absence of air resistance, an objects fall at constant.
(A) acceleration (B) velocity (C) speed (D) distance (E) none of these

B

Q.17 What is the speed of an object at rest?
(A) 1.0 m/s (B) 9.8 m/s (C) zero (D) 32 m/s (E) -9.8 m/s

Q.18 A soccer ball is kicked horizontally. If its displacement after 5 s is 30 m, then its average speed is:
(A) 5.0 m/s (B) 8.0 m/s (C) 14.1 m/s (D) 6.0 m/s (E) Zero

Q.19 Which of the following quantities is not a scalar quantity?
(A) Mass (B) Time (C) Speed (D) Temperature (E) weight

Q.20 A vector of magnitude 10 has an angle with the positive x-axis of 120°. There components are:
(A) 5 and 8.7 (B) -5 and -8.7 (C) 5 and -8.7 (D) -5 and 8.7 (E) none of these

Q.21 A ball is released at rest from the top of building. It hits the ground after falling for 5 s. The magnitude of the height of the building is:
(A) 122.5 m (B) 224 m (C) 332 m (D) 176.4 m (E) 420 m

Q.22 An object falling toward the earth's surface will have velocity that its magnitude is: (Ignore air resistance)
(A) Increasing (B) Decreasing (C) 9.8 m/s^2 (D) Zero (E) none of these

Q.23 The result of $(\hat{j}\times\hat{k})\cdot\hat{i}$ is:
(A) $\hat{i}$ (B) 1 (C) Zero (D) $\hat{k}$ (E) $\hat{j}$

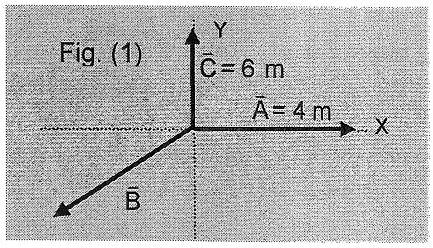
Q.24 Given $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{b}=2\hat{i}-3\hat{j}+4\hat{k}$, $\vec{c}=2\hat{i}-\hat{j}-4\hat{k}$. If $\vec{r}=\vec{a}+\vec{b}+\vec{c}$ .Then the vector $\vec{r}$ is:
(A) $-\hat{i}-2\hat{j}+3\hat{k}$ (B) $\hat{i}+4\hat{j}-5\hat{k}$ (C) $3.5\hat{i}$ (D) $5\hat{i}-2\hat{j}+3\hat{k}$ (E) $\hat{i}+2\hat{j}-5k$

Q.25 A vector has components x=8 m and y=6 m. its magnitude and direction with positive x-axis are:
(A) 10 m and 57° (B) 14 m and 53° (C) 10 m and 53° (D) 10 m and 36.7° (E) 10 m and 30°

Q.26 Given $\vec{C}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{D}=2\hat{i}-3\hat{j}+4\hat{k}$, then the angle between vector $\vec{C}$ and $\vec{D}$ is:
(A) 90° (B) 30° (C) 45° (D) 180° (E) 66.6°

Q.27 Given $\vec{a}=\hat{i}+\hat{j}+3\hat{k}$, $\vec{b}=2\hat{i}-3\hat{j}+4\hat{k}$, $\vec{c}=2\hat{i}+2\hat{j}-4\hat{k}$. Then $\vec{a}\cdot(\vec{b}\times\vec{c})$ is:
(A) $3\hat{i}+4\hat{j}-5\hat{k}$ (B) 66 (C) 25 (D) $\hat{i}+2\hat{j}-5\hat{k}$ (E) 50

Q.28 In figure (1), if $\vec{A}+\vec{B}+\vec{C}=-2\hat{i}$ then the vector $\vec{B}$ in unit vector notation is:
(A) $-6\hat{i}-6\hat{j}$ (B) $9\hat{i}+4\hat{j}$ (C) $-8\hat{i}+6\hat{j}$ (D) $5\hat{i}-4\hat{j}$ (E) $4\hat{i}$



Q.29 The angle between vector $\vec{E}=-4\hat{i}+2\hat{j}$ and the positive + x-axis is:
(A) 90° (B) 153.4° (C) 45° (D) 180° (E) 53.13°

Q.30 If $\vec{A}$ and $\vec{B}$ are vectors with magnitudes 5 and 4, respectively, and the their dot product is 17.32, then the angle between $\vec{A}$ and $\vec{B}$ is:
(A) 90° (B) 60° (C) 45° (D) 180° (E) 30°

(1) Nanometer = 10^{-9} m (A)

---

(2) micro = μ = 10^{-6} = 0.000 001 (D)

---

(3)

MKS → متر ، كيلو ، ثانية

FPS → قدم ، باوند ، ثانية

The fundamental الوحدة الأساسية المشتركة unit which is common is **second** (E)

---

(4) Mass ⇒ kilogram (F)

---

(5) 36 km/h ⇒ $36 \times \frac{1000}{3600}$ = 10 m/s (A)

---

(6) $V_0 = 20$ m/s $V = 5$ m/s $t = 6$ s $a = ?$

$V = V_0 + at$

$5 = 20 + 6a$

$5 - 20 = 6a \Rightarrow -15 = 6a$ $(\div 6)$

$a = \frac{-15}{6} = -2.5$ m/s^2

(2)

$v_0 = 20\ m/s$ $\quad t = 5\ s$ $\quad a = -2.5\ m/s^2$

$$x_1 = v_0 t + \frac{1}{2} a t^2 = 20(5) + \frac{1}{2}(-2.5)(5)^2$$

$$\boxed{x_1 = 68.75\ m}$$

$v_0 = 20\ m/s$ $\quad t = 6\ s$ $\quad a = -2.5\ m/s^2$

$$x_2 = v_0 t + \frac{1}{2} a t^2 = 20(6) + \frac{1}{2}(-2.5)(6)^2$$

$$x_2 = 75\ m$$

المسافة المقطوعة في الثانية السادسة = المسافة المقطوعة
في ستة ثواني - المسافة المقطوعة في خمس ثوان

$$x = x_2 - x_1 = 75 - 68.75 = 6.25\ m$$

(E)

(7) $V_0 = 96\ m/s$ $a = -8\ m/s^2$

$x = ?$ $V = 0$

$$V^2 = V_0^2 + 2ax \Rightarrow 0 = (96)^2 + 2(-8)x$$

$$0 = (96)^2 - 16x \Rightarrow 16x = (96)^2 \quad (\div 16)$$

$$x = \frac{(96)^2}{16} = 576\ m$$ (A)

---

(8) $a = 3\ m/s^2$ $V_0 = 2.2\ m/s$

$t = 3.6\ s$ $V = ?$

$$V = V_0 + at = 2.2 + 3(3.6) = 13\ m/s$$

(B)

---

(9) $V = 24 + t^3$

$$a = \frac{dV}{dt} = 3t^2$$

$t = 2s \Rightarrow a = 3(2)^2 = 12\ m/s^2$ (B)

(4)

(10) dropped $\Rightarrow V_0 = 0$

$y = -28.5\ m$ (داخل/↓)

$a = -9.8\ m/s^2$ $t = ?$

$y = V_0 t + \frac{1}{2} a t^2$

$-28.5 = 0 + \frac{1}{2}(-9.8)t^2$

$-28.5 = -4.9 t^2$

$t^2 = \frac{-28.5}{-4.9} = 5.816$ "$\sqrt{\ }$"

$t = \sqrt{5.816} = 2.41\ s$ (A)

---

(11) maximum height $\Rightarrow V = 0$ $a = -9.8\ m/s^2$

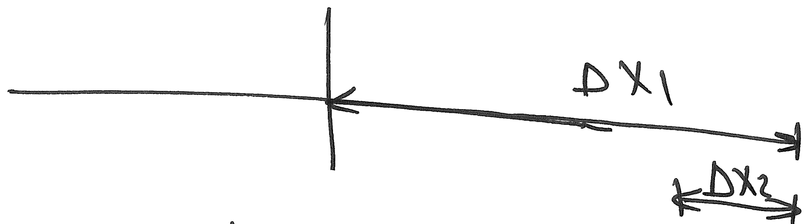
$V_0 = ?$ $y = 45\ m$

$V^2 = V_0^2 + 2ay \Rightarrow 0 = V_0^2 + 2(-9.8)(45)$

$0 = V_0^2 - 882 \longrightarrow V_0 = 882$ "$\sqrt{\ }$"

$V_0 = \sqrt{882} = 29.7\ m/s$ (E)

(12)



$\Delta x_1 = 180\,i$ east

$\Delta x_2 = -30\,i$ west

$\Delta x = 180i - 30i = 150i = 150\text{ m}$ east

---

(13) distance $= 150 + 40 = 190\text{ m}$ (A)

---

(14) $v_0 = 2\text{ m/s}$ $v = 5\text{ m/s}$ $a = ?$ $t = 2\text{ s}$

$v = v_0 + at \Rightarrow 5 = 2 + 2a$

$5 - 2 = 2a$ $3 = 2a$

$a = \frac{3}{2} = 1.5\text{ m/s}^2$ (C)

---

(15) $s = \frac{x}{t}$ $x \rightarrow$ distance, $t \rightarrow$ time

(D)

(16) تسارع ثابت

$a = 9.8\ m/s^2$ (A) في السقوط الحر

---

(17) at rest ساكن

$v = 0$ (C)

---

(18) $x = 30m$ $t = 5s$

$S_{ave} = \frac{x}{t} = \frac{30}{5} = 6\ m/s$ (D)

---

(19) Weight كمية متجهة

<u>not scalar</u> (E)

---

(20) $|\vec{A}| = 10$ $\theta = 120°$

$A_x = |\vec{A}| \cos\theta = 10 \cos 120 = -5$

$A_y = |\vec{A}| \sin\theta = 10 \sin 120° = 8.66$ (D)

---

(21) $v_0 = 0$ $a = -9.8\ m/s^2$ $t = 5s$ $y = ?$

$y = v_0 t + \frac{1}{2} a t^2 = 0 + \frac{1}{2}(-9.8)(5)^2 = -122.5m$

$|y| = \text{height} = 122.5m$ (A)

(22) في حالة سقوط الجسم نحو الأرض

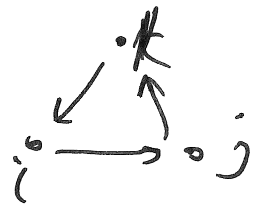
مقدار السرعة يتزايد

increasing (A)

---

(23) $(\hat{j} \times \hat{k}) \cdot \hat{i}$

$= \hat{i} \cdot \hat{i} = 1$ (B)



---

(24) $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$

$\vec{b} = 2\hat{i} - 3\hat{j} + 4\hat{k}$

$\vec{c} = 2\hat{i} - \hat{j} - 4\hat{k}$

$\vec{r} = \vec{a} + \vec{b} + \vec{c} = 5\hat{i} - 2\hat{j} + 3\hat{k}$ (D)

---

(25) $x = 8m$ $y = 6m$

$\vec{A} = x\hat{i} + y\hat{j} = 8\hat{i} + 6\hat{j}$

$|\vec{A}| = \sqrt{(8)^2 + (6)^2} = 10\,m$

$\theta = \tan^{-1}\left|\frac{6}{8}\right| = 36.87^\circ$ (D)

(26) $\vec{C} = i + 2j + 3k$

$\vec{D} = 2i - 3j + 4k$

$\vec{C} \cdot \vec{D} = 2 - 6 + 12 = 8$

$|\vec{C}| = \sqrt{(1)^2 + (2)^2 + (3)^2} = \sqrt{1 + 4 + 9} = \sqrt{14}$

$|\vec{D}| = \sqrt{(2)^2 + (3)^2 + (4)^2} = \sqrt{4 + 9 + 16} = \sqrt{29}$

$\cos\theta = \frac{\vec{C} \cdot \vec{D}}{|\vec{C}||\vec{D}|} = \frac{8}{\sqrt{14}\sqrt{29}} = 0.397$

$\theta = \cos^{-1}(0.397) = 66.6°$ (E)

---

(27) $\vec{a} = i + j + 3k$ $\vec{b} = 2i - 3j + 4k$

$\vec{c} = 2i + 2j - 4k$

$$\vec{b} \times \vec{c} = \begin{vmatrix} i^{+} & j^{-} & k^{+} \\ 2 & -3 & 4 \\ 2 & 2 & -4 \end{vmatrix}$$

$$= i(12-8) - j(-8-8) + k(4+6)$$

$$= 4i + 16j + 10k$$

$$\vec{a} = i + j + 3k$$

$$\vec{b} \times \vec{c} = 4i + 16j + 10k$$

$$\vec{a} \cdot (\vec{b} \times \vec{c}) = 4 + 16 + 30 = 50$$ (E)

---

(28) $\vec{A} = 4i$ ‏+x ‏ﺑﺎﺗﺠﺎه

$\vec{C} = 6j$ ‏+y ‏ﺑﺎﺗﺠﺎه

$$\vec{A} + \vec{B} + \vec{C} = -2i$$

$$4i + \vec{B} + 6j = -2i$$

$$\vec{B} = -2i - 4i - 6j$$

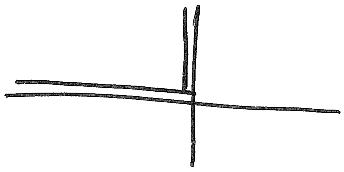
$$\boxed{\vec{B} = -6i - 6j}$$ (A)

10

(29) $\vec{E} = -4i + 2j$

$\theta = \tan^{-1}\left|\frac{2}{4}\right| = 26.6^\circ$ في الربع الثاني

$x \oplus, \; y \ominus \Longrightarrow$



$\theta = 180^\circ - 26.6^\circ = 153.4^\circ$ (B)

---

(30) $|\vec{A}| = 5 \qquad |\vec{B}| = 4 \qquad \vec{A}\cdot\vec{B} = 17.32$

$$\cos\theta = \frac{\vec{A}\cdot\vec{B}}{|\vec{A}|\,|\vec{B}|} = \frac{17.32}{(5)(4)} = 0.866$$

$\theta = \cos^{-1}(0.866) = 30^\circ$ (E)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

حل دوري أول 65
Ph 110

B

Test1	25/11/1432H	Time:90 min.
Student Name:	Student no.:	Section:

Q.1 The density of Aluminum is 2.7 g/cm^3 . This value in SI-unit is:
(A) 270 kg/m^3 (B) 1 kg/m^3 (C)2.7×10^{-3} kg/m^3 (D) 2700 kg/m^3 (E) 27 kg/m^3

Q.2 A car is driving with a constant speed of 36 km/hr. This speed in SI-unit is:
(A) 45 m/s (B) 20 m/s (C) 10 m/s (D) 12.5 m/s (E) 25 m/s

Q.3 The SI (*metric system*) unit of length is,
(A) nm (B) mm (C) meter(m) (D) kilogram(kg) (E) cm

Q.4 A square with an edge of exactly 10 mm has an area of
(A) 10^3 m^2 (B) 1 m^2 (C) 10^{-2} m^2 (D) 10^{-4} m^2 (E) 10^4 m^2

Q.5 The speed υ in m/s of a car is given by $\upsilon = bt^2$ where the time t is in seconds .The unit of b is:
(A) m/s^4 (B) ms (C) m/s^2 (D) m/s^3 (E) m/s

Q.6 The SI units of the base quantities (Length, Mass, Time) are:
(A) gcs (B) MKS (C) cgs (D) cms (E) mgs

Q.7 You walk at speed of 1.22 m/s and then run a distance 20.0 m in 10.0 s .The run average speed is:
(A) 2.2 m/s (B) 1.0 m/s (C) 1.22 m/s (D) 4.0 m/s (E) 2.0 m/s

Q.8 A car moving with a constant speed of 30 m/s for 20 s. The distance covered is:
(A) 300 m (B) 400 m (C) 100 m (D) 500 m (E) 600 m

Q.9 If a particle moves from x = 6 m to x = 11 m then Δx is
(A) + 5.0 m (B) – 5.0 m (C) + 17.0 m (D) -17.0 m (E) + 10.0 m

Q.10 The position of a body moving along the x axis is given by $x = 3t - 4t^2 + t^3$. Its position at t = 2 s is:
(A) + 6.0 m (B) +2.0 m (C) -6.0 m (D) -2.0 m (E) +8.0 m

Q.11 How many meters in 50 kilometers?
(A) 50×10^{-1} m (B) 50×10^3 m (C) 100 m (D) 10 m (E) 50.0 m

Q.12 A stone dropped from a building of height 60.0 meters. The velocity after 2 seconds is:
(A) -16.6 m/s (B) -19.6 m/s (C) -15.6 m/s (D) -17.6 m/s (E) -8.3 m/s

Q.13 A stone dropped from a building of height 20.0 meters. The time at a half of the distance is:
(A) 3.43 s (B) 2.43 s (C) 5.43 s (D) 6.43 s (E) 1.43 s

Q.14 An object is thrown straight up from ground level with a speed of 30 m/s. Its maximum height is:
(A) 10.0 m (B) 20.4 m (C) 45.9 m (D) 5.0 m (E) 15.0 m

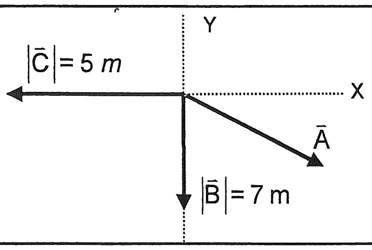
Q.15 An object is thrown straight up from ground level with a speed of 5 m/s. If g = 10 m/s^2 its final velocity after 2 s is:
(A) -6.0 m/s (B) -8.0 m/s (C) -10.0 m/s (D) -15.0 m/s (E) 5.0 m/s

Q.16 A car starts from rest and goes down a slope with a constant acceleration of 2.0 m/s^2. The final velocity at the bottom of the hill is 6.0 m/s. The time is :
(A) 3.0 s (B) 4.0 s (C) 1.0 s (D) 5.0 s (E) 6.0 s

Q.17 The result of $(\hat{i}\times\hat{k})\bullet\hat{j}$ is:

(A) $\hat{i}$ (B) 1 (C) $\hat{j}$ (D) $\hat{k}$ (E) -1

Q.18 In figure, if $\vec{A}-\vec{B}+\vec{C}=-7\hat{j}$ then the vector $\vec{A}$ in unit vector notation is:



(A) $2\hat{i}+10\hat{j}$ (B) $5\hat{i}-10\hat{j}$ (C) $6\hat{i}+6\hat{j}$ (D) $5\hat{i}-14\hat{j}$ (E) $4\hat{i}$

Q.19 The angle between vector $\vec{E}=\hat{i}+3\hat{j}+2\hat{k}$ and the positive y-axis is :

(A) 15° (B) 155° (C) 145° (D) 36.66° (E) 74.49°

Q.20 Given $\vec{a}=9\hat{i}-6\hat{j}+21\hat{k}$, then the magnitude of vector $\frac{1}{3}\vec{a}$ is:

(A) 7.9 (B) $15.33\hat{i}$ (C) $10.33\hat{j}$ (D) $12.33\hat{k}$ (E) 5.2

Q.21 Given two vectors $\vec{a}=3\hat{i}+10\hat{j}-6\hat{k}$, $\vec{b}=-4\hat{i}+5\hat{j}+7\hat{k}$, then $\vec{a}-\vec{b}$ is:

(A) $5\hat{i}+3\hat{j}$ (B) -56 (C) $2\hat{i}+3\hat{j}+7\hat{k}$ (D) $7\hat{i}+5\hat{j}-13\hat{k}$ (E) $10\hat{i}+5\hat{j}$

Q.22 Given two vectors $\vec{A}=6\hat{i}-10\hat{j}+4\hat{k}$, $\vec{B}=4\hat{i}-7\hat{j}+4\hat{k}$, then $\vec{A}+\vec{B}$ is:

(A) $10\hat{i}-17\hat{j}+8\hat{k}$ (B) $4\hat{i}-3\hat{j}$ (C) $9.5\hat{i}$ (D) $7\hat{i}+5\hat{j}-13\hat{k}$ (E) $2\hat{i}+3\hat{j}$

Q.23 Two vectors $\vec{A}=8\hat{j}+6\hat{k}$ and $\vec{B}=2\hat{j}-4\hat{k}$, then the vector product of $\vec{A}\bullet\vec{B}$ is:

(A) $3i+3\hat{j}$ (B) $-44\hat{i}$ (C) -8 (D) $2\hat{i}-3\hat{j}$ (E) 18

Q.24 The result of $(\hat{i}\times\hat{k})$ is:

(A) $\hat{i}$ (B) Zero (C) $-\hat{j}$ (D) $\hat{k}$ (E) 1

Q.25 Given two vectors $\vec{a}=10\hat{j}-4\hat{k}$, $\vec{b}=5\hat{j}+10\hat{k}$, then $\vec{a}\times\vec{b}$ is:

(A) 20 (B) $120\hat{i}$ (C) $10\hat{j}$ (D) $10\hat{i}+3\hat{j}$ (E) $10\hat{i}-3\hat{j}$

Q.26 If the components of the vector $\vec{B}$ is given by B_x=-20 cm and B_y=6 cm, then the direction of this vector with the positive x-axis is:

(A) 163.3° (B) 60° (C) 45° (D) 16.7° (E) 180°

Q.27 If the components of the vector is given by A_x= -97.0 cm and A_y= -24.5 cm, then the magnitude of this vector is:

(A) 1 cm (B) 100 cm (C) 15 cm (D) 10 cm (E) 5 cm

Q.28 Which of the following quantities is a vector quantity?

(A) weight (B) distance (C) time (D) temperature (E) Mass

Q.29 An object falling toward the earth's surface will have acceleration that its magnitude is: (Ignore air resistance)

(A) Decreasing (B) Zero (C) 9.8 m/s^2 (D) Increasing (E) -9.8 m/s^2

Q.30 An object is thrown straight up from ground level with a speed of 15 m/s. Its maximum height is:

(A) 6.0 m (B) 8.0 m (C) 20.4 m (D) 10.0 m (E) 11.5 m

(1)

(1) $g/cm^3 \xrightarrow{\times 1000} kg/m^3$

$2.7 \times 1000 = 2700 \ kg/m^3$ (D)

---

(2) $km/h \xrightarrow{\times \frac{1000}{3600}} m/s$

$36 \times \frac{1000}{3600} = 10 \ m/s$ (C)

---

(3) Length ⟶ meter (m) (C)

---

(4) طول الضلع = 10mm $= \frac{10}{1000} = 0.01$

مساحة المربع = (طول الضلع)²

$(0.01)^2 = 10^{-4} \ m^2$ (D)

---

(5) $v = bt^2 \Rightarrow b = \frac{v}{t^2} = \frac{m/s}{s^2}$

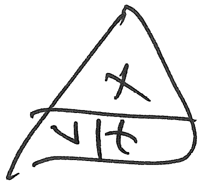
$= \frac{m}{s^3} = m/s^3$ (D)

---

(6) Length , Mass , Time

m kg s MKS (B)

(7) المطلوب السرعة المتوسطة لفترة الجري

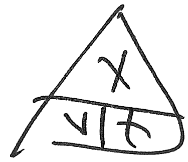


$x = 20\,m \qquad t = 10\,s$

$v = \frac{x}{t} = \frac{20}{10} = 2\,m/s$ (E)

---

(8) $v = 30\,m/s \qquad t = 20\,s$



$x = vt = (30)(20) = 600\,m$ (E)

---

(9) $x_1 = 6\,m \qquad x_2 = 11\,m$

$\Delta x = x_2 - x_1 = 11 - 6 = 5\,m$ (A)

---

(10) $x = 3t - 4t^2 + t^3$

$t = 2\,s \Rightarrow x = 3(2) - 4(2)^2 + (2)^3$

$= 6 - 16 + 8 = -2\,m$ (D)

---

(11) $km \xrightarrow{\times 1000} m$

$50\,km = 50 \times 1000 = 50000 = 50 \times 10^3\,m$

(B)

(12) dropped $\Rightarrow v_0 = 0$ $\qquad v = ?$

$t = 2s$ $\qquad a = -9.8\ m/s^2$

$v = v_0 + at = 0 - 9.8(2) = -19.6\ m/s$ (B)

---

(13) dropped $\Rightarrow v_0 = 0$ $\qquad t = ?$

$a = -9.8\ m/s^2$ $\qquad y = \frac{-20}{2} = -10m$

نصفها

$y = v_0 t + \frac{1}{2}at^2$

$-10 = 0 + \frac{1}{2}(-9.8)t^2$

$-10 = -4.9t^2 \xrightarrow{\div -4.9} t^2 = 2.0408$

"√"

$t = \sqrt{2.0408} = 1.43\ s$ (E)

---

(14) $v_0 = 30\ m/s$ $\qquad$ maximum height $\Rightarrow$ $v = 0$

$a = -9.8\ m/s^2$ $\qquad y = ?$

$v^2 = v_0^2 + 2ay \Rightarrow 0 = (30)^2 + 2(-9.8)y$

$0 = 900 - 19.6y \Rightarrow 19.6y = 900 \xrightarrow{\div 19.6}$

$y = \frac{900}{19.6} = 45.9\ m$ (C)

(15) ④

$g = 10\ m/s^2$

$V_0 = 5\ m/s^2$ $a = -g = -10\ m/s^2$

$V = ?$ $t = 2s$

$$V = V_0 + at = 5 - 10(2) = -15\ m/s \quad (D)$$

---

(16) $V_0 = 0$ $a = 2\ m/s^2$

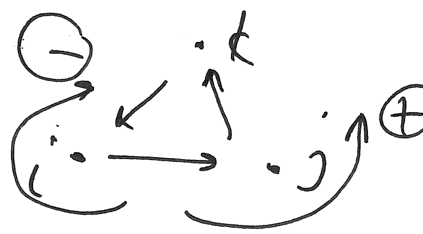
$t = ?$ $V = 6\ m/s$

$$V = V_0 + at$$

$$6 = 0 + 2t \xRightarrow{\div 2} t = 3s \quad (A)$$

---

(17) $(i \times k) \cdot j$



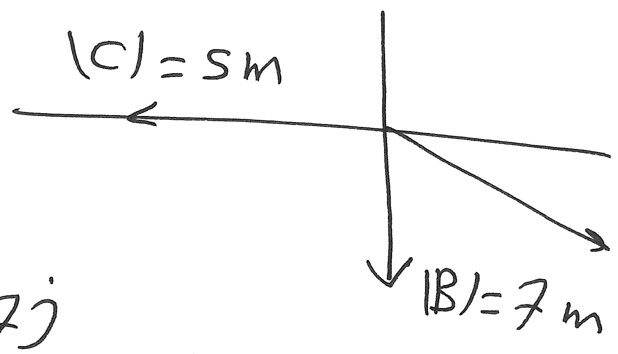
$$i \times k = -j$$

$$(i \times k) \cdot j = -j \cdot j = -(j \cdot j) = -1 \quad (E)$$

---

(18) $\vec{C} = -5i$

$\vec{B} = -7j$



$$\vec{A} - \vec{B} + \vec{C} = -7j$$

$$\vec{A} - (-7j) - 5i = -7j$$

$$\vec{A} = -7j - 7j + 5i = 5i - 14j \quad (D)$$

(5)

(19) $\vec{E} = i + 3j + 2k$

$|\vec{E}| = \sqrt{1 + 9 + 4} = \sqrt{14}$

$\theta = \cos^{-1}\left(\frac{3}{\sqrt{14}}\right) = 36.7°$ (D)

---

(20) $\vec{a} = 9i - 6j + 21k$

بالضرب في $\frac{1}{3}$
أي نقسم على 3

$\frac{1}{3}\vec{a} = 3i - 2j + 7k$

$|\frac{1}{3}\vec{a}| = \sqrt{9 + 4 + 49} = 7.9$ (A)

---

(21) $\vec{a} = 3i + 10j - 6k$

$\vec{b} = -4i + 5j + 7k$

$\vec{a} - \vec{b} = 7i + 5j - 13k$ (D)

---

(22) $\vec{A} = 6i - 10j + 4k$

$\vec{B} = 4i - 7j + 4k$

$\vec{A} + \vec{B} = 10i - 17j + 8k$ (A)

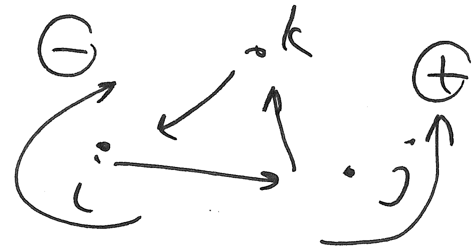
(23) $\vec{A} = 8\hat{j} + 6\hat{k}$

$\vec{B} = 2\hat{j} - 4\hat{k}$

$\vec{A} \cdot \vec{B} = (8)(2) + 6(-4) = 16 - 24$

$= -8$ (C)

(24) $\hat{i} \times \hat{k} = -\hat{j}$ (C)



(25) $\vec{a} = 10\hat{j} - 4\hat{k}$

$\vec{b} = 5\hat{j} + 10\hat{k}$

لاحظ الاجابة غ i أي (B)

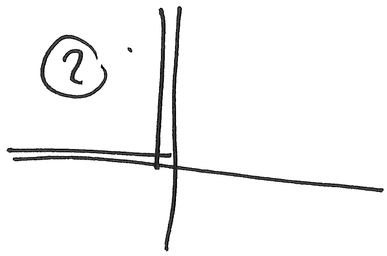
$$\vec{a} \times \vec{b} = \begin{vmatrix} \overset{+}{\hat{i}} & \overset{-}{\hat{j}} & \overset{+}{\hat{k}} \\ 0 & 10 & -4 \\ 0 & 5 & 10 \end{vmatrix}$$

$= \hat{i}(100 + 20) - \hat{j}(0) + \hat{k}(0)$

$= 120\hat{i}$ (B)

(7)

(26) $B_x = -20$ $\quad$ $B_y = 6$



$\theta = \tan^{-1}\left|\frac{B_y}{B_x}\right|$

$= \tan^{-1}\left|\frac{6}{20}\right| = 180 - 16.7 = 163.3^\circ$

(A)

---

(27) $A_x = -97$ $\quad$ $A_y = -24.5$

$|\vec{A}| = \sqrt{A_x^2 + A_y^2} = \sqrt{(97)^2 + (24.5)^2}$

$= 100$ (B)

---

(28) Weight (A) [illegible]

---

(29) $|a| = 9.8\ m/s^2$ (C)

---

(30) $v_0 = 15\ m/s$ $\quad$ $a = -9.8\ m/s$

maximum height $\Rightarrow v = 0$ $\quad$ $y = ?$

$v^2 = v_0^2 + 2ay \Rightarrow 0 = (15)^2 + 2(-9.8)y$

$19.6y = 225$

$y = \frac{225}{19.6} = 11.5\ m$

اختبارات
الدوري الثاني

ملخص قوانين

Ph110

Ch 4 (1)

$$\vec{r} = x(t)\,i + y(t)\,j$$

$$\vec{v} = v_x(t)\,i + v_y(t)\,j$$

$$\vec{a} = a_x(t)\,i + a_y(t)\,j$$

$\vec{r}$ —اشتقاق→ $\vec{v}$ —اشتقاق→ $\vec{a}$

$$v = \frac{d\vec{r}}{dt}$$

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d}{dt}\left(\frac{dr}{dt}\right)$$

$\vec{a}$ is Constant

$$\vec{v} = \vec{v}_0 + at$$

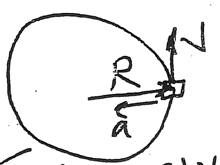
Circular motion الحركة الدائرية

centriptal acceleration

التسارع المركزي اتجاهه دائماً نحو المركز

toward the center

$$a = \frac{v^2}{R}$$



$a \perp v$

$$\text{Period} = T = \frac{\text{المحيط}}{\text{السرعة}} = \frac{2\pi R}{v}$$

$$T = \frac{\text{الزمن الكلي}}{\text{عدد اللفات}}$$

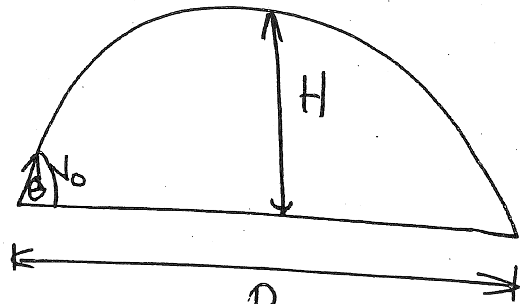
Ch 4 (2)

$$R = \frac{v_0^2 \sin 2\theta}{g}$$

$$H = \frac{v_0^2 (\sin\theta)^2}{2g}$$

$$t = \frac{2 v_0 \sin\theta}{g}$$

الحالة الخاصة :



$$\tan\theta = \frac{4H}{R}$$

for maximum range $\theta = 45°$

$$R_{max} = \frac{v_0^2}{g}$$

$a_y = -g$

$a_x = 0$

V_x ثابتة يعني

If $\vec{V_0} = V_{0x} i + V_{0y} j$ ⟹

$$V_0 = \sqrt{V_{0x}^2 + V_{0y}^2} \qquad \theta = \tan^{-1}\left(\frac{V_{0y}}{V_{0x}}\right)$$

at the highest Point : عند أعلى نقطة

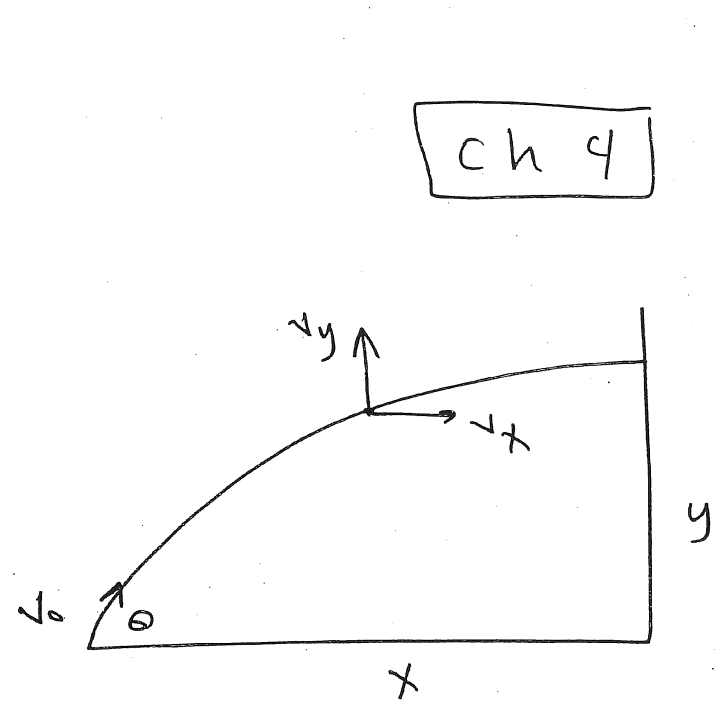
$V_y = 0$ $\qquad V_x = V_0 \cos\theta$

$y = H$ $\qquad x = \frac{1}{2} R$

$t_{أقصى ارتفاع} = \frac{1}{2} t_{الكلي}$

ch 4 ③

<u>الحالة العامة</u>



$$v_x = v_0 \cos\theta$$

$$a_x = 0$$

$$x = v_0 \cos\theta \, t$$

$$a_y = -g = -9.8 \ m/s^2$$

$$v_{0y} = \begin{cases} v_0 \sin\theta & \text{above the horizontal} \\ -v_0 \sin\theta & \text{below the horizontal} \end{cases}$$

$$v_y = v_{0y} + at$$ → v_y = vertical component (y-component of the velocity)

$$y = v_{0y} t + \frac{1}{2} a t^2$$

v = speed = velocity → $v = \sqrt{v_x^2 + v_y^2}$

$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$

thrown horizontally →
$\theta = 0$ $v_{0y} = 0$

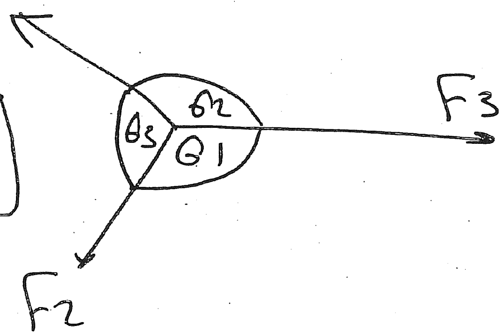
(*) If the block is at rest or moving at constant speed

إذا كان الجسم يتحرك بسرعة ثابتة أو ساكن

$$\sum \vec{F} = \vec{0}$$

في حالة اتزان الجسم تحت تأثير ٣ قوى فقط

$$\frac{F_1}{\sin\theta_1} = \frac{F_2}{\sin\theta_2} = \frac{F_3}{\sin\theta_3}$$



$$\sum \vec{F} = m\vec{a}$$ ⇐ $\vec{a}$ إذا تحرك الجسم بتسارع

وحدة

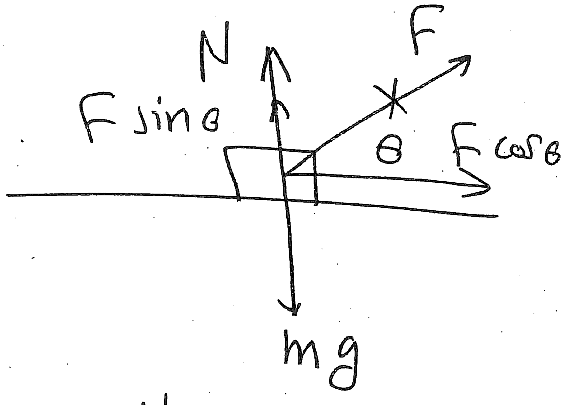
الكتلة m ⟶ kg

الوزن W ⟶ النيوتن N

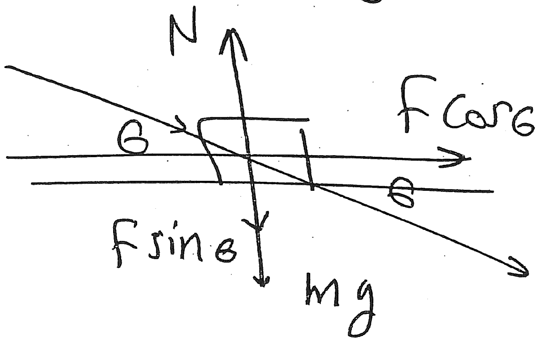
النيوتن $N = kg \cdot m/s^2$

$W = mg \Longrightarrow m = \frac{W}{g} = \frac{W}{9.8}$

$N + F\sin\theta = mg$

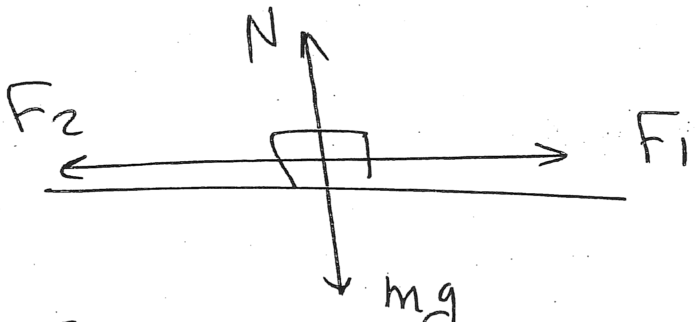


$$N = mg - F\sin\theta$$



$$N = mg + F\sin\theta$$

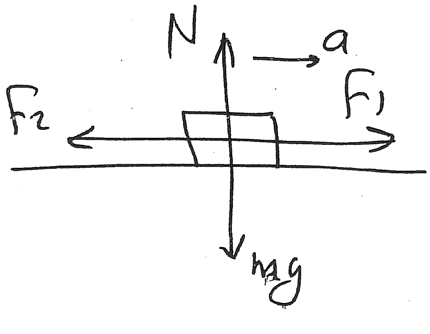
اذا تحرك الجسم بسرعة ثابتة



$$N = mg$$

$$F_1 = F_2$$

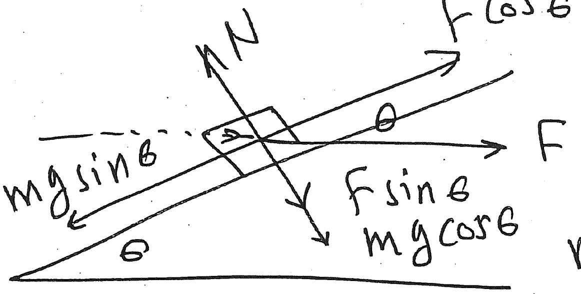
اذا تحرك الجسم بتسارع ثابت a

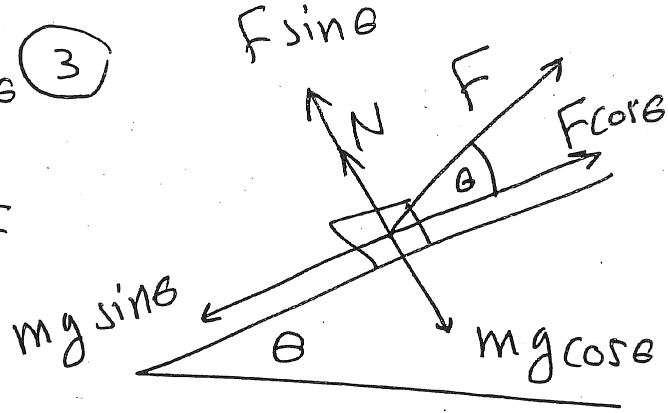


$$F_1 - F_2 = ma$$

$$N = mg$$

3





$$N = F\sin\theta + mg\cos\theta$$

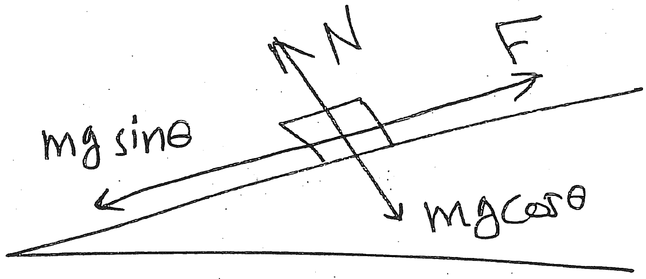
$$F\sin\theta + N = mg\cos\theta$$

$$N = mg\cos\theta - F\sin\theta$$

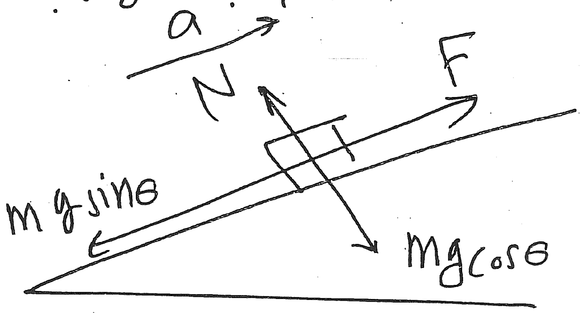
اذا تحرك الجسم بسرعة ثابتة أو الجسم ساكن (متزن at equilibrium)

$$N = mg\cos\theta$$

$$F = mg\sin\theta$$



اذا تحرك الجسم بتسارع ثابت a

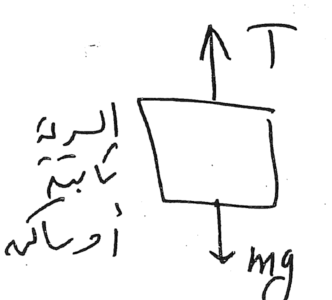


$$F - mg\sin\theta = ma$$

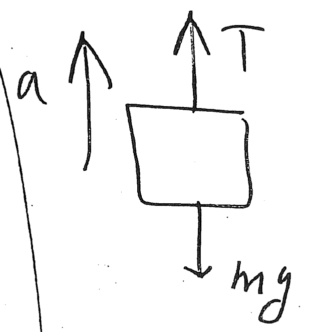
$$N = mg\cos\theta$$

ملاحظات هامة

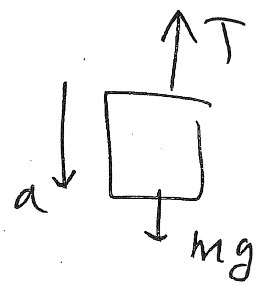
① Elevator



$T = mg$



$T - mg = ma$



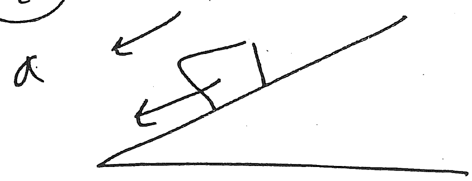
$mg - T = ma$

T = apperent weight الوزن الظاهري (قراءة الميزان)

②

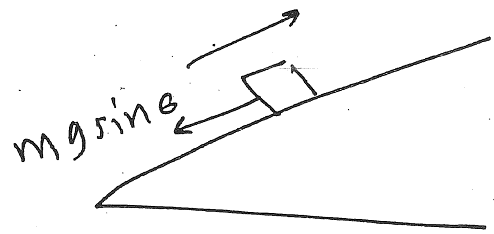
الجسم يتحرك تحت تأثير وزنه فقط

ولا تؤثر عليه قوة f ولا T



$a = g\sin\theta$

$\Sigma F = mg\sin\theta$

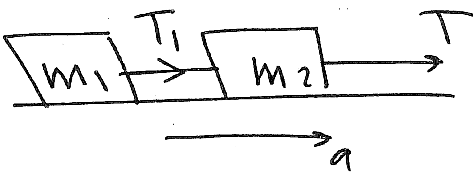


$a = -g\sin\theta$

$\Sigma F = -mg\sin\theta$

(3)

الجسم يتحرك بتسارع a

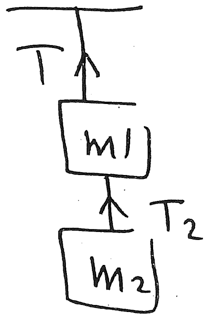


$$T = (m_1 + m_2)a$$

$$T_1 = m_1 a$$

(5)

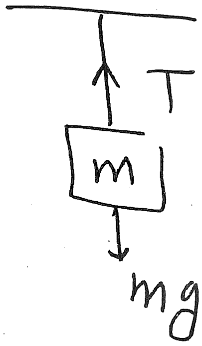
الجسم ساكن



$$T = (m_1 + m_2)g$$

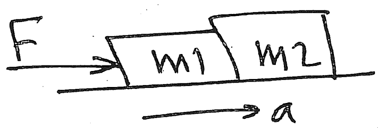
$$T_2 = m_2 g$$

الجسم ساكن



$$T = mg$$

الجسم يتحرك بتسارع a

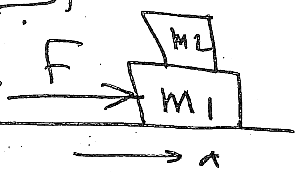


$$F = (m_1 + m_2)a$$

قوة دفع m_1 لـ m_2

$$F' = m_2 a$$

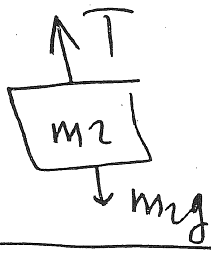
الجسم يتحرك بتسارع a



$$F = (m_1 + m_2)a$$

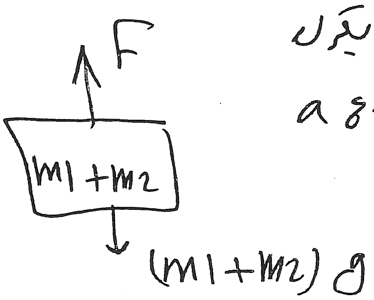
قوة دفع m_1 لـ m_2

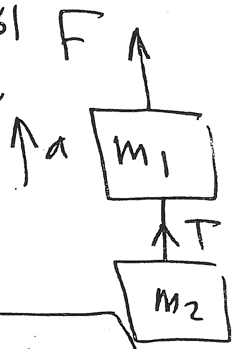
$$F' = m_2 a$$



$$T - m_2 g = m_2 a$$

الجسم يتحرك بتسارع a



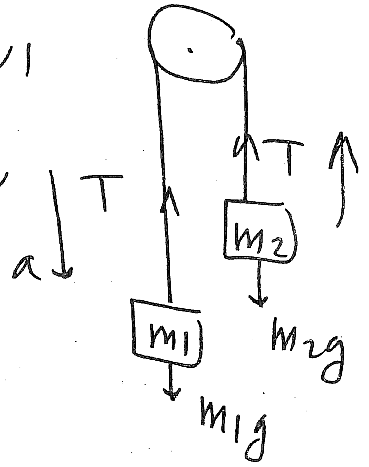


$$F - (m_1 + m_2)g = (m_1 + m_2)a$$

البكرات

الكتلة الأكبر تتحرك لأسفل

الشد T دائماً نحو البكرة

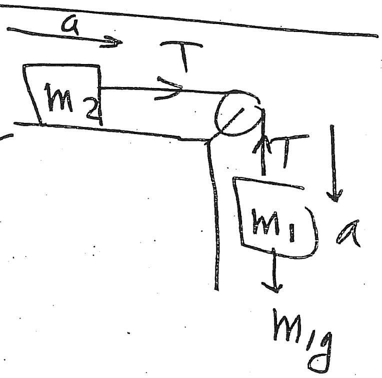


بفرض $m_1 > m_2$

$$m_1 g - T = m_1 a$$

$$T - m_2 g = m_2 a$$

الجسم المعلق يتحرك لأسفل حتى لو كانت كتلته أقل

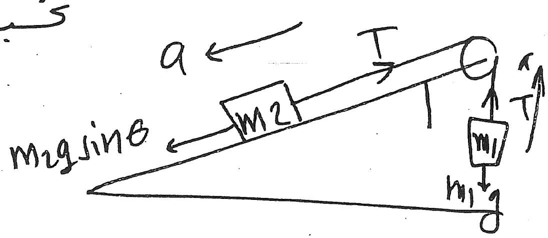


$$m_1 g - T = m_1 a$$

$$T = m_2 a$$

نحسب $m_1 g$ ، $m_2 g \sin\theta$ الكبير يتحرك لأسفل

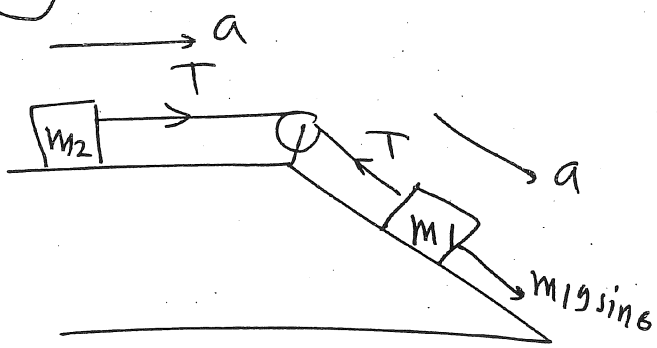
بفرض $m_2 g \sin\theta > m_1 g$



$$m_2 g \sin\theta - T = m_2 a$$

$$T - m_1 g = m_1 a$$

(7)



الكتلة الموضوعة ع المستوى المائل تتحرك لأسفل حتى لو كانت تثقل أقل لأنه المستوى أملس

$$m_1 g\sin\theta - T = m_1 a$$

$$T = m_2 a$$

Ch 6

دائماً قوة الاحتكاك اتجاهها عكس اتجاه الحركة

(1) f_s = static frictional force

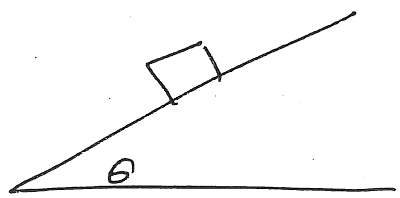
قوة الاحتكاك الساكنة

$$F_s = \mu_s N$$

(2) kinetic frictional force قوة الاحتكاك الحركي

$$F_k = \mu_k N$$

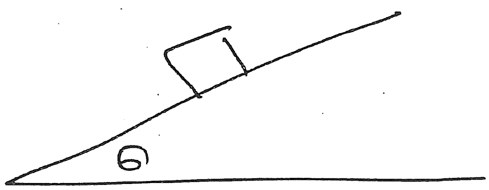
إذا كان الجسم لا تؤثر عليه قوة F ولا T



إذا كان الجسم على وشك الحركة لأسفل

$$\mu_s = \tan\theta$$

$$\theta = \tan^{-1}(\mu_s)$$



إذا كان الجسم يتحرك بسرعة ثابتة لأسفل

$$\mu_k = \tan\theta$$

$$\theta = \tan^{-1}(\mu_k)$$

ch 6

(17)

ملاحظات هامة

(١) إذا تحرك جسم على سطح أفقي خشن ولا تؤثر على الجسم قوى خارجية غير الاحتكاك (قوة الاحتكاك هي التي توقف حركته)

فإنه

$$a = -\mu_k g$$

---

(٢) إذا تحرك جسم على سطح مائل خشن لأسفل ولا تؤثر عليه قوى خارجية غير قوة الاحتكاك

فإنه

$$a = g\sin\theta - \mu_k g\cos\theta$$

---

(٣) إذا تحرك جسم على مائل خشن لأعلى ولا تؤثر عليه قوى خارجية غير قوة الاحتكاك

فإنه

$$a = -g\sin\theta - \mu_k g\cos\theta$$

---

(٤) لاحظ إذا كانت μ_k غير معلومة وطلب قوة الاحتكاك الحركي F_k لا نستخدم القانون

$$F_k = \mu_k N$$

ولكن

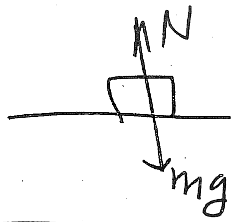
نوجد F_k من معادلة الحركة

$$\Sigma F = ma$$

عندما يتحرك جسم بسرعة ثابتة في مسار دائري أفقي

فشكله يكون

$$F_s = F_\perp$$



$$\mu_s N = m\frac{v^2}{R}$$

$$N = mg$$

$$\mu_s \cancel{m} g = \frac{\cancel{m} v^2}{R}$$

① إذا طلب قوة الاحتكاك و μ_s غير معلومة

$$F_s = F_\perp = \frac{mv^2}{R}$$

$$F_\perp = \frac{mv^2}{R}$$

② إذا طلب معامل الاحتكاك الساكن μ_s للمستوى الدائري

الذي يجعل الجسم يتحرك بسرعة ثابتة

$$\mu_s = \frac{v^2}{Rg}$$

③ إذا طلب أكبر سرعة يتحرك بها الجسم دون أن ينزلق من

المستوى الدائري

$$v = \sqrt{Rg\mu_s}$$

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

Ph 110

D

Test #2	11/2/1436H	**Time:90** min.
Student Name:	Student no.:	Section:

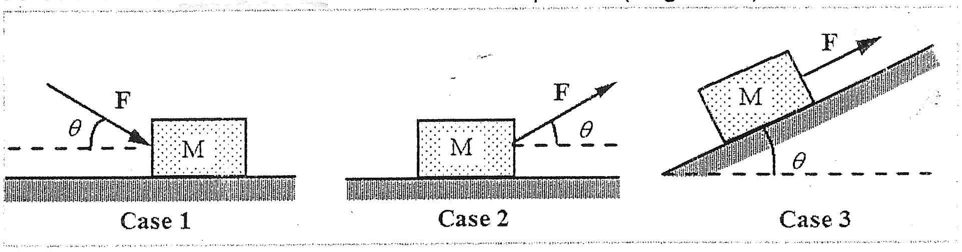
Q.1 A body of weight 600 N running in a circular path of R=1 m at a velocity of 8 m/s. The centripetal force is:
(A) 64.5 N (B) 5224.5 N (C) 4096 N (D) 408 N (E) 3918.4 N

Q.2 At the highest point, the magnitude of the acceleration of a projectile is:
(A) -9.8 m/s^2 (B) Zero (C) 4.9 m/s^2 (D) 19.6 m/s^2 (E) 9.8 m/s^2

Q.3 A feather (ريشة) and a coin dropped in a vacuum fall with equal
(A) force (B) none of these (C) kinetic energy (D) acceleration (E) velocity

Q.4 In which case will the magnitude of the normal force on the block be equal to ($Mg\cos\theta$)?

(A) case 1only
(B) case 2 only
(C) case 1 and 2
(D) case 3 only
(E) cases 1, 2, and 3



Q.5 Referring to question 4, in which case will the x-component of the weight of the block be equal to (Mg sinθ)?
(A) cases 1 and 2 (B) case 2 only (C) case 3 only (D) cases 2 and 3 (E) case 1 only

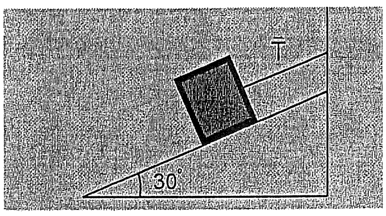
Q.6 If the forces on an object are balanced, the object will
(A) Remain at rest if initially at rest.
(B) Continue moving in a straight line if initially moving in a straight line.
(C) Both A and B
(D) Neither A nor B
(E) None of these

Q.7 A man of mass 100 kg. His weight is:
(A)50 N (B) 980 N (C) zero (D) 98 N (E) 490 N

Q.8 1Newton is equivalent to:
(A) 9.8 kg.m/s^2 (B) 1 kg. m/s^2 (C) 1 kg of mass (D) 1 kg of force (E) none of these

Q.9 The static coefficient of friction μ_s and the angle at which the object is about to move on a surface **θ** are related as
(A) $\sin\theta=\mu_s$ (B) $\cos\theta=\mu_s$ (C) $\tan\theta=\mu_s$ (D) $\tan\mu_s=\theta$ (E) $\sin\mu_s=\theta$

Q.10 A 5 kg mass is held at rest on a frictionless 30° incline by force $\bar{T}$. The magnitude of $\bar{T}$ is:



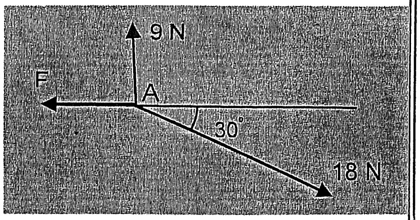
(A) 5 N (B) 75 N (C) 24.5 N (D) 50 N (E) 100 N

Q.11 An elevator and three men inside have a total mass of 600 kg. If the elevator is accelerating upwards with acceleration of 1.2 m/s2, the tension in the cable is:
(A) 600 N (B) 5160 N (C) 100 N (D) Zero (E) 6600 N

Q.12 The formula for the centripetal force is:
(A) $a = \frac{v^2}{R}$ (B) F=ma (C) F=mg (D)none of these (E) $F = m\frac{v^2}{R}$

Q.13 As shown in the figure, two forces of 9 N and 18 N are now acting on a point mass A. in order to keep A in equilibrium, the magnitude of the third horizontal force F is:

(A) 13.5 N (B) 18.82 N (C) 2.7 N (D) 15.59 N (E) 75 N

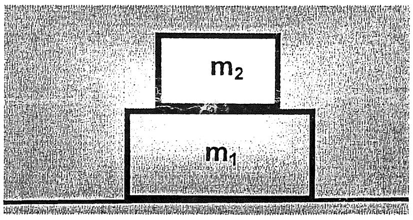


Q.14 Acceleration is always in the direction:
(A) of the displacement (B) of the final velocity (C) of the net force (D) of the initial velocity (E) time

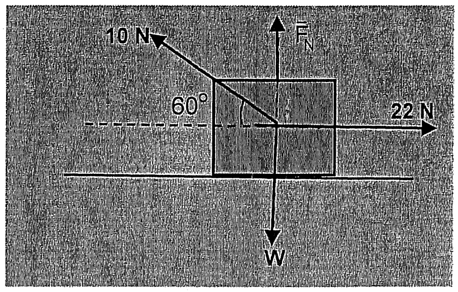
Q.15 A force of 98 N is required to just start moving a body of mass 100 kg over ice. The coefficient of static friction is
(A) 0.2 (B)) 0.1 (C) 0.6 (D) 0.4 (E) 0.5

Q.16 In the figure m_1=10 kg and m_2=5 kg, the gravitational force on m_1 is:

(A) 30 N (B) 147 N (C) 9.8 N (D)Zero (E) 75 J



Q.17 A 12 kg object is moving on a horizontal frictionless plane, as shown in the figure, the object accelerates at:
(A) 1.4 m/s^2 (right) (B) 10 m/s^2 (left)
(C) 15 m/s^2 (left) (D) 1.8 m/s^2 (right)
(E) none of these



Q.18 A box stands on a rough incline plane of θ, its moving with a constant speed, the friction force is:
(A) mg sinθ (B) mg tanθ (C) mg cosθ (D) mg (E) ½ mg^2

Q.19 When a body is moving on a rough surface, the force of friction is called.
(A) Static friction (B) Dynamic friction (C) Limiting friction (D) Rolling friction (E) parallel friction

Q.20 A force of 24 N is applied to move a stationary body of mass 8 kg. The acceleration of the body is:
(A) 16 m/s^2 (B) 3 m/s^2 (C) 12 m/s^2 (D) 8 m/s^2 (E) 6 m/s^2

Q.21 The components of the a car's velocity as a function of time are given by v_x=2t+2 and v_y=4t-2, then its velocity $\overline{v}$ at (t = 3s) is :
(A) $\overline{v} = -8\hat{i} - 10\hat{j}$ (B) $\overline{v} = 9\hat{i} - 3\hat{j}$ (C) $\overline{v} = 10\hat{i} + 8\hat{j}$ (D) $\overline{v} = 8\hat{i} - 10\hat{j}$ (E) $\overline{v} = 8\hat{i}$

Q.22 A block is initially sliding with acceleration of -1 m/s^2 on a rough horizontal surface. The coefficient of friction between the block and the surface is:
(A) 0.3 (B) 0.2 (C) Zero (D) 0.1 (E) 0.4

Q.23 The displacement of a particle moving from $\vec{r}_1 = 5\hat{i} + 6\hat{j} + 2\hat{k}$ to $\vec{r}_2 = -5\hat{i} + 6\hat{j} + 2\hat{k}$ is:
(A) 8 (B) $4\vec{j} + 6\vec{k}$ (C) $10\hat{i} + 5\hat{j}$ (D) $5\hat{j}$ (E) $-10\hat{i}$

Q.24 A ball is kicked horizontally on the ground towards east. The direction of frictional force will be towards:
(A) North (B)East (C) South (D) East north (E) West

Q.25 An object slows down in such a way that its acceleration is constant. This means that:
(A) there is no force acting on it (B) the force acting on it increases
(C) the force acting on it decreases (D) the force acting on it is constant (E) none of these

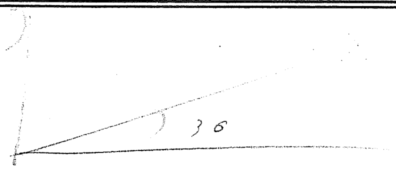
Q.26 When a force is applied to a body with mass of 10 kg, the acceleration of the body is 1m/s^2. If the same force is applied to a body with mass of 40 kg, the acceleration of the body is:
(A) 1 m/s^2 (B) 16 m/s^2 (C) 4 m/s^2 (D) 0.25 m/s^2 (E) 24 m/s^2

Q.27 If a ball is projected with velocity 30 m/s at angle of 30° with the horizontal. The y-component of the velocity of the ball after one second is:
(A) 0.2 m/s (B) 20 m/s (C) 5.2 m/s (D) 10 m/s (E) 12 m/s

Q.28 Refer to question 27, the time taken by the ball to return to the ground is:
(A) 2.04 s (B) (C) 3.06 s (D) 10 s (E) 2 s

Q.29 Refer to question 27, the range of the projectile is:
(A) 100 m (B) 79.53 m (C) 200 m (D) 35.35 m (E) 20 m

Q.30 Refer to question 27, the maximum height attained by the projectile is:
(A) 5.1 m (B) 11.48 m (C) 20 m (D) 100 m (E) 25 m



Revolutions	دورات	Object	جسم	Experience	واجه	Angle	زاوية
Stationary	ثابت	Oppose	تعيق	Describe	صف	Ball	كره
Slide	انزلق	Parachute	مظله	Dropped	سقط	Balanced	متزن
Spring	زنبرك	Particle	جسيم	Exerted	تؤثر	Block	كتله
Stretch	استطال	Perpendicular	عمودي	Flat board	لوح مستوي	Brick	بلوك
Toolbox	صندوق	Projected	قذف	Height	ارتفاع	Cable	سلك
Thrown	رمي	Radius	نصف القطر	Inclined plane	مستوى مائل	Cart	عربه
Track	مسار دائري	Remain	يبقى	Influence	تأثير	Circular	دائري
Traveling	يسير	Restoring force	قوة الإرجاع	kicked	ركلت	Clockwise	مع عقارب الساعة
		Referring to	بالرجوع الى	Magnitude	قيمة	Elevator	مصعد

(1) $W = mg = 600\ N \Rightarrow m = \frac{600}{9.8} = 61.2\ kg$

$R = 1\ m$ $\qquad$ $v = 8\ m/s$

$$F_1 = \frac{mv^2}{R} = \frac{(61.2)(8)^2}{1} = 3918.4\ N$$

(E)

---

(2) $a = -g = -9.8\ m/s^2$ دائماً التسارع في المقذوفات

$|a| = 9.8\ m/s^2$ (E)

---

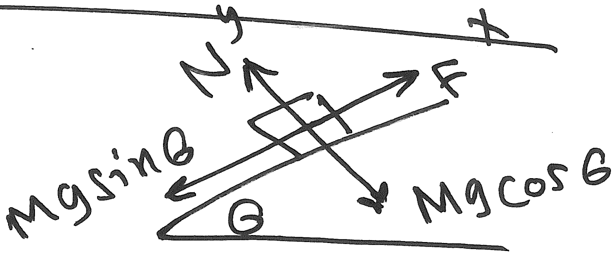
(3) $a = -g$ السقوط الحر دائماً بتسارع ثابت

Constant acceleration (D)

---

(4) $N = Mg\cos\theta$

care (3) (D)



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(5) $Mg\sin\theta$ المركبة x للوزن

(C)

(6) the forces on an object are

balanced (متزنة) $\Rightarrow \Sigma F = 0$ قانون نيوتن الأول

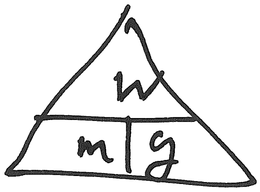
A and B ∴ الجسم ساكن أو يتحرك بسرعة ثابتة

(C)

---

(7) $m = 100\,kg$

$W = mg = 100 \times 9.8 = 980\,N$ (B)



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(8) $1\,N = 1\,kg \cdot m/s^2$ (B)

---

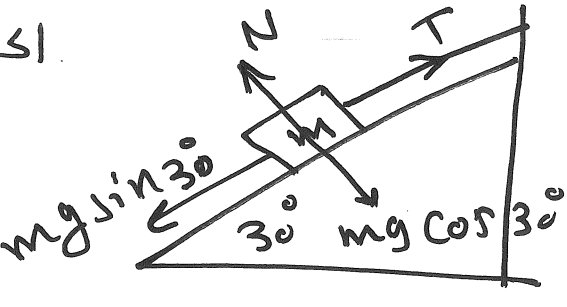
(9) $\mu_s = \tan\theta$ (C)

---

(10) $m = 5\,kg$

الجسم ساكن

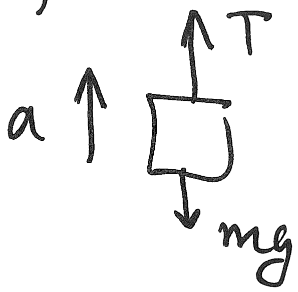
قانون نيوتن الأول



$T = mg\sin\theta$

$= 5 \times 9.8 \sin 30 = 24.5\,N$ (C)

(11) $m = 600\ kg$ $\quad a = 1.2\ m/s^2 \uparrow$



$T - mg = ma$

$T = mg + ma$

$= 600 \times 9.8 + 600(1.2) = 6600\ N$

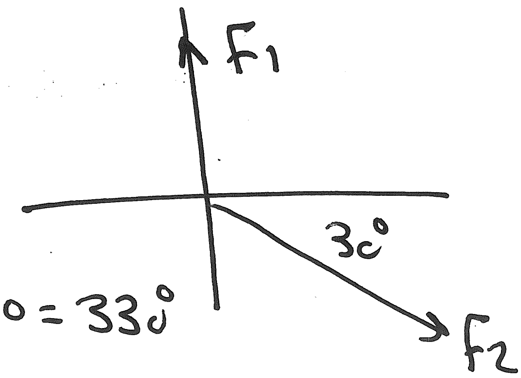
(E)

---

(12) $F_{\perp} = m\frac{v^2}{R}$ (E)

---

(13) $F_1 = 9\ N$



$\vec{F_1} = 9j$

$F_2 = 18\ N$ $\quad \theta = 360 - 30 = 330°$

$\vec{F_2} = 18\cos 330\, i + 18\sin 330\, j$

$\vec{F_2} = 15.59i - 9j$

the mass is in equilibrium (متزنه) $\Rightarrow \Sigma F = 0$ (قانون نيوتن الأول)

$\Sigma\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3} = 0$

$9j + 15.59i - 9j + \vec{F_3} = 0$

(4)

$\vec{F_3} = -15.59\,i$

$|\vec{F_3}| = \sqrt{(15.59)^2 + 0} = 15.59 \text{ N}$

(D)

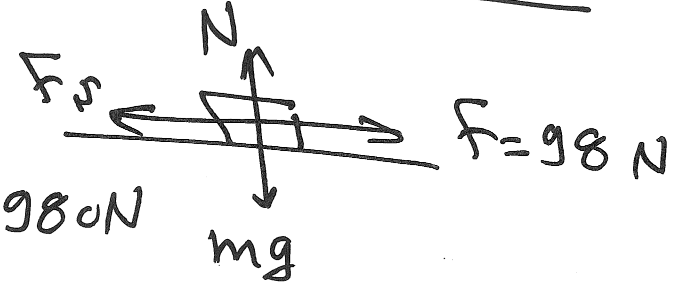
---

(14) (C)

---

(15)

الجسم ساكن ⇐ نيوتن الأول



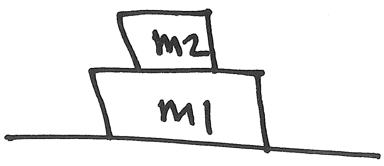
$N = mg = 100 \times 9.8 = 980\,N$

$F_s = F = 98\,N$

$\mu_s = \frac{F_s}{N} = \frac{98}{980} = 0.1$ (B)

---

(16) $m_1 = 10\,kg$ $m_2 = 5\,kg$

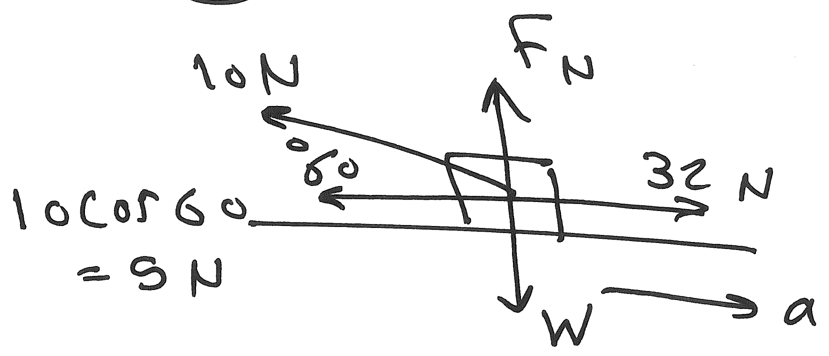


$F_{g1} = (m_1 + m_2)g = (10+5)(9.8) = 147\,N$ (B)

(5)

(17)

m = 12 kg



$\Sigma F = ma$ قانون نيوتن الثاني

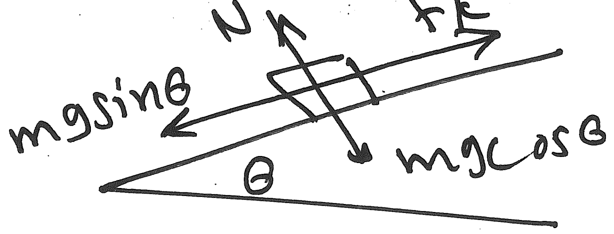
$22 - 10\cos 60 = ma$

$22 - 5 = 12a$

$a = \frac{17}{12} = 1.4\ m/s^2$ right (A)

---

(18)



السرعة ثابتة
قانون نيوتن الأول

$F_k = mg\sin\theta$ (A)

---

(19) moving ⟹ kinetic friction

dynamic //

↓

(B)

(20) $F = 24\ N$ $m = 8\ kg$

$F = ma \Rightarrow a = \frac{F}{m} = \frac{24}{8} = 3\ m/s^2$

(B)

---

(21) $v_x = 2t + 2$ $v_y = 4t - 2$

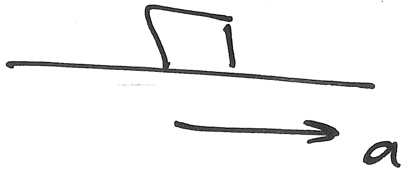
$\vec{v} = v_x i + v_y j = (2t+2) i + (4t-2) j$

$t = 3s \Rightarrow \vec{v} = (2(3)+2) i + (4(3)-2) j$

$\vec{v} = 8i + 10j$

---

(22) $a = -1\ m/s^2$



$a = -\mu_k g$

$-1 = -\mu_k (9.8) \Rightarrow \mu_k = \frac{-1}{-9.8}$

$\mu_k = 0.1$ (D)

(23)

$$\vec{r_2} = -5i + 6j + 2k$$

$$\vec{r_1} = 5i + 6j + 2k$$

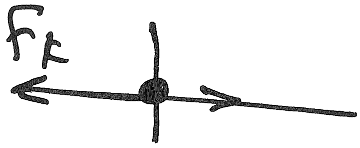
$$\vec{\Delta r} = \vec{r_2} - \vec{r_1} = -10i$$

(E)

---

(24)

تعاكس الحركة F_k



east الحركة في اتجاه الشرق

F_k west في اتجاه الغرب (E)

---

(25)

التسارع ثابت ⇐

net force = القوة المحصلة ثابتة

the force acting on the object is constant (D)

(26) $m_1 = 10\,kg$ $a_1 = 1\,m/s^2$

$F = m_1 a_1 = 10(1) = 10\,N$

$m_2 = 40\,kg$ $a_2 = ??$

نفس القوة
the same force

$F = m_2 a_2 \Rightarrow a_2 = \frac{F}{m_2} = \frac{10}{40}$

$= 0.25\,m/s^2$

(D)

---

(27) $v_0 = 30\,m/s$ $\theta = 30°$

$v_{0y} = v_0 \sin\theta = 30 \sin 30° = 15\,m/s$

$a = -9.8\,m/s^2$ $t = 1\,s$ $v_y = ?$ (X)

$v_y = v_{0y} + at = 15 - 9.8(1) = 5.2\,m/s$ (C)

---

(28) $v_0 = 30\,m/s$ $\theta = 30°$

$t = \frac{2v_0 \sin\theta}{g} = \frac{2(30)\sin 30}{9.8} = 3.06\,s$

(C)

(29) $v_0 = 30\,m/s$ $\theta = 30^\circ$

$$R = \frac{v_0^2 \sin 2\theta}{g} = \frac{(30)^2 \sin(2\times 30)}{9.8}$$

$R = 79.53$ m (B)

---

(30) $v_0 = 30\,m/s$ $\theta = 30^\circ$

$$H = \frac{v_0^2 (\sin\theta)^2}{2g} = \frac{(30)^2 (\sin 30)^2}{2\times 9.8}$$

$= 11.48$ (B)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

D

Second Term Exam	22/1/1435 H	**Time:** 90 min.
Student Name:	Student no.:	Section:

Q.1 The position of a particle is $\vec{r} = 4\hat{i} + 3\hat{j} + \hat{k}$, its component in the z-axis is:
(A) 1 (B) 2 (C) 3 (D) 4

Q.2 A particle moves from position $\vec{r}_1 = 2\hat{i} - 5\hat{j} + 4\hat{k}$ to $\vec{r}_2 = 2\hat{i} + 4\hat{j} - 2\hat{k}$, then the displacement is:
(A) $4\hat{i} + 9\hat{j} - 6\hat{k}$ (B) $9\hat{j} - 6\hat{k}$ (C) $9\hat{j} + 2\hat{k}$ (D) $\hat{j} - 6\hat{k}$

Q.3 Referring to question 2, the average velocity of the particle in 3 s is:
(A) $0.33\hat{j} - 2\hat{k}$ (B) $3\hat{j} - 1.5\hat{k}$ (C) $3\hat{j} - 2\hat{k}$ (D) $1.33\hat{i} + 3\hat{j} - 2\hat{k}$

Q.4 A car is moving in x-y plane. The coordinates (meters) of the car's position as a function of time t (seconds) are given by $x = 5t$ and $y = t^2 - 1$, the velocity of the particle in vector notation at t = 2 s is:
(A) $10\hat{i} + 3\hat{j}$ (B) $5\hat{i} + 4\hat{j}$ (C) $10\hat{i} + 4\hat{j}$ (D) $2\hat{j}$

Q.5 An airplane changes its velocity from $\vec{v}_1 = 6\hat{i} - 10\hat{j} - 5\hat{k}$ to $\vec{v}_2 = 18\hat{i} + 14\hat{j} + 7\hat{k}$ in 2 s, its average acceleration is:
(A) $6\hat{i} + 12\hat{j} + 6\hat{k}$ (B) $3\hat{i} + 6\hat{j} + 3\hat{k}$ (C) $2\hat{i} + 4\hat{j} + 2\hat{k}$ (D) $4\hat{i} + 8\hat{j} + 4\hat{k}$

Q.6 A particle moves so that its position (in meters) as a function of time (in seconds) is $\vec{r} = 6t^2\hat{i} - t^3\hat{j} + 3t\hat{k}$, its acceleration as function of time is:
(A) $-6\hat{j}$ (B) $12t\hat{i} - 3t^2\hat{j} + 3\hat{k}$ (C) $12\hat{i} - 6t\hat{j}$ (D) $12\hat{i} - 6t\hat{j} + 3\hat{k}$

Q.7 A stone is thrown horizontally from the top of a tall building. It follows a path that is:
(A) circular (B) parabolic (C) a straight line (D) two straight lines

Q.8 The horizontal range for the projectile is maximum when its launch angle is:
(A) 90° (B) 45° (C) 30° (D) 60°

Q.9 A projectile is launched to achieve a maximum range of 60 m, the initial speed of the projectile is:
(A) 20 m/s (B) 24 m/s (C) 30 m/s (D) 33 m/s

Q.10 A toy car runs on a horizontal table with 6 m/s. The angle it makes with the horizontal when it leaves the table is:
(A) 60° (B) 45° (C) 0° (D) 90°

Q.11 The velocity and acceleration of a body in a uniform circular motion are:
(A) differed by 45^0 (B) differed by 135^0 (C) perpendicular (D) parallel

Q.12 A truck is traveling with a constant speed of 30 m/s. When the truck follows a curve in the road, its centripetal acceleration is 4.0 m/s^2. The radius of the curve is:
(A) 225 m (B) 144 m (C) 100 m (D) 81 m

Q.13 The unit of force is called Newton, which is equivalent to:
(A) 9.8 $kg.m/s^2$ (B) 1 kg of mass (C) 1 $kg.m/s^2$ (D) 1 kg of force

Q.14 A car travels east at constant velocity. The net force on the car is:
(A) greater than zero (B) less than zero (C) 9.8 N (D) zero

Q.15 Two forces are applied to an object of mass 5 kg. One force is 16 N to the north and the other is 12 N to the west. The magnitude of the acceleration of the object is:

(A) 5.0 m/s^2 (B) 4.0 m/s^2 (C) 2.5 m/s^2 (D) 2.0 m/s^2

Q.16 Acceleration is always in the direction of the:

(A) net force (B) initial velocity (C) final velocity (D) displacement

---

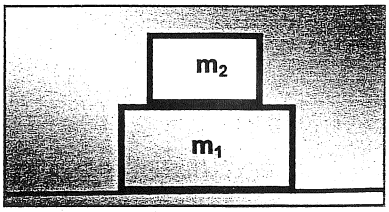
Q.17 A string from the ceiling suspends a mass of 3.5 kg. The tension in the string is:

(A) 49 N (B) 34.3 N (C) 3.5 N (D) zero

Q.18 A 70 kg person weighs 116.9 N on the moon. The acceleration of gravity on the moon is:

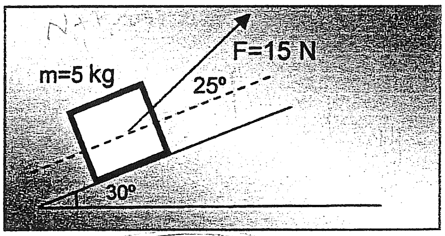
(A) 1.67 m/s^2 (B) 19.6 m/s^2 (C) 4.9 m/s^2 (D) 9.8 m/s^2

Q.19 In the figure m_1=13 kg and m_2=2 kg, the gravitational force on m_1 is:



(A) 50 N (B) 98 N (C) Zero (D) 147 N

Q.20 In the figure, the normal force on the mass is:

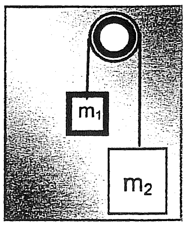


(A) 41.1 N (B) 39.9 N (C) 37.8 N (D) 36.1 N

Q.21 A cable holds a ball of weight 200 N in static equilibrium. The tension in the cable is:

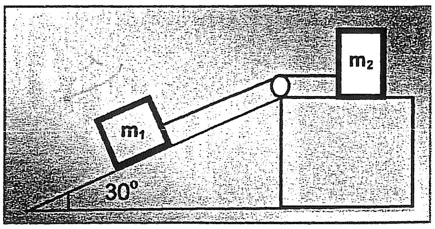
(A) 200 N (B) 400 N (C) 100 N (D) zero

Q.22 If m_1=9 kg and m_2=5 kg are connected by a string through the pulley. The acceleration is:



(A) 1.6 m/s^2 (B) 2.8 m/s^2 (C) 3.3 m/s^2 (D) 4.9 m/s^2

Q.23 In the figure m_1=2 kg and m_2=4 kg the two blocks are moving together on frictionless surface downward, the acceleration of the system is:

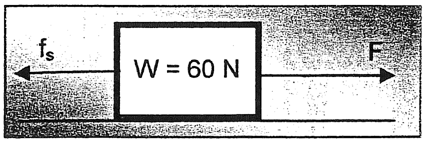


(A) 1.63 m/s^2 (B) 2.94 m/s^2 (C) 3.06 m/s^2 (D) 3.92 m/s^2

Q.24 When a body is moving on a rough surface, the force of friction is called:
(A) Static friction (B) Limiting friction (C) Kinetic friction (D) Rolling friction

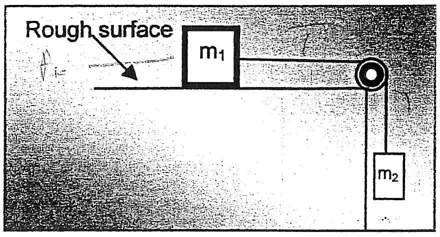
---

Q.25 The block shown in the figure starts to slide on a rough surface when a parallel force F= 20 N is applied. The coefficient of static friction μ_s is:



(A) 0.17 (B) 0.25 (C) 0.33 (D) 0.42

Q.26 In the figure, two boxes of mass m_1=12 kg and m_2=5 kg are connected to each other by a massless cord. If m_2 descends with constant velocity, the magnitude of the frictional force between the surface and m_1 is:



(A) 49.0 N (B) 68.6 N (C) 78.4 N (D) 88.2 N

Q.27 Referring to question 26, the normal force exerted on m_1 by the plane is:
(A) 137.2 N (B) 127.4 N (C) 107.8 N (D) 117.6 N

Q.28 A box stands on a rough incline plane. The plane is inclined at an angle of θ. If the box moves with constant speed, the friction force is:
(A) mg cosθ (B) mg sinθ (C) mg tanθ (D) mg

Q.29 A block is initially sliding with acceleration of -4 m/s^2 on a rough horizontal surface. The coefficient of friction between the block and the surface is:
(A) 0.4 (B) 0.2 (C) 0.1 (D) 0.3

Q.30 An automobile moves on a circular road of radius 22 m. The coefficient of friction between the tires and the road is 0.50. The maximum speed with which this car can round this curve without sliding is:
(A) 11.5 m/s (B) 10.4 m/s (C) 9.65 m/s (D) 8.85 m/s

Words Meanings:

Acceleration	تسارع	Differed	مختلف	Make	يصنع	Second	ثانية
Achieve	يحصل على	Direction	إتجاه	Mass	كتله	Shown	موضح
Airplane	طائرة	Displacement	إزاحة	Massless	عديم الكتلة	Slide	ينزلق
Always	دائماً	Downward	اسفل	Maximum	حد أقصى	Speed	سرعة
Angle	زاوية	East	شرق	Meter	متر	Stand	يقف
Applied	مؤثر	Equilibrium	أتزان	Moon	قمر	Start	يبدأ
Automobile	عربة	Equivalent	مكافيء	Motion	حركة	Static	سكوني
Average	متوسط	Exerted	مبذول	Move	يتحرك	Straight	مستقيم
Axis	محور	Figure	رسم بياني	Net	محصلة	String	وتر
Ball	كره	Final	نهائي	Normal	رد الفعل	Surface	سطح
Between	بين	Follow	يتبع	North	شمال	Suspend	معلق
Block	قالب	Force	قوة	Notation	صيغه	System	نظام
Body	جسم	Friction	إحتكاك	Object	جسم	Table	طاولة
Box	صندوق	Frictionless	عديم الإحتكاك	Parabolic	على شكل قطع مكافئ	Tall	طويل
Building	مبنى	Function	دالة	Parallel	موازي	Tension	شد
Cable	كبل	Given	معطى	Particle	جسيم	Through	خلال
Called	يسمى	Gravitational	جاذبي	Path	مسار	Thrown	قذف
Car	سيارة	Gravity	جاذبية	Perpendicular	متعامد	Time	زمن
Ceiling	سقف	Greater	أكبر	Person	شخص	Top	أعلى
Centripetal	مركزي	Hold	يمسك	Position	موضع	Toy	لعبة
Change	تغير	Horizontal	أفقي	Projectile	مقذوفة	Travel	يرحل
Circular	دائري	Incline	مائل	Pulley	بكرة	Truck	شاحنة
Coefficient	معامل	Initial	ابتدائي	Radius	نصف قطر	Uniform	منتظم
Component	مركبة	Kinetic	حركي	Range	مدى	Unit	وحدة
Connected	متصل	Launch	يطلق	Referring to	بالرجوع إلى	Velocity	سرعة
Constant	ثابت	Leave	يترك	Road	طريق	Weigh	يزن
Coordinate	أحداثي	Less	أقل	Rolling	تدحرج	Weight	وزن
Cord	حبل	Limiting	محدد	Rough	خشن	West	غرب
Curve	منحنى	Line	خط	Run	يجري	When	عندما
Descend	يهبط	Magnitude	مقدار	Round	يدور		

Some Used Formula:

$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$	$x - x_0 = (v_0 \cos \theta_0)t.$ $y - y_0 = (v_0 \sin \theta_0)t - \frac{1}{2}gt^2.$ $v_y = v_0 \sin \theta_0 - gt.$ $v_y^2 = (v_0 \sin \theta_0)^2 - 2g(y - y_0).$	$T = \frac{2\pi r}{v}$
$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$		$\vec{F}_{net} = m\vec{a}$
$\vec{v}_{avg} = \frac{\Delta\vec{r}}{\Delta t}$		$W = mg.$
$\vec{v} = \frac{d\vec{r}}{dt}.$	$y = (\tan \theta_0)x - \frac{gx^2}{2(v_0 \cos \theta_0)^2}$	$f_{s,max} = \mu_s F_N.$
$\vec{a}_{avg} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t} = \frac{\Delta\vec{v}}{\Delta t}$	$R = \frac{v_0^2}{g} \sin 2\theta_0$	$f_k = \mu_k F_N.$
$\vec{a} = \frac{d\vec{v}}{dt}$	$a = \frac{v^2}{r}$	$F = \frac{mv^2}{R}$
	$\frac{d}{dx}x^m = mx^{m-1}$	$a = \sqrt{a_x^2 + a_y^2}$

قسم الفيزياء يتمنى لكم دوام التوفيق ،،،

(1) $\vec{r} = 4i + 3j + k$

z-component = 1 (A)

---

(2) $\vec{r_2} = 2i + 4j - 2k$

$\vec{r_1} = 2i - 5j + 4k$

$\Delta\vec{r} = \vec{r_2} - \vec{r_1} = 9j - 6k$ (B)

---

(3) $\Delta t = 3\,s$

$$\vec{v}_{ave} = \frac{\Delta \vec{r}}{\Delta t} = \frac{9j - 6k}{3}$$

$= 3j - 2k$ m/s (C)

---

(4) $x = 5t \qquad y = t^2 - 1$

$\vec{r} = xi + yj = 5ti + (t^2 - 1)j$

$$\vec{v} = \frac{d\vec{r}}{dt} = 5i + 2tj$$

$t = 2s \Rightarrow \vec{v} = 5i + 2(2)j = 5i + 4j$ (B)

(5) $\vec{v_1} = 6i - 10j - 5k$ $\quad \vec{v_2} = 18i + 14j + 7k$

$\Delta t = 2\,s$

$$a_{ave} = \frac{\vec{v_2} - \vec{v_1}}{\Delta t} = \frac{(18-6)i + (14+10)j + (7+5)k}{2}$$

$$\vec{a}_{ave} = \frac{12i + 24j + 12k}{2}$$

$$\vec{a}_{ave} = 6i + 12j + 6k \quad m/s^2$$ (A)

---

(6) $\vec{r} = 6t^2 i - t^3 j + 3t k$

$$\vec{v} = \frac{d\vec{r}}{dt} = 12t i - 3t^2 j + 3k$$

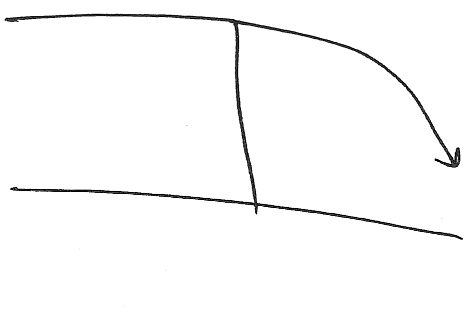
$$\vec{a} = \frac{d\vec{v}}{dt} = 12i - 6t j$$ (C)

---

(7)

Parabolic path

(B)



(8) Maximum range $\Rightarrow \theta = 45^\circ$

(B)

---

(9) $R_{max} = 60m$ $\qquad v_0 = ?$

$$R_{max} = \frac{v_0^2}{g} \Rightarrow 60 = \frac{v_0^2}{9.8}$$

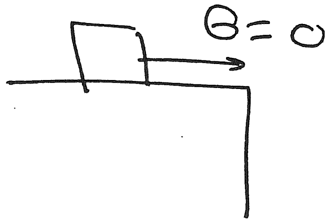
$$v_0^2 = (60)(9.8) = 588 \qquad \text{"}\sqrt{\ }\text{"}$$

$v_0 = 24.25 \ m/s$ (B)

---

(10)

(C)



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(11) $a \perp v$ (C)

---

(12) $v = 30 \ m/s$ $\qquad a = 4 \ m/s^2$ $\qquad R = ?$

$$a = \frac{v^2}{R} \Rightarrow 4 = \frac{(30)^2}{R} \Rightarrow R = \frac{(30)^2}{4} = 225 \ m$$

(A)

(13) $N = 1\ kg \cdot m/s^2$ (C)

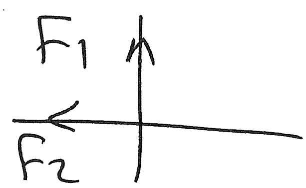
---

(14) Constant velocity $\Rightarrow$ net force = 0

(D)

---

(15) $m = 5\ kg$



$|\vec{F_1}| = 16\ N$ (north) $\Rightarrow$ $\boxed{\vec{F_1} = 16j}$

$|\vec{F_2}| = 12\ N$ (west) $\Rightarrow$ $\boxed{\vec{F_2} = -12i}$

$\sum \vec{F} = m\vec{a} \Rightarrow 16j - 12i = 5\vec{a}$ $(\div 5)$

$\vec{a} = -2.4i + 3.2j$

$|\vec{a}| = \sqrt{(2.4)^2 + (3.2)^2} = 4\ m/s^2$ (B)

---

(16) دائماً التسارع في اتجاه القوة المحصلة

(A)

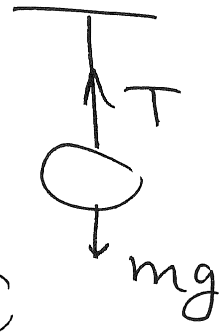
5

(17) $m = 3.5\ kg$

$\Sigma \vec{F} = 0$ الجسم ساكن

$T = mg = 3.5 \times 9.8$

$= 34.3\ N$ (B)



---

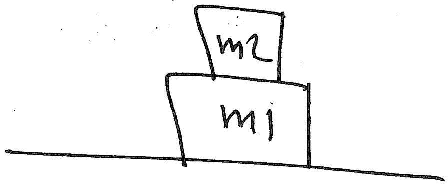
(18) $m = 70\ kg$ $W = 116.9\ N$

$g' = \frac{W}{M} = \frac{116.9}{70} = 1.67\ m/s^2$ (A)

---

(19) $m_1 = 13\ kg$

$m_2 = 2\ kg$



$F_{g_1} = m_1 g + m_2 g$

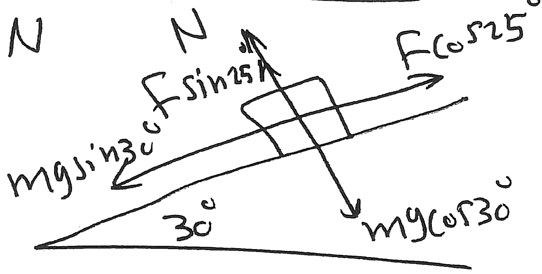
$= 13 \times 9.8 + 2 \times 9.8 = 147\ N$ (D)

---

(20) $m = 5\ kg$ $F = 15\ N$

$N + F \sin 25 = mg \cos 30^\circ$

$N = mg \cos 30^\circ - F \sin 25^\circ$



(6)

$N = 5 \times 9.8 \cos 30^\circ - 15 \sin 25^\circ$

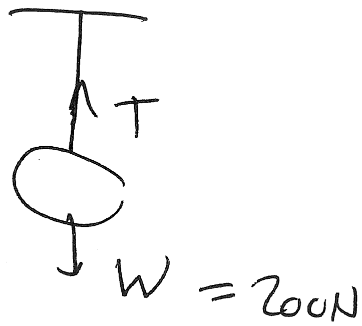
$N = 36.1\ N$ (D)

---

(21)

الجسم ساكن

$T = W = 200\ N$ (A)



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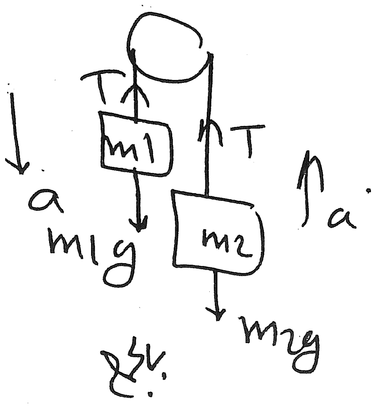
(22) $m_1 = 9\ kg$ $m_2 = 5\ kg$



For m_1: $m_1 g - T = m_1 a$

For m_2: $T - m_2 g = m_2 a$

$m_1 g - m_2 g = m_1 a + m_2 a$

$9 \times 9.8 - 5 \times 9.8 = 9a + 5a$

$39.2 = 14a$

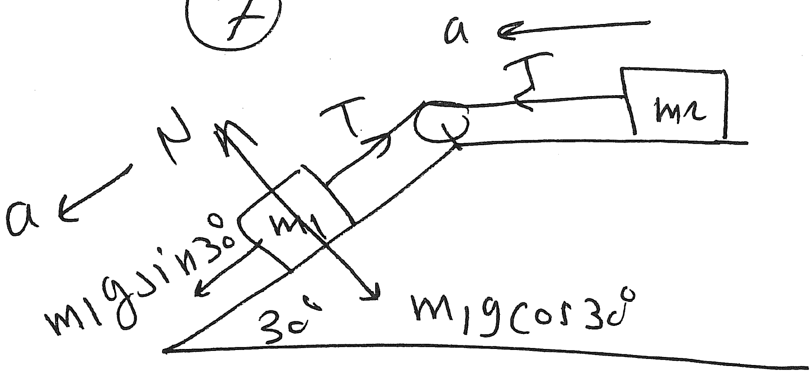
$a = \frac{39.2}{14} = 2.8\ m/s^2$ (B)

(7)

(23)

$m_1 = 2kg$

$m_2 = 4 kg$



For m1 $m_1 g \sin 30° - T = m_1 a$

For m2 $T = m_2 a$

$m_1 g \sin 30° = m_1 a + m_2 a$

$2 \times 9.8 \sin 30 = 2a + 4a$

$9.8 = 6a$

$a = \frac{9.8}{6} = 1.63 \ m/s^2$ (A)

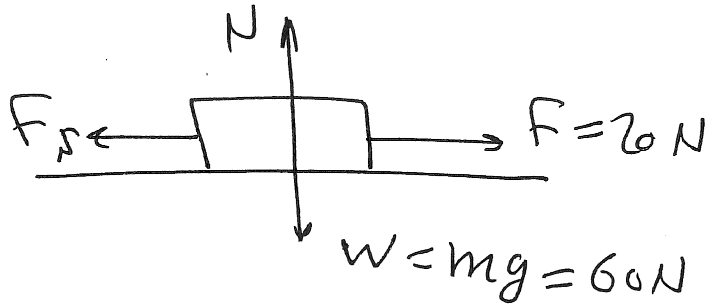
---

(24) The body is moving $\Rightarrow$

kinetic friction (C)

(25)

الجسم على وشك الحركة



$F_s = F = 20\,N$

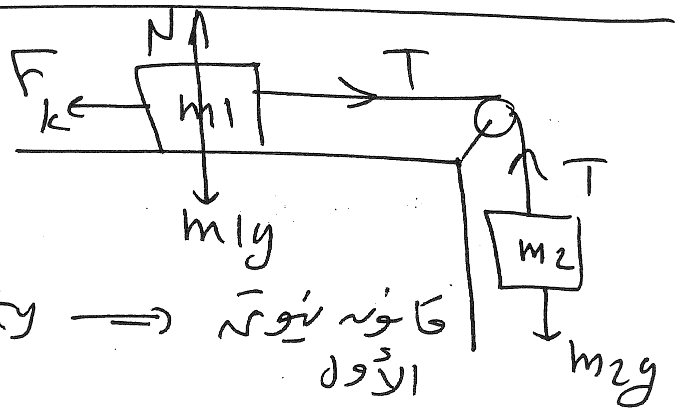
$N = W = mg = 60\,N$

$\mu_s = \frac{F_s}{N} = \frac{20}{60} = 0.33$ (C)

---

(26) $m_1 = 12\,kg$

$m_2 = 5\,kg$



Constant velocity ⟹ قانون نيوتن الأول

<u>For m_2</u> $T = m_2 g = 5 \times 9.8 = 49\,N$

For m_1 $F_k = T = 49\,N$ (A)

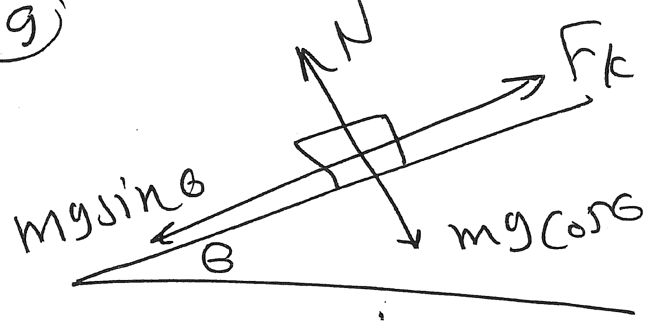
---

(27) $N = m_1 g = 12 \times 9.8 = 117.6\,N$ (D)

(9)

(28)

السرعة ثابتة



$F_k = mg\sin\theta$ (B)

---

(29) $a = -4\ m/s^2$ $\mu_k = ?$

$a = -\mu_k g \Rightarrow -4 = -\mu_k (9.8)$

$\mu_k = \frac{4}{9.8} = 0.408$ (A)

---

(30) $R = 22m$ $\mu_s = 0.5$ $v = ?$

$F_s = F_\perp \Rightarrow \mu_s mg = m\frac{v^2}{R}$

$0.5 \times 9.8 = \frac{v^2}{22}$

$v^2 = 0.5 \times 9.8 \times 22 = 107.8$

$v = \sqrt{107.8} = 10.38\ m/s$ (B)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

C

Test #2	22/1/1434H	**Time:90** min.
Student Name:	Student no.:	Section:

Q.1 The displacement of a particle moving from $\bar{r}_1 = \hat{i} - 2\hat{j} + 3\hat{k}$ to $\bar{r}_2 = 2\hat{i} - 3\hat{j} + 4\hat{k}$ is:

(A) $\hat{k}$ (B) $\hat{i} + 5\hat{j} + \hat{k}$ (C) 25 (D) $\hat{i} - 5\hat{j} + \hat{k}$ (E) $\hat{i} - \hat{j} + \hat{k}$

Q.2 A particle moves in x-y plane in such a way that its x and y coordinates vary with time according to **$x=t^3-5t$ m** and **$y=2t^2+6$ m**. where t is measured in seconds. The velocity of the particle at t=3 s is:

(A) $(7\hat{i} - 12\hat{j})$ m/s (B) $(22\hat{i} + 18\hat{j})$ m/s (C) 14 m/s (D) $(22\hat{i} + 12\hat{j})$ m/s (E) $(2\hat{k})$ m/s

Q.3 If a ball is projected with velocity 30 m/s at angle of 30° with the horizontal. The y-component of the velocity of the ball after one second is:

(A) 10 m/s (B) 20 m/s (C) 0.2 m/s (D) 5.2 m/s (E) 12 m/s

Q.4 Refer to question 3, the time taken by the ball to return to the ground is:

(A) 5 s (B) 4 s (C) 2.04 s (D) 10 s (E) 3.06 s

Q.5 Refer to question 3, the range of the projectile is:

(A) 100 m (B) 200 m (C) 79.5 m (D) 35.35 m (E) 20 m

Q.6 Refer to question 3, the maximum height attained by the projectile is:

(A) 11.5 m (B) 20 m (C) 100 m (D) 5.1 m (E) 25 m

Q.7 If you drive west at 15 km/h for one hour, then drive east at 20 km/h for one hour, your net displacement is:

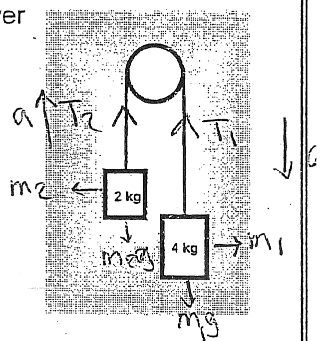
(A) 5 km east (B) 35 km west (C) 15 km west (D) 35 km east (E) 5 km west

Q.8 An 800 kg elevator is moving up with an acceleration of 1.2 m/s^2. The tension in the cable is:

(A) 8800 N (B) 12800 N (C) Zero (D) 10400 N (E) 6880 N

Q.9 In the figure m_1=4 kg and m_2=2 kg are connected by a light string that passes over a smooth pulley. The tension in the string is:

(A) 26.13 N (B) 9.8 N (C) 17.6 N (D) 13.07 N (E) zero



$T_2 - m_2 g = m_2 a$

$m_1 g - T_1 = m_1 a$

$m_1 g - m_2 g = 6a$

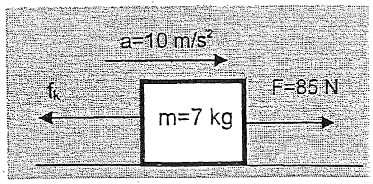
$a = 3.27$

Q.10 If the forces on an object are balanced, the object will

(A) Remain at rest if initially at rest.
(B) Continue moving in a straight line if initially moving in a straight line.
(C) Both A and B
(D) Neither A nor B
(E) None of these

C

Q.11 The diagram shows a 7 kg object accelerating at 10 m/s^2 on rough horizontal surface. The magnitude of the frictional force f_k acting on the object is:



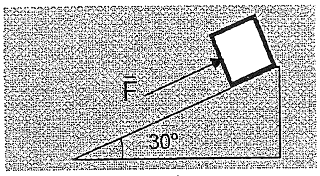
(A) 20 N (B) 5 N (C) 10 N (D) 15 N (E) 25 N

Q.12 A body of 600 N running in a circular path of R=1 m at a velocity of 8 m/s. The centripetal force is:
(A) 64.5 N (B) 5224.5 N (C) 4096 N (D) 408 N (E) 3918.4 N

Q.13 A 10 kg brick and a 1 kg book are dropped in a vacuum. The force of gravity on the 10 kg brick is:
(A) The same as the force on the 1 kg book.
(B) 10 times as much as the force on the 1 kg book.
(C) Zero
(D) All of these
(E) None of these

Q.14 A ball is shot from the ground into the air. At a height of 12.5 m, its velocity is observed to be $\vec{v} = 5.8\hat{i} + 9.7\hat{j}$ in m/s. The magnitude of the ball's initial velocity is:
(A) 19.3 m/s (B) 5.8 m/s (C) 18.41 m/s (D) 9.7 m/s (E) 33.6 m/s

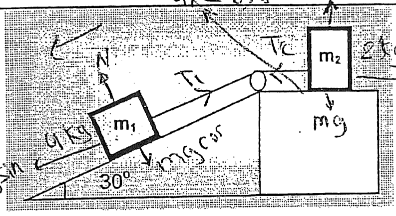
Q.15 A 6 kg mass is held at rest on a frictionless 30° incline by force $\vec{F}$. The magnitude of $\vec{F}$ is:



(A) 5 N (B) 29.4 N (C) 4.9 N (D) 24.5 N (E) Zero

Q.16 A force of 20 N is applied to move a stationary body of mass 5 kg. The acceleration of the body is:
(A) 8 m/s^2 (B) 12.5 m/s^2 (C) 16 m/s^2 (D) 20 m/s^2 (E) 4 m/s^2

Q.17 In the figure m_1=4 kg and m_2=2 kg the coefficient of kinetic friction between m_2 and the horizontal plane is 0.50. The inclined plane is frictionless. The frictional force exerted on m_2 by the plane is:



(A) Zero (B) 9.8 N (C) 19.6 N (D) 2 N (E) 4.9 N

Q.18 You drive your car clockwise around a circular track of radius 30 m. you completes 12 revolutions around the track in 2 minutes. Your average speed is:
(A) 18.8 m/s (B) 9.8 m/s (C) 10 m/s (D) 30 m/s (E) 15.7 m/s

Q.19 Which of the following units is equivalent to a newton (N)?
(A) kg.m/s^2 (B) g·cm/s (C) kg.s^2/m (D) kg.m/s (E) kg · m^2/s

Q.20 Mr. Felix of 900 N opens his parachute and experiences an air resistance force of 500 N. The net force on the Felix is:
(A) 300 N downward (B) 500 N downward (C) 400 N downward (D) 400 N upward (E) 500 N upward

Q.21 An object is pulled northward with a force of 20 N and southward with a force of 10 N. The magnitude of the net force on the object is:
(A) Zero (B) 5 N (C) 15 N (D) 10 N (E) 30 N

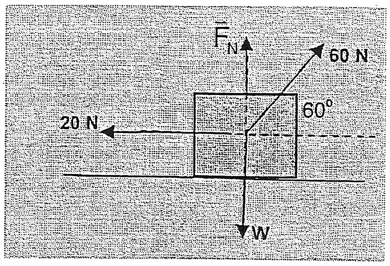
Q.22 The force that opposes the motion of an object is called
(A) Tension (B) Normal force (C) Gravitational force (D) Applied force (E) Friction

C

Q.23 Describe the motion of the 5 kg mass in the horizontal frictionless plane, as shown in the figure:

(A) The object accelerates at 1.5 m/s^2 (right)
(B) The object accelerates at 10 m/s^2 (right)
(C) The object accelerates at 15 m/s^2 (right)
(D) The object accelerates at 2 m/s^2 (right)
(E) The object does not accelerate

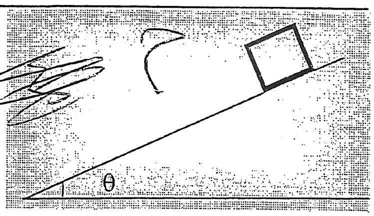
30-20
10 = ma
5



Q.24 At the highest point, the magnitude of the acceleration of a projectile is

(A) -9.8 m/s^2 (B) Zero (C) 4.9 m/s^2 (D) 19.6 m/s^2 (E) 9.8 m/s^2

Q.25 A toolbox, of mass M, is resting on a flat board. One end of the board is lifted up until the toolbox just to slide. The angle θ that the board makes with horizontal for this to occur depends on the



(A) mass, M (B) gravity is not acting on it (C) normal force
(D) coefficient of static friction (E) none of these

Q.26 A block is initially sliding with acceleration of -1.5 m/s^2 on a rough horizontal surface. The coefficient of friction between the block and the surface is:

(A) 0.1 (B) 0.2 (C) 0.3 (D) 0.4 (E) 0.15

Q.27 An object moves left to right (right is positive) with speed decreasing at a constant rate,

(A) its acceleration is negative. (B) the net force on it is decreasing
(C) the net force on it is increasing (D) its acceleration is positive. (E) none of these

Q.28 A ball was projected upward at angle θ_0 with the horizontal at an initial speed 40 m/s. The ball reached the highest point after three seconds, the angle θ_0 is:

(A) 5.7° (B) 37.3° (C) 60° (D) 47.3° (E) 36°

Q.29 Two forces act on a particle of mass 2 kg. $\bar{F}_1(40\hat{i}+30\hat{j})$ N and $\bar{F}_2(20\hat{i}+50\hat{j})$ N. The magnitude of acceleration is:

(A) 10 m/s^2 (B) Zero (C) 200 m/s^2 (D) 100 m/s^2 (E) 50 m/s^2

Q.30 A particle of mass m=1.5 kg is moving with velocity, $v(t) = [(5t^2)\hat{i} - (2t)\hat{j}]$ m/s where t is time. The net force on the particle in SI units (as unit vector notation) is:

(A) $20t\hat{i} - 4\hat{j}$ (B) $14t\hat{j}$ (C) 25 (D) $15\hat{i}t - 3\hat{j}$ (E) $16\hat{i}$

---

a 10 t -2
Σf = a x m
15 t i
15 t i - 3 j

(1)

(1) $\vec{r_2} = 2i - 3j + 4k$

$\vec{r_1} = i - 2j + 3k$

$\Delta\vec{r} = i - j + k$ (E)

---

(2) $x = t^3 - 5t$ $y = 2t^2 + 6$

$\vec{r} = xi + yj = (t^3 - 5t)i + (2t^2 + 6)j$

$\vec{v} = \frac{d\vec{r}}{dt} = (3t^2 - 5)i + 4tj$

$t = 3s \Rightarrow \vec{v} = (3(3)^2 - 5)i + 4(3)j$

$\vec{v} = 22i + 12j$ (D)

(3) $V_o = 30\ m/s$ $\theta = 30°$

$V_y = ?$ $t = 1s$ $a = -9.8\ m/s^2$

$V_{oy} = V_o \sin\theta = 30 \sin 30 = 15\ m/s$

$V_y = V_{oy} + at = 15 - 9.8(1)$

$= 5.2\ m/s$ (D)

---

(4) $t = \frac{2 V_o \sin\theta}{g} = \frac{2(30)\sin 30}{9.8}$

$= 3.06\ s$ (E)

---

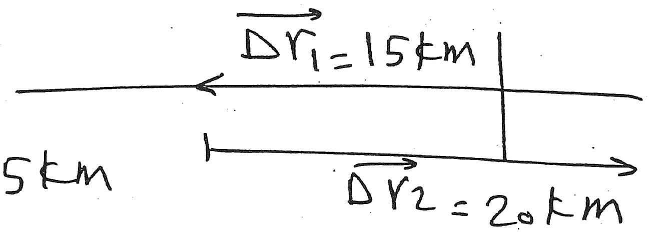
(5) $R = \frac{V_o^2 \sin 2\theta}{g} = \frac{(30)^2 \sin(2 \times 30°)}{9.8}$

$= 79.53\ m$ (C)

---

(6) $H = \frac{V_o^2 (\sin\theta)^2}{2g} = \frac{(30)^2 (\sin 30)^2}{2 \times 9.8} = 11.5\ m$ (A)

(7)



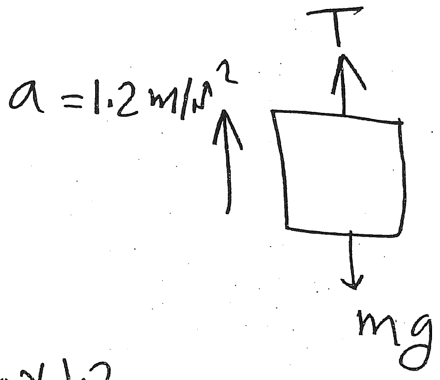
$Dr_1 = 15 \times 1 = 15km$

$Dr_2 = 20 \times 1 = 20km$

$Dr_1 = 20 - 15 = 5km$ east (A)

---

(8)



$T - mg = ma$

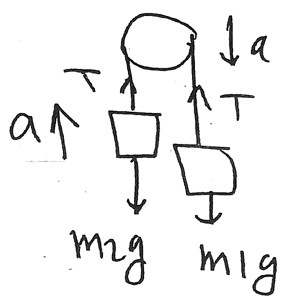
$T = mg + ma$

$= 800 \times 9.8 + 800 \times 1.2$

$= 8800$ N (A)

---

(9) $m_1 = 4kg$ $m_2 = 2kg$



$\underline{m_1}$ $m_1 g - \cancel{T} = m_1 a$ (1)

$\underline{m_2}$ $\cancel{T} - m_2 g = m_2 a$ (2)

$m_1 g - m_2 g = m_1 a + m_2 a$

$4 \times 9.8 - 2 \times 9.8 = 4a + 2a$

$19.6 = 6a \implies a = \frac{19.6}{6} = 3.27 m/s^2$

(4)

وكي نوجد T نعوضه في المعادلة (2)

$$T - m_2 g = m_2 a$$

$$T = m_2 g + m_2 a$$

$$T = 2\times 9.8 + 2\times 3.27 = 26.14\ N$$ (A)

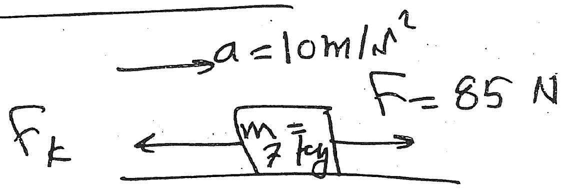
---

(10) الجسم متزن ⇐ يتحرك بسرعة ثابتة أو ساكن

(C)

---

(11) $m = 7\ kg$



$$\Sigma F = ma$$

$$F - F_k = ma \Rightarrow 85 - F_k = 7(10)$$

$$F_k = 85 - 70 = 15\ N$$ (D)

---

(12) $W = mg = 600\ N \Rightarrow m = \frac{W}{g} = \frac{600}{9.8} = 61.22\ kg$

$R = 1 m$ $\quad V = 8\ m/s$

$$F_\perp = m\frac{v^2}{R} = 61.22\ \frac{(8)^2}{1} = 3918.4\ N$$

(13) $W_{brick} = m_{brick} \cdot g = 10g$

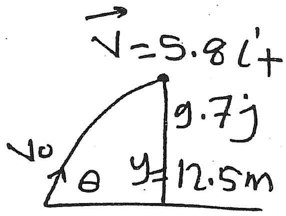
$W_{book} = m_{book} \cdot g = 1g$

$W_{brick} = 10(W_{book})$ (B)

---

(14) $\vec{V} = 5.8i + 9.7j$ m/s

$V_x = 5.8$ m/s $\quad V_y = 9.7$ m/s



$V_{oy} = ?$ $\quad a = -9.8$ m/s^2 $\quad V_y = 9.7$ m/s

$y = 12.5$ m

$V_y^2 = V_{oy}^2 + 2ay \Rightarrow (9.7)^2 = V_{oy}^2 + 2(-9.8)(12.5)$

$V_{oy}^2 = (9.7)^2 + 2(9.8)(12.5) = 339.1$ $\sqrt{\ }$

$V_{oy} = 18.4$ m/s

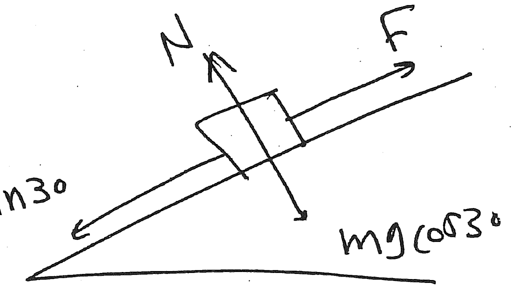
$V_o = \sqrt{V_x^2 + V_{oy}^2} = \sqrt{(5.8)^2 + (18.4)^2} = \sqrt{372.2}$

$= 19.3$ m/s (A)

(15) $m = 6\,kg$

الجسم ساكن

$\Sigma F = 0$



$F = mg\sin 30^\circ = 6 \times 9.8 \sin 30 = 29.4\,N$ (B)

---

(16) $\Sigma F = ma$

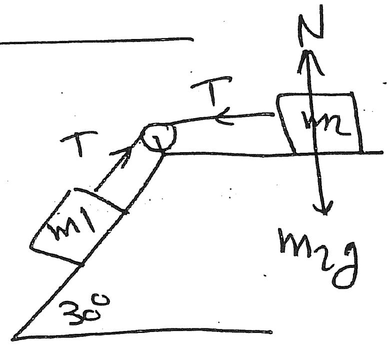
$20 = 5a \qquad a = \frac{20}{5} = 4\,m/s^2$ (E)

---

(17) $m_1 = 4\,kg \qquad m_2 = 2\,kg$

$N = m_2 g = 2 \times 9.8$

$= 19.6\,N$



$\mu_k = 0.5$

$F_k = \mu_k N = 0.5\,(19.6) = 9.8\,N$

---

(18) $R = 30\,m$

$T = \frac{\text{الزمن الكلي}}{\text{عدد اللفات}} = \frac{2 \times 60}{12}$

$= 10\,s$

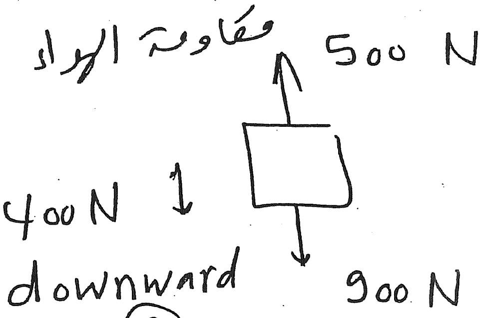
$T = \frac{2\pi R}{v} \Rightarrow v = \frac{2\pi R}{T} = \frac{2 \times 3.14 \times 30}{10}$

$= 18.8\,m/s$ (A)

(19) $N = kg \cdot m/s^2$ (A)

---

(20)



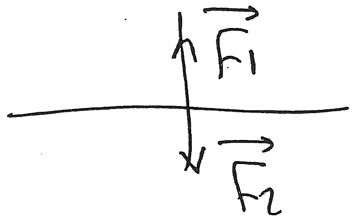
$\Sigma F = 900 - 500 = 400\,N \downarrow$ downward

(C)

---

(21) $\vec{F_1} = 20j$

$\vec{F_2} = -10j$



$\Sigma\vec{F} = F_1 + F_2 = 20j - 10j = 10j$ N (D)

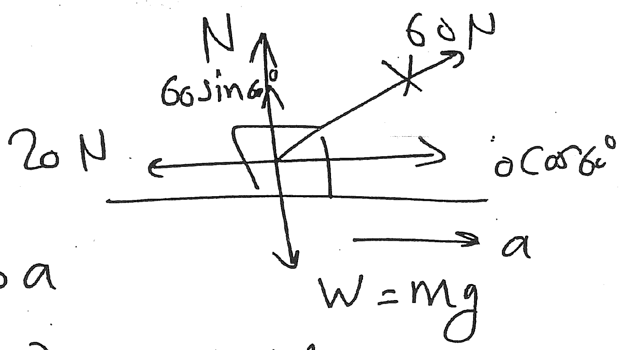
---

(22) (E) قوة الاحتكاك عكس الاتجاه

---

(23) $m = 5\,kg$

$\Sigma F = ma$



$60\cos 60° - 20 = 5a$

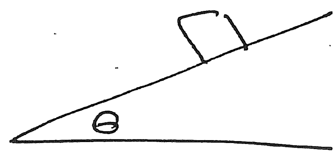
$10 = 5a \Rightarrow a = 2\,m/s^2$

$a = 2\,m/s^2$ (right) (D)

(24) $|a| = 9.8\ m/s^2$ دائماً في المقذوفات (E)

---

(25)



الجسم على وشك الحركة

$\mu_s = \tan\theta$

$\theta = \tan^{-1}(\mu_s)$

θ depends on the coefficient of static firction (D)

---

(26) $a = -\mu_k g$

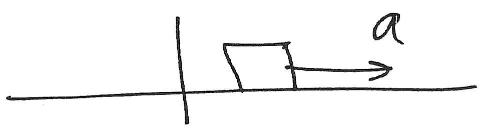
الجسم يتحرك على سطح أفقي خشن ولا تؤثر عليه F ولا T

$-1.5 = -\mu_k (9.8)$

$\mu_k = \frac{-1.5}{-9.8} = 0.153$ (E)

---

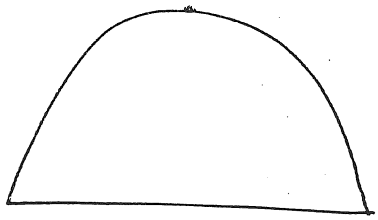
(27)



الجسم سرعته تتناقص (تباطؤ) ⇐ a سالبة

∴ its acceleration is negative (A)

(28) $V_0 = 40\ m/s$



زمن الصعود = $3s$

الزمن الكلي $t = 2 \times 3 = 6s$

$$t = \frac{2 V_0 \sin\theta}{g} \Rightarrow 6 = \frac{2(40)\sin\theta}{9.8}$$

$$\sin\theta = \frac{6 \times 9.8}{2 \times 40} = 0.735$$

$$\theta = \sin^{-1}(0.735) = 47.3^\circ$$ (D)

---

(29) $m = 2kg$

$\vec{F_1} = (40i + 30j)N$, $\vec{F_2} = 20i + 50j$

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

$$\vec{F_1} + \vec{F_2} = ma \Rightarrow (40i + 30j) + (20i + 50j) = 2\vec{a}$$

$$60i + 80j = 2\vec{a} \xrightarrow{\div 2} \vec{a} = (30i + 40j)\ m/s^2$$

$$|\vec{a}| = \sqrt{(30)^2 + (40)^2} = 50\ m/s^2$$ (E)

(30) $m = 1.5\ kg$

$$\vec{v} = (5t^2 i - 2t j)\ m/s$$

$$\vec{a} = \frac{d\vec{v}}{dt} = 10t i - 2j$$

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

$$\Sigma \vec{F} = 1.5\,(10t i - 2j)$$

$$= 15t i - 3j$$

(D)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

ڤيزياء Ph 110

A

Test#2	1/6/1433 H	**Time:** 90 min.
Student Name:	Student no.:	Section:

Q.1 The displacement of a particle moving from $\bar{r}_1 = 5\hat{i} + 6\hat{j} + 2\hat{k}$ to $\bar{r}_2 = -5\hat{i} + 6\hat{j} + 2\hat{k}$ is:

(A) $-10\hat{i}$ (B) $4\hat{j} + 6\hat{k}$ (C) $10\hat{i} + 5\hat{j}$ (D) $5\hat{j}$ (E) 8

Q.2 The components of the a car's velocity as a function of time are given by v_x=2t+2 and v_y=4t-2, then its velocity $\bar{v}$ at (t = 3s) is:

(A) $\bar{v} = 8\hat{i} - 10\hat{j}$ (B) $\bar{v} = 9\hat{i} - 3\hat{j}$ (C) $\bar{v} = 8\hat{i} + 10\hat{j}$ (D) $\bar{v} = 10\hat{i} - 8\hat{j}$ (E) $\bar{v} = 8\hat{i}$

Q.3 A man of mass 60 kg. His weight is:

(A) 122 N (B) 6.12 N (C) zero (D) 9.8 N (E) 588 N

Q.4 1Newton is equivalent to:

(A) 9.8 kg.m/s² (B) 1 kg. m/s² (C) 1 kg of mass (D) 1 kg of force (E) none of these

Q.5 A body moves with constant speed in a circular orbit. Its acceleration is:

(A) equal zero
(B) toward the center
(C) outward, away from the center
(D) in the direction of the velocity of the body
(E) opposite to the velocity of the body.

Q.6 In the projectiles motion the acceleration in the horizontal direction is:

(A) Zero (B) 9.8 m/s² (C) 19.6 m/s² (D) 4.9 m/s² (E) 32 m/s²

Q.7 A ball is shot from the top of a building of height 12.5 m, with initial velocity $\bar{v}_o = 5.8\,\hat{i} + 9.7\,\hat{j}$, in meters per second ($\hat{i}$ horizontal, $\hat{j}$ upward). What is the magnitude of the ball's velocity just before it hits the ground?

(A) 5 m/s (B) 6 m/s (C) 19.3 m/s (D) 10 m/s (E) Zero

Q.8 A projectile is fired from the ground. If it reaches the maximum range at 50 m from the starting point, the initial velocity is:

(A) 34.3 m/s (B) 10 m/s (C) 196 m/s (D) 24.25 m/s (E) 22.14 m/s

Q.9 Two forces are applied to a 16.25 kg object, one is 33 N to the north and the other is 56 N to the west. The magnitude of the acceleration of the object is:

(A) 4 m/s² (B) 2 m/s² (C) 3 m/s² (D) Zero (E) 5 m/s²

Q.10 Three forces act on a particle that moves at a constant speed $v = 4\hat{i} - 14\hat{j}$ m/s. If $\bar{F}_1 = 5\hat{i} - 4\hat{j}$ N and $\bar{F}_2 = -5\hat{i} - 4\hat{j}$ N, $\bar{F}_3$ is:

(A) $10\hat{i}$ (B) $8\hat{j}$ (C) $10\hat{i} + 8\hat{j}$ (D) $-10\hat{j}$ (E) $8\hat{i}$

A

Q.11 A plastic box of mass 0.7 kg slides down an inclined plane with an angle 40° with the horizontal. If μ_k=0.2 the acceleration of the box in SI units is:
(A) 1.5 up (B) 4.8 down (C) 0.5 up (D) 1.5 down (E) 3.5 up

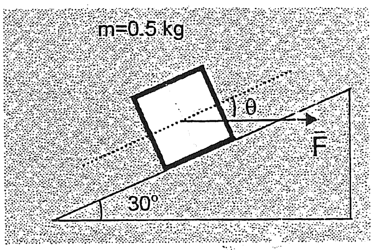
Q.12 A block is initially at a speed of 9.8 m/s on a rough horizontal surface. If it come to rest in a distance of 49 m, the coefficient of friction between the block and the surface is:
(A) 1 (B) 0.1 (C) 2.3 (D) 0.3 (E) 0.5

Q.13 A particle moves at constant speed in a horizontal circle of radius 5 m, making a complete circle in 4 s. The acceleration is:
(A) 15 m/s^2 (B) 10 m/s^2 (C) 8 m/s^2 (D) 12.34 m/s^2 (E) Zero

Q.14 The x-and y-coordinates of a particle in motion, as functions of time t, are given by: $x=5t^2-3t+6$ and $y=3t^3-3t^2-12t-3$. The x- and y-components of the velocity at t=0 is:
(A) (-3,-12) m/s (B) (10,-6) m/s (C) (18,-6) m/s (D) (-6,-3) m/s (E) (-6,10) m/s

Q.15 The formula for the centripetal force is:
(A) $a=\frac{v^2}{R}$ (B) F=ma (C) F=mg (D) $F=m\frac{v^2}{R}$ (E) none of these

Q.16 As shown in the figure a box on frictionless inclined plane. The horizontal force, which prevents the box from slipping down the plane, then the magnitude of $\vec{F}$ is:
(A) 8.3 N (B) 9.8 N (C) 4.9 N (D) 2.83 N (E) Zero



Q.17 In the figure, if F=4 N then the value of box acceleration is:
(A) 1 m/s^2 (B) 4 m/s^2 (C) 9.8 m/s^2 (D) 6 m/s^2 (E) 2.03 m/s^2

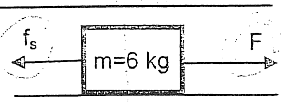
Q.18 In the figure, if F=4 N then the normal force on the box is:
(A) 2 N (B) 2.24 N (C) 12.24 N (D) 6.24 N (E) Zero

Q.19 A boy kicks a ball at an angle of 30° to the horizontal with a speed of 14.0 m/s. The time it takes to reach the horizontal range is:
(A) 0.92 s (B) 0.71 s (C) 0.15 s (D) 1.43 s (E) 0.38 s

Q.20 The formula for the friction force is:
(A) F=2f (B) F=ma (C) w=mg (D) F=N (E) f=μ N

Q.21 boy kicks a ball at an angle of 30° to the horizontal with a speed of 14.0 m/s. The maximum height that the ball can reach is:
(A) 9.87 m (B) 4.13 m (C) 15.33 m (D) 12.68 m (E) 2.5 m

Q.22 In the figure, the block is about to slide when a force F is applied. If the coefficient of static friction μ_s=0.45, then the applied force is:



(A) 6 N (B) 30 N (C) 26.46 N (D) 13.23 N (E) Zero

A

Q.23 A block slides down on a frictionless inclined plane at an angle of 20°. The acceleration of the block is:
(A) 9.8 m/s^2 (B) 4.9 m/s^2 (C) Zero (D) 3.35 m/s^2 (E) 1 m/s^2

Q.24 The velocity and acceleration of a body in a uniform circular motion are:
(A) differed by 45^0 (B) differed by 135^0 (C) perpendicular (D) parallel (E) none of these

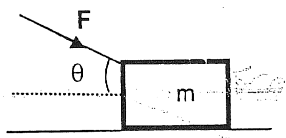
Q.25 Refer to question 22, the normal force on the box is:
(A) 49 N (B) 84.87 N (C) Zero (D) 58.8 N (E) 26.4 N

Q.26 A cable holds a ball of mass 20 kg in static equilibrium. The tension in the cord is:
A) 500 N (B) 9.8 N (C) 220 N (D) zero (E) 196 N

Q.27 A 1500 kg car is moving with a constant speed. The net force on the box is:
(A) Zero (B) 1500 N (C) 14700 N (D) 9.8 N (E) 153 N

Q.28 A forward horizontal force of 12 N is used to pull a 240 N crate at constant velocity across a horizontal floor. The coefficient of friction is:
(A) 1 (B) 0.1 (C) 2.3 (D) 0.3 (E) 0.05

Q.29 A block of mass m is pulled at constant velocity along a rough horizontal floor by an applied force **F** as shown. The magnitude of the frictional force is:
(A) F cosθ (B) F sinθ (C) F tanθ (D) mg cosθ (E) zero



Q.30 A box is sliding down an incline that is 35° above the horizontal. If the coefficient of kinetic friction is 0.40, the acceleration of the crate is:
(A) Zero (B) 2.4 m/s^2 (C) 5.8 m/s^2 (D) 8.8 m/s^2 (E) 1.3 m/s^2

Good Luck

Radius	نصف القطر	Object	جسيم	down	الى اسفل	Angle	زاوية
Refer to question	بالرجوع الى السؤال السابق	Period	الزمن الدوري	Elevator	مصعد	Automobile	سيارة
Upwards	للاعلى	Prevents the box from slipping down			يمنع الصندوق من الانزلاق الى اسفل	Block	جسم
Vertically	عمودياً	Rough surface	سطح خشن	kick	ضربت	Brake	فرامل
		Speed	سرعة	Hang	معلق	Component	مركبة
		String	خيط	Initial	الابتدائية	Cord	حبل
		Tension	الشد	Magnitude	قيمة	Carte	صندوق
		Thrown	قذف	Massless	عديم الكتلة	Circular path	مسار دائري
		Traveling	تسير	Moving	تتحرك	Cubic	مكعب

(1) $\vec{r_1} = 5i + 6j + 2k$

$\vec{r_2} = -5i + 6j + 2k$

$\vec{\Delta r} = \vec{r_2} - \vec{r_1} = -10i$ (A)

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(2) $v_x = 2t+2$ $v_y = 4t-2$

$\vec{v} = v_x i + v_y j = (2t+2)i + (4t-2)j$

$t = 3s \Rightarrow \vec{v} = (6+2)i + (12-2)j$

$\vec{v} = 8i + 10j$ (C)

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(3) $m = 60\ kg \Rightarrow w = mg = 60 \times 9.8 = 588\ N$ (E)

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(4) $1N = 1kg \cdot m/s^2$ (B)

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(5) (B)

(2)

(6) (A) $a_x = 0$ المقذوفات

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(7) $\vec{v}_0 = 5.8\hat{i} + 9.7\hat{j}$

$v_x = 5.8$ m/s $v_{0y} = 9.7$ m/s

$y = -12.5$ m (لأنه هابط) $v_y = ?$

$a = -9.8$ m/s²

$$v_y^2 = v_{0y}^2 + 2ay = (9.7)^2 + 2(-9.8)(-12.5)$$

$$v_y^2 = 339.09 \xrightarrow{\sqrt{}} v_y = -18.414 \text{ m/s}$$

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(5.8)^2 + (18.414)^2}$$

$$= 19.306 \text{ m/s}$$ (C)

حل آخر

$v_{0y} = 9.7$ m/s $y = -12.5$ m

$a = -9.8$ m/s² $t = ?$

$$y = v_{0y}t + \frac{1}{2}at^2 \Rightarrow -12.5 = 9.7\,t + \frac{1}{2}(-9.8)t^2$$

(3)

$4.9t^2 - 9.7t - 12.5 = 0$ بالآلة الحاسبة

$t = 2.87\ s$

$V_y = V_{oy} + at = 9.7 + (-9.8)(2.87)$

$= -18.4\ m/s$

$V = \sqrt{V_x^2 + V_y^2} = 19.3\ m/s$ (C)

---

(٨) $R_{max} = 50m$ $V_o = ?$

$R_{max} = \frac{V_o^2}{g} \Longrightarrow 50 = \frac{V_o^2}{9.8}$

$V_o^2 = 50 \times 9.8 = 490$ "٤٢"

$V_o = \sqrt{490} = 22.14\ m/s$ (E)

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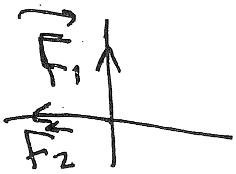
(9) $m = 16.25\ kg$



$\vec{F_1} = 33\hat{j}$ (أعلى) , $\vec{F_2} = -58\hat{i}$ يسار

$\Sigma\vec{F} = m\vec{a} \Rightarrow -58\hat{i} + 33\hat{j} = 16.25\ \vec{a}$ (A)

$\vec{a} = -3.45\hat{i} + 2.03\hat{j} \Longrightarrow |\vec{a}| = \sqrt{(3.45)^2 + (2.03)^2} = 4\ m/s^2$

(Q10) Constant speed $\Rightarrow \sum \vec{F} = \vec{0}$

$\vec{F_1} + \vec{F_2} + \vec{F_3} = \vec{0}$

$8\hat{i} - 4\hat{j} + (-8\hat{i} - 4\hat{j}) + \vec{F_3} = \vec{0}$

$\vec{F_3} = 8\hat{j}$ (B)

---

(11) $\theta = 40$ $\mu_k = 0.2$ slides down

$a = g\sin\theta - \mu_k g\cos\theta = 9.8\sin 40° - 0.2 \times 9.8\cos 40°$

$a = 4.8\ m/s^2$ (B) لا يؤثر على الجسم قوة خارجية لا F ولا T

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(12) $v_0 = 9.8\ m/s$, $x = 49\ m$, $v = 0$, $a = ?$

$v^2 = v_0^2 + 2ax \Rightarrow 0 = (9.8)^2 + 2a(49)$

$-98a = (9.8)^2 \Rightarrow a = \frac{(9.8)^2}{-98} = -0.98\ m/s^2$

الحركة على مستوى أفقي خشن

$a = -\mu_k g \Rightarrow -0.98 = -\mu_k (9.8)$

ولا تؤثر على الجسم قوة غير الاحتكاك

$\mu_k = \frac{-0.98}{-9.8} = 0.1$ (B)

(13) $R = 5\ m$

$$T = \frac{\text{الزمن الكلي}}{\text{عدد اللفات}} = \frac{4}{1} = 4\ s$$

$$T = \frac{2\pi R}{v} \Rightarrow v = \frac{2\pi R}{T} = \frac{2\times 3.14\times 5}{4} = 7.85\ m/s$$

$$a = \frac{v^2}{R} \Rightarrow a = \frac{(7.85)^2}{5} = 12.325\ m/s^2$$ (D)

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(14) $\vec{r}(t) = x(t)\,i + y(t)\,j$

$$= (5t^2 - 3t + 6)\,i + (3t^3 - 3t^2 - 12t - 3)\,j$$

$$\vec{v} = \frac{d\vec{r}(t)}{dt} = (10t - 3)\,i + (9t^2 - 6t - 12)\,j$$

$t = 0 \Rightarrow \vec{v} = -3i - 12j\ m/s$ $(-3, -12)$ (A)

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(15) $F = m\dfrac{v^2}{R}$ (D)

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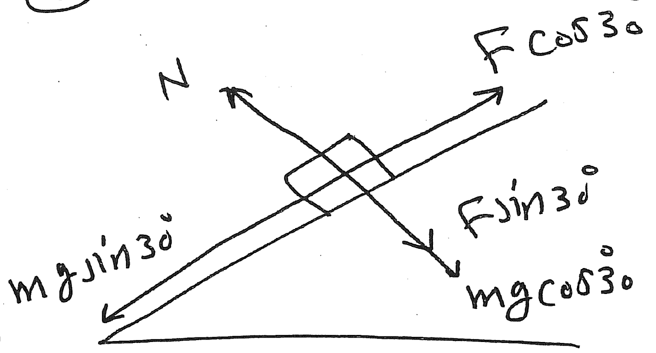
(6)

(16)

$m = 0.5\ kg$



الجسم ساكن ← $\Sigma F = 0$

$$F \cos 30^\circ = mg \sin 30$$

$$F = \frac{mg \sin 30^\circ}{\cos 30^\circ} = \frac{0.5 \times 9.8 \sin 30^\circ}{\cos 30^\circ}$$

$$\boxed{F = 2.83\ N}$$ (D)

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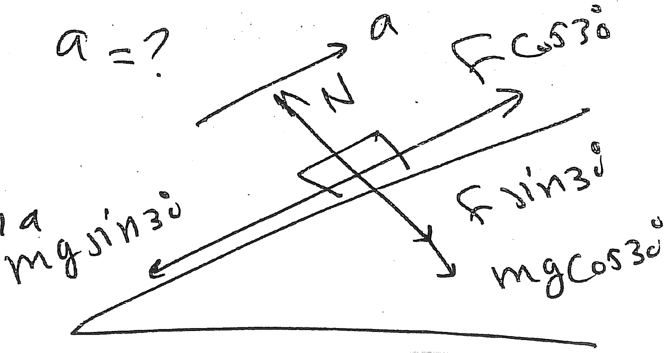
(17) $F = 4\ N$ $\quad a = ?$

$\Sigma F = ma$

$F \cos 30^\circ - mg \sin 30^\circ = ma$



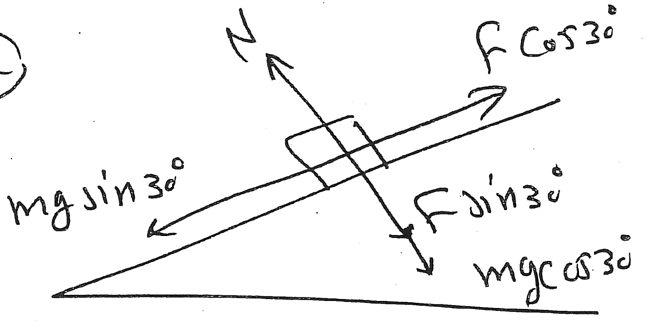
$$4 \cos 30^\circ - 0.5 \times 9.8 \sin 30^\circ = ma$$

$$1.014 = 0.5\, a$$

$$a = \frac{1.014}{0.5} = 2.028\ m/s^2$$ (E)

(18)

(7)



$\sum F_y = 0$

$N = F \sin 30° + mg \cos 30°$

$= 4 \sin 30 + 0.5 \times 9.8 \cos 30$

$N = 6.244 \text{ N}$ (D)

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(19) $\theta = 30°$ $v_o = 14 \text{ m/s}$

$t = \dfrac{2 v_o \sin\theta}{g} = \dfrac{2(14) \sin 30}{9.8} = 1.43 \text{ s}$ (D)

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(20) $f = \mu N$ (E)

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(21) $v_o = 14 \text{ m/s}$ $\theta = 30°$

$H = \dfrac{v_o^2 (\sin\theta)^2}{2g} = \dfrac{(14)^2 (\sin 30)^2}{2 \times 9.8} = 2.5 \text{ m}$ (E)

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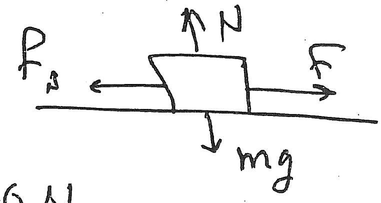
(22) $m = 6 \text{ kg}$ $\mu_s = 0.45$

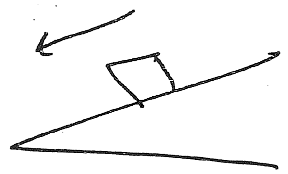


$N = mg = 6 \times 9.8 = 58.8 \text{ N}$

$f_s = \mu_s N = 0.45 (58.8) = 26.46 \text{ N}$ (C)

الجسم ساكن $F = f_s = 24.46 \text{ N}$

(23) $\theta = 20^\circ$



$a = g\sin\theta = 9.8\sin 20^\circ = 3.35\ m/s^2$ (D)

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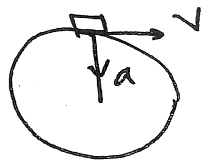
(24) $\vec{v} \perp \vec{a}$ (C)



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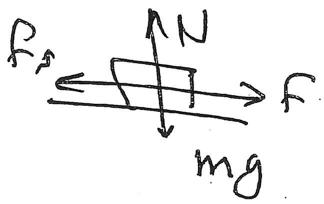
(25) $N = mg = 6 \times 9.8$

$= 58.8\ N$ (D)



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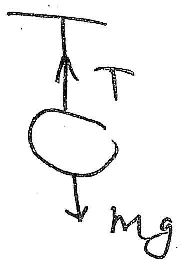
(26) $m = 20\,kg$

الجسم ساكن $T = mg = 20 \times 9.8 = 196\ N$ (E)



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(27) Constant speed $\Rightarrow$ $\Sigma F = 0$ (A)

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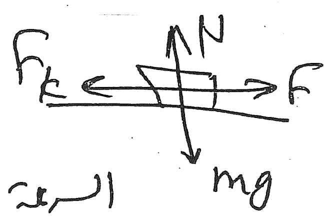
(28) $F = 12\,N$ $mg = 240\,N$



السرعة ثابتة

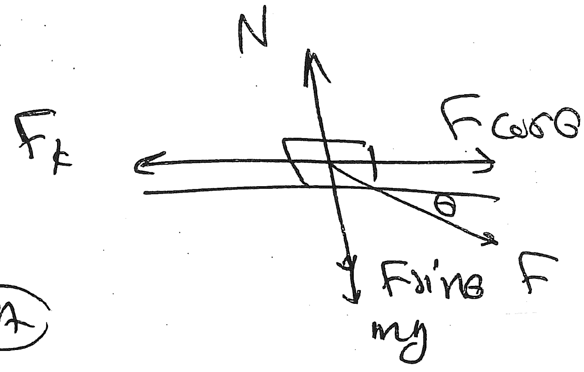
$N = mg = 240\ N$

$F_k = F = 12\,N$

$\mu_k = \frac{F_k}{N} = \frac{12}{240} = 0.05$ (E)

(9)

(29)



السرعة ثابتة

$F_k = F\cos\theta$ (A)

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(30) sliding down $\theta = 35^\circ$ $\mu_k = 0.4$

الجسم لا تؤثر عليه قوة خارجية F ولا T

$a = g\sin\theta - \mu_k g\cos\theta = 9.8\sin35^\circ - 0.4 \times 9.8\cos35^\circ$

$a = 2.41\ m/s^2$ (B)

Phy110

Ch7 (1)

ملخص القوانين

Work الشغل

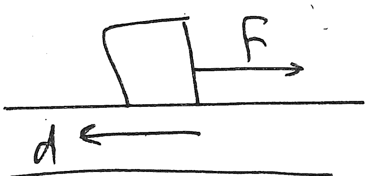
$$W = \vec{F} \cdot \vec{d}$$ جول (J)

$\vec{F} =$ متجه القوة

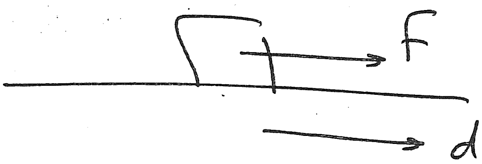
$\vec{d} =$ متجه الإزاحة

وإذا كانت F دالة في X والجسم تحرك من X_1 إلى X_2

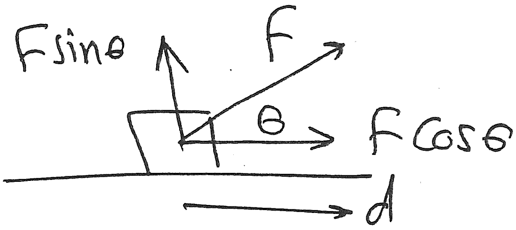
$$W = \int_{X_1}^{X_2} F(x)\,dx$$ جول (J)



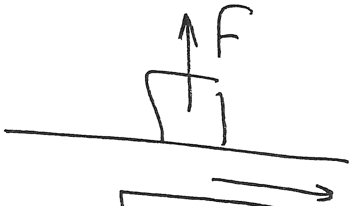
$$W = -Fd$$



$$W = Fd$$



$$W = (F\cos\theta)\,d$$



$$W = 0$$

مثل شغل رد الفعل العمودي

$$W_N = 0$$ دائماً

Power = rate of work done

الـ القدرة (معدل الشغل المبذول)

لو V غير معلومة

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

واط Watt

$$\text{watt} = J/s$$

$$hP = 746\ W$$

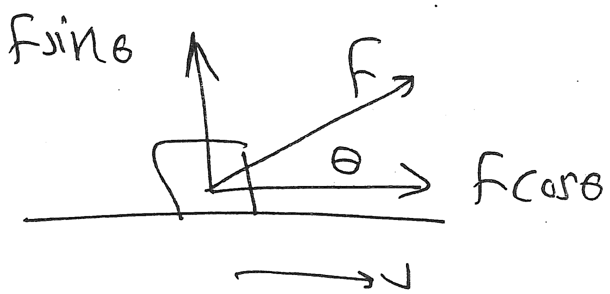
$$hp \xrightarrow{\times 746} W$$

$$W \xrightarrow{\div 746} hp$$

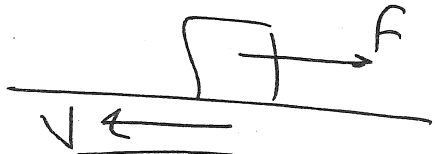
لو V معلومة

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

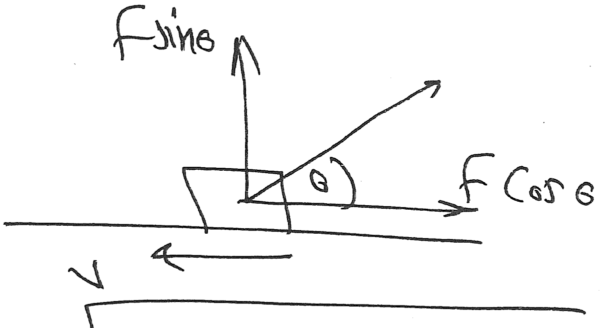
$$P = Fv$$



$$P = (F\cos\theta)\,v$$



$$P = -Fv$$



$$P = -(F\cos\theta)\,v$$

$$P = 0$$

$N = kg \cdot m/s^2$

$J = N \cdot m$

$J = kg \cdot m^2/s^2$

$Watt = J/s$

$Watt = kg \cdot m^2/s^3$

---

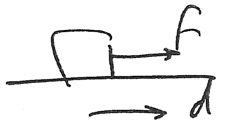
k = kinetic energy

$k = \frac{1}{2} m v^2$

لو متجه

$k = \frac{1}{2} m |\vec{v}|^2$

$W = \Delta k = \frac{1}{2} m (v_f^2 - v_i^2)$



$F \cdot d = \frac{1}{2} m (v_f^2 - v_i^2)$

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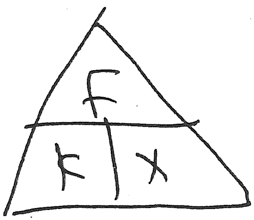
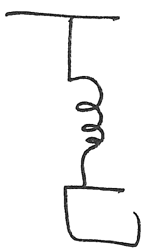
spring $F = mg = kx$





شغل الزنبرك $W_s = -\frac{1}{2} k (x_f^2 - x_i^2)$ work done <u>by</u> the spring

الشغل على الزنبرك $W_F = \frac{1}{2} k (x_f^2 - x_i^2)$ Work done <u>on</u> the spring

Ch 8

(1)

طاقة الحركة

k = kinetic energy

$$k = \frac{1}{2} m v^2$$

$$k = \frac{1}{2} m |\vec{v}|^2$$

U_g = gravitational potential energy طاقة الوضع للجاذبية الأرضية

$$U_g = mgh$$

h = height الارتفاع

U_s = elastic potential energy طاقة الوضع للزنبرك

$$U_s = \frac{1}{2} k x^2$$

k = spring constant
or (force constant)
ثابت الزنبرك

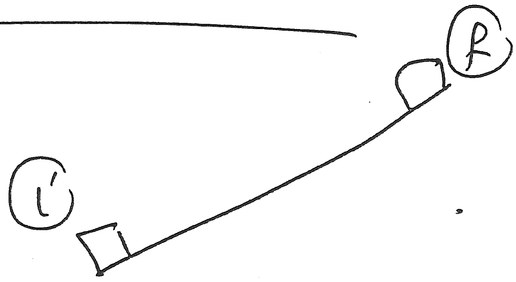
$$N/cm \xrightarrow{\times 100} N/m$$

E = Mechanical energy الطاقة الميكانيكية

$$E = k + U_g + U_s$$

$$W_{i-f} = \Delta E$$

$$W_{i-f} = \Delta k + \Delta U_g + \Delta U_s$$



ch 8 ②

$W_{i-f} =$ شغل القوة الخارجية F أو شغل قوة الاحتكاك f_k

$W_{f_k} = -f_k d$

$W_{i-f} = 0$ إذا كان لا يوجد قوة خارجية F ولا قوة احتكاك

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

لو K معلومة — لو v معلومة

$\Delta K = 0$ لو $v_f = v_i$ أي إذا الجسم يتحرك بسرعة ثابتة

$\Delta U_g = mg(h_f - h_i)$ لو h معلومة

$\Delta U_g = mg \sin\theta (d_f - d_i)$ لو المستوى مائل و θ معلومة و h غير معلومة

$\Delta U_g = 0$ إذا تحرك الجسم على مستوى أفقي

$\Delta U_s = \frac{1}{2} k (x_f^2 - x_i^2)$

$\Delta U_s = 0$ إذا لم يوجد بالمسألة زنبرك

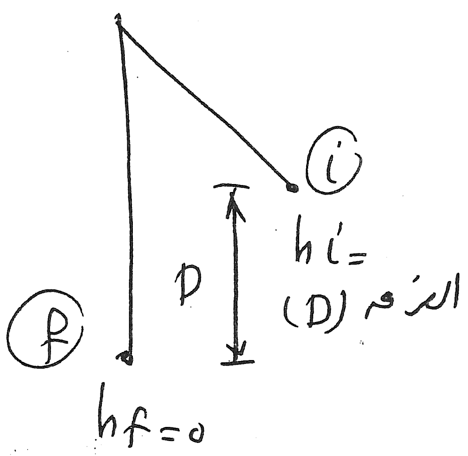
Ch 8 ③

ملاحظات

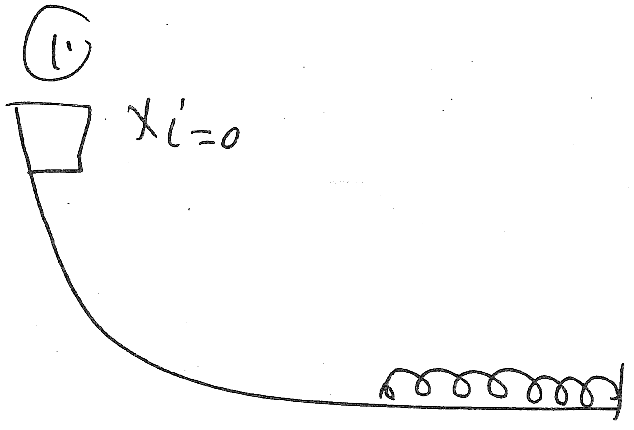
① إذا كان البعد عن الأرض غير معلوم نجعل النقطة السفلى

h عندها يساوي صفر والنقطة الثانية h عندها

يساوي الفرق بين النقطتين



② عندما يكون الجسم بعيداً عن الزنبرك ⇐ $X = 0$



Ch 9

(1)

$$x_{cm} = \frac{\sum mx}{\sum m}$$

$$= \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$$

m	x	y
m_1	x_1	y_1
m_2	x_2	y_2

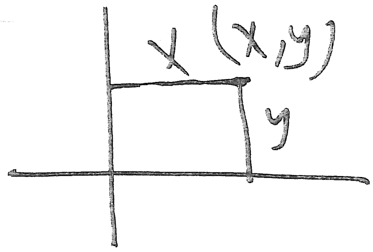
$$y_{cm} = \frac{\sum my}{\sum m} = \frac{m_1y_1 + m_2y_2}{m_1 + m_2}$$

the center of mass is (x_{cm}, y_{cm})

the position vector of the center of mass is

$$\vec{r} = x_{cm}\,\hat{i} + y_{cm}\,\hat{j}$$

$$|\vec{r}| = \sqrt{x_{cm}^2 + y_{cm}^2}$$



$$\vec{a}_{com} = \frac{\sum \vec{F}}{\sum m}$$

$\vec{a} = a_x\hat{i} + a_y\hat{j}$ $\qquad |\vec{a}| = \sqrt{a_x^2 + a_y^2}$

Ch 9 (2)

linear momentum

$$\vec{P} = m\vec{v}$$ (kg.m/s) vector quantity كمية متجهة

Change in momentum $= \Delta\vec{P} = m(\vec{v_f} - \vec{v_i})$

$$K = \frac{1}{2}mv^2$$

$$K = \frac{1}{2}Pv$$

The velocity of the center of mass

$P_i = P_f \Longrightarrow$ $m_1v_1 + m_2v_2 = (m_1 + m_2)v_{com}$

v_{com} = the velocity of the center of mass سرعة مركز الثقل (السرعة المشتركة)

Impulse الدفع

$$\vec{J} = \Delta\vec{P} = m(\vec{v_f}\ \vec{v_i})$$

$$\vec{J} = \vec{F}.t$$

$$J = F.t = m(v_f - v_i)$$ kg.m/s

اختبارات نهائية

bdulaziz University
aculty of Science
hysics Dept.
hysics 110

Ph 110 السليمانية · ثول

B

Final Exam. Time:120 min.

Student Name: Student no: Section:

Q.1 If $\vec{A}=\hat{i}+5\hat{j}$, $\vec{B}=2\hat{i}-10\hat{j}$, $\vec{C}=3\hat{i}-5\hat{j}$ then $(2\vec{A}+\vec{C})\times(\vec{B})$ is:
(A) -22 (B) $\hat{i}+2\hat{j}$ (C) 57 (D) $40\hat{k}$ (E) $-60\hat{k}$

Q.2 If $\vec{A}=2\hat{i}+4\hat{j}+4\hat{k}$, $\vec{B}=5\hat{i}-5\hat{j}+5\hat{k}$ then $\vec{A}\bullet\vec{B}$ is:
(A) $-22\hat{k}$ (B) 10 (C) $\hat{i}+2\hat{j}-5k$ (D) $-20\hat{k}$ (E) 20

Q.3 The acceleration of a car that maintains a constant velocity of 120 km/h for 15 seconds is:
(A) 15 m/s^2 (B) zero (C) 120 km/h^2 (D) 40 m/s^2 (E)20m/s^2

Q.4 A stone is thrown vertically into the air. At the very top of its trajectory the net force on it is:
(A) its weight (B) less than its weight (C) more than its weight (D) zero (E) half its weight

Q.5 A scalar quantity is:
(A) a quantity that has both magnitude and direction
(B) a quantity that has magnitude only and no direction
(C) a quantity that has no magnitude and only direction
(D) a quantity that has neither magnitude of direction (E) none of these

Q.6 A stone is thrown vertically into the air. At the top of its path, its acceleration (m/s^2) is:
(A) 9.8 (B) less than 9.8 (C) greater than 9,8 (D) zero (E) none of these

Q.7 A car takes 10 s to accelerate from 0 to 70 m/s. assuming constant acceleration, then acceleration is:
(A) 7 m/s^2 (B) 9.8 m/s^2 (C) 2.8 m/s^2 (D) zero (E) 5 m/s^2

Q.8 According to Newton, force is equal to acceleration multiplied by..................
(A) mass (B) speed (C) vector plane (D) time (E) velocity

Q.9 The force of friction on a sliding object is 20 N. The magnitude of the applied force need to maintain a constant velocity is:
(A) more than 10 N (B) less than 10 N (C) 10 N (D) 20 N (E) zero

Q.10 When a box rests on a floor, it is acted upon by the gravitational and the .... force.
(A) acceleration (B) friction (C) inertia (D) normal (E) centrifugal

Q.11 The unit for work is:
(A) watts (B) kg (C) newton (D) second (E) joule

Q.12 In the formula $w=\vec{F}\bullet\vec{d}$, then $\vec{d}$ stand for?
(A) time (B) displacement (C) work (D) force (E) mass

Q.13 Compared to the mass of a certain object on the Earth, the mass of the same object on the moon is:
(A) more (B) less (C) the same (D) zero (E) half

Q.14 Force is defined as:
(A) mass/volume (B) (mass) × (velocity) (C) mass/acceleration (D) (mass) × (acceleration)
(E) acceleration/area

Q.15 An object that has kinetic energy must be:
(A) moving (B) at rest (C) at static equilibrium (D) at elevated position (E) none of these

Q.16 Your weight is:
(A) your mass (B) the gravitational attraction between you and the Earth
(C) your work (D) all of these (E) none of these

Q.17 A particle moves 8 m in the positive y-direction while being acted upon by a constant force $\vec{F}=(4\hat{i}+2\hat{j}-4\hat{k})$ N. The work done on the particle by this force is:
(A) 20 J (B) 10 J (C) 16 J (D) -20 J (E) none of these

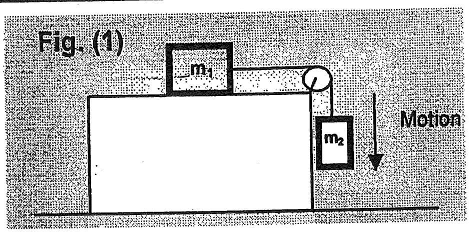
Q.18 At time t = 0 a 2 kg particle has a velocity of $(3\hat{i}-2\hat{j})$ m/s. At t = 3s its velocity is $(4\hat{i}+3\hat{j})$ m/s. During this time the work done on it was:
(A) 6 J (B) 24 J (C) 14 J (D) 12 J (E) $(4\hat{i}+36\hat{j})$ J

Q.19 An 800 kg elevator is moving up with an acceleration of 1.4 m/s^2. The tension in the cable is:
(A) 6720 N (B) 8960 N (C) Zero (D) 10400 N (E) 6880 N

Q.20 A boy kicks a ball at an angle 42° to the horizontal with speed 12.5 m/s. The time it takes to reach its range is:
(A) 0.92 s (B) 1.96 s (C) 1.57 s (D) 1.71 s (E) 0.79 s

Q.21 A force of 20 N is applied to move a stationary body of mass 10 kg. The speed of the body after 6 s is:
(A) 1.25 m/s (B) 12 m/s (C) 16 m/s (D) 18 m/s (E) 8 m/s

Q.22 In figure (1) m_1=2 kg and m_2=1 kg. If m_2 descend with constant speed, the tension in the cord is
(A) Zero (B) 19.6 N (C) 4.9 N (D) 7.35 N (E) 9.8 N



Q.23 In figure (1), the normal force between m_1 and the plane is:
(A) 19.6 N (B) 25.46 N (C) 9.8 N (D) 980 N (E) zero

Q.24 In the figure (1), the frictional force exerted on m_1 by the plane is:
(A) 7.35 N (B) 9.8 N (C) 4 N (D) 19.6 N (E) zero

Q.25 If the restoring force is 15 N, Then the work done in stretching a spring a distance of 0.5 m is:
(A) -3 J (B) -6 J (C) -9 J (D) -12 J (E) -3.75 J

Q.26 The maximum range of a projected ball is 92 m, the initial speed of the ball was: :
(A) 30 m/s (B) 253.57 m/s (C) 88.2 m/s (D) 28.17 m/s (E) 9 m/s

Q.27 If the work done on a particle is 32 J in 4 s. The power is:
(A) 36 W (B) 8 W (C) 1 W (D) 6 W (E) 12 W

Q.28 The potential energy of a falling object of weight w from height h is:
(A) mgh (B) $Fd\cos\theta$ (C) ma (D) mvt^2 (E) mv

Q.29 Which of the following quantities is not a scalar quantity?
(A) Temperature (B) Speed (C) Mass (D) Time (E) Force

Q.30 The result of $(\hat{j}\times\hat{k})\bullet\hat{i}$ is:

(A) Zero (B) $\hat{k}$ (C) $\hat{j}$ (D) $\hat{i}$ (E) 1

Q.31 Which one of the following choices is a unit of kinetic energy?

(A) watts (B) joule (C) newton (D) second (E) kg

Q.32 In the figure (2), three forces pull on a box. Then the box acceleration is:

(A) 5.8 m/s^2 (B) 0.56 m/s^2 (C) 0.63 m/s^2 (D) 1.8 m/s^2 (E) Zero

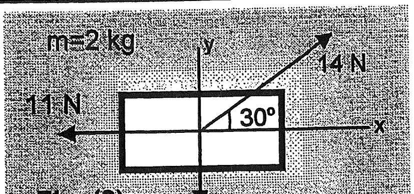


Fig. (2)

Q.33 A ball is thrown down vertically with an initial speed of v_0 from a height of h. The speed of the ball just before it strikes the ground is:

(A) v=ht (B) $v=\sqrt{v_0^2+2gh}$ (C) $v=v_0-gt$ (D) $v=v_0\sin\theta$ (E) $v=v_0$

Q.34 A train travels 175 km in 30 min. Its average speed is:

(A) 240 km/h (B) 18 km/h (C) 350 km/h (D) 0.3 km/h (E) 300 km/h

Q.35 A particle moving according to coordinates $x=(t+4)\,m$, $y=(2t+4)\,m$ .the position vector at t=2 s is:

(A) $(10\hat{i}+10\hat{j})\,m$ (B) 40 m (C) $(6\hat{i}+8\hat{j})\,m$ (D) 4 m (E) 3 m

Q.36 A ball of mass 5 kg has kinetic energy of 250 J. Its velocity is:

(A) 3 m/s (B) 2 m/s (C) 5.72 m/s (D) 10 m/s (E) 7 m/s

Q.37 A small ball tied to a string swing beginning from rest at point **A**. The ball has maximum kinetic energy at point:

(A) A (B) B (C) C (D) D (E) E

Q.38 In figure (3), the ball has maximum potential energy at point:

(A) A (B) B (C) C (D) D (E) E

Q.39 In figure (3), if h=1.5 m, the speed at point **C** is:

(A) 3 m/s (B) 1 m/s (C) 5.42 m/s (D) zero (E) 4.43 m/s

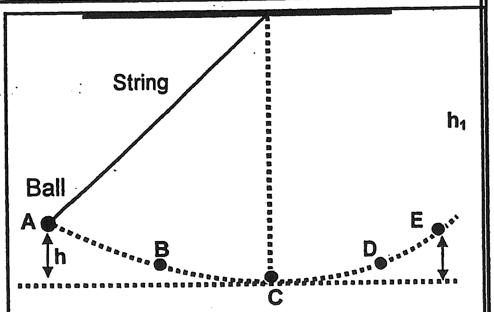


Fig. (3)

Q.40 In figure (3), if the speed at point C is 2 m/s and the speed at point E is 1 m/s, then the height h_1 is:

(A) 3 m (B) 0.61 m (C) 5 m (D) zero (E) 0.15 m

Good Luck

(1) $\vec{A} = i + 5j$ $\vec{B} = 2i - 10j$

$\vec{C} = 3i - 5j$

$2\vec{A} = 2i + 10j$

$\vec{C} = 3i - 5j$

$2\vec{A} + \vec{C} = 5i + 5j$

$$(2\vec{A} + \vec{C}) \times \vec{B} = \begin{vmatrix} \overset{+}{i} & \overset{-}{j} & \overset{+}{k} \\ 5 & 5 & 0 \\ 2 & -10 & 0 \end{vmatrix}$$

$= 0i - 0j + k(-50 - 10) = -60k$ (E)

---

(2) $\vec{A} = 2i + 4j + 4k$

$\vec{B} = 5i - 5j + 5k$

$\vec{A} \cdot \vec{B} = 10 - 20 + 20 = 10$ (B)

②

③ Constant velocity $\Rightarrow a = 0$ Ⓑ

---

④ دائماً في السقوط الحر
لأسفل

$a = -g$

$\Sigma F = ma = -mg$

Ⓐ

---

⑤ الكمية القياسية لها مقدار فقط وليس لها اتجاه

Ⓑ

---

⑥ $a = -g = -9.8 \; m/s^2$ Ⓐ

---

⑦ $v_0 = 0$ $v = 70 \, m/s$

$t = 10 \, s$ $a = ?$

$v = v_0 + at$

$70 = 0 + a(10)$ $a = 7 \, m/s^2$ Ⓐ

---

⑧ $F = ma$

m → mass

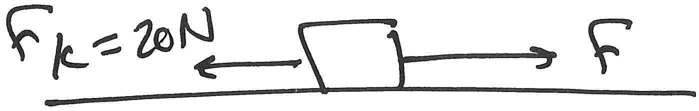
a → acceleration

Ⓐ

(3)

(9) Constant velocity

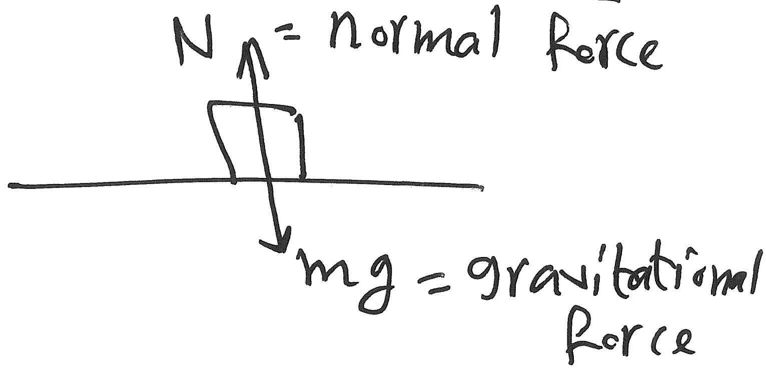
قانون نيوتن الأول



$F = f_k = 20N$

---

(10)



(D)

---

(11) (E)

---

(12) $W = \vec{F} \cdot \vec{d}$

$\vec{d}$ → displacement (B)

---

(13)

الكتلة دائماً ثابتة الوزن يختلف حسب تسارع الجاذبية

(C)

(4)

(14) $F = ma =$ mass x acceleration

(D)

---

(15) (A) $K = \frac{1}{2} m v^2$

$\downarrow$ السرعة

---

(16) (B)

---

(17) $\vec{F} = 4i + 2j - 4k$

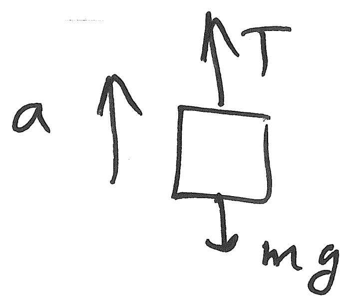
$\vec{d} = 8j$ +y

$W = \vec{F} \cdot \vec{d} = 0 + 16 + 0 = 16 J$ (C)

---

(19) $m = 800$ kg

$a = 1.4$ m/s^2



$T - mg = ma$

$T - 800 \times 9.8 = 800(1.4) \Rightarrow T = 8960$ N

(B)

(18) $m = 2kg$

$t = 0$ $\quad \vec{v_i} = 3\hat{i} - 2\hat{j}$

$|\vec{v_i}| = \sqrt{9+4} = \sqrt{13}$

$t = 3s$ $\quad \vec{v_f} = 4\hat{i} + 3\hat{j}$

$|\vec{v_f}| = \sqrt{16+9} = \sqrt{25} = 5 m/s$

$W = \Delta K = \frac{1}{2} m (|\vec{v_f}|^2 - |\vec{v_i}|^2)$

$= \frac{1}{2}(2)((5)^2 - (\sqrt{13})^2)$

$= 12 J$ (D)

---

(20) $\theta = 42°$ $\quad v_0 = 12.5 m/s$

$t = \frac{2 v_0 \sin\theta}{g} = \frac{2(12.5)\sin 42°}{9.8}$

$= 1.71 s$ (D)

(21) $F = 20N$ $m = 10\,kg$

$F = ma \Longrightarrow 20 = 10a \Longrightarrow$

$a = 2$ m/ث^2

stationary ← ساكن
$v_0 = 0$

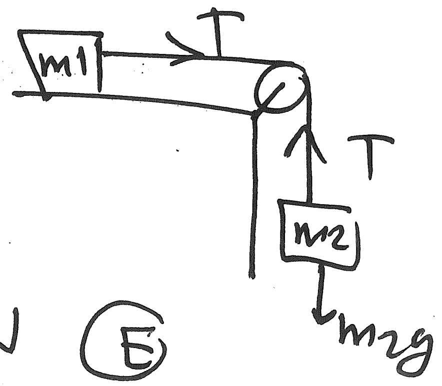
$a = 2$ m/ث^2

$t = 6$ ث $v = ??$

$v = v_0 + at = 0 + (2)(6) = 12$ m/ث (B)

---

(22) $m_1 = 2kg$ $m_2 = 1kg$



السرعة ثابتة ⇐ قانون نيوتن الأول

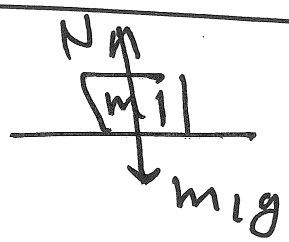
$T = m_2 g = 1 \times 9.8 = 9.8\,N$ (E)

---

(23) $m_1 = 2kg$

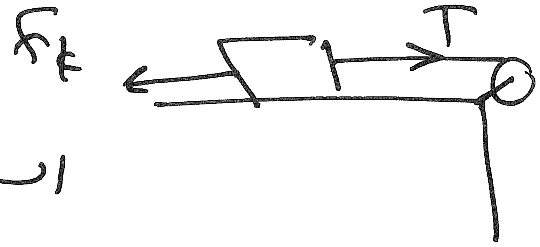
$N = m_1 g$

$= 2 \times 9.8 = 19.6\,N$ (A)



(7)

(24)



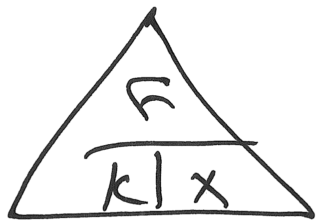
السرعة ثابتة ← قانون نيوتن الأول

$$F_k = T = 9.8\ N$$ (B)

---

(25) $F = 15N$ $\quad x_i = 0$ $\quad x_f = 0.5m$

$$k = \frac{F}{x} = \frac{15}{0.5} = 30\ N/m$$



$$W = -\frac{1}{2}k(x_f^2 - x_i^2)$$

$$= -\frac{1}{2}(30)((0.5)^2 - 0) = -3.75\ J$$ (E)

---

(26) $R_{max} = 92\ m$ $\quad v_0 = ??$

$$R_{max} = \frac{v_0^2}{g} \Longrightarrow 92 = \frac{v_0^2}{9.8}$$

$v_0 = 30\ m/s$ (A)

---

(27) $W = 32\ J$ $\quad t = 4s$

$$P = \frac{W}{t} = \frac{32}{4} = 8\ W$$ (B)

(28) $U_g = mgh$ (A)

---

(29) not scalar $\Rightarrow$ Vector

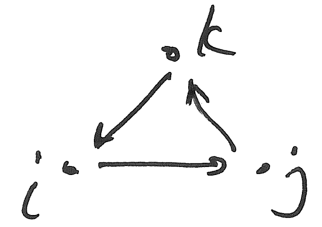
Force (E)

---

(30) $(\hat{j} \times \hat{k}) \cdot \hat{i}$

$\downarrow$

$= \hat{i} \cdot \hat{i} = 1$ (E)



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(31) (B)

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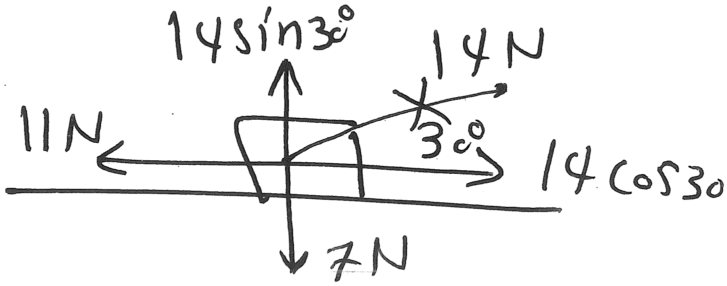
(32) $m = 2\,kg$



$\Sigma F = ma$

$14\cos 30 - 11 = 2a$

$a = 0.56\ m/s^2$ (B)

(33) $y = -h$ $a = -g$

$-v_0$ $v = ?$

$$v^2 = v_0^2 + 2ay$$

$$v^2 = (-v_0)^2 + 2(-g)(-h)$$

$$v^2 = v_0^2 + 2gh$$

$$\text{speed} = |v| = \sqrt{v_0^2 + 2gh}$$ (B)

---

(34) $x = 175\ km$ $t = 30\ min$

$= \frac{30}{60} = 0.5h$

$$v = \frac{x}{t} = \frac{175}{0.5} = 350\ km/h$$ (C)

---

(35) $x = (t+4)\ m$, $y = (2t+4)m$

$$\vec{r} = x\hat{i} + y\hat{j} = (t+4)\hat{i} + (2t+4)\hat{j}$$

$$t = 2s \Rightarrow \vec{r} = (2+4)\hat{i} + (4+4)\hat{j}$$

$$\vec{r} = (6\hat{i} + 8\hat{j})m$$ (C)

(36) $m = 5\,kg$ $K = 250\,J$

$$K = \frac{1}{2} m v^2$$

$$250 = \frac{1}{2}(5)\,v^2 \Longrightarrow v = 10\,m/s$$ (D)

---

(37) أكبر طاقة حركة عند أقل نقطة C ——

(C)

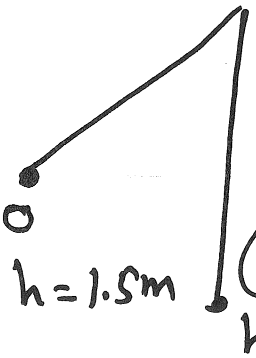
---

(38) أكبر طاقة وضع عند أعلى نقطة A

(A)

---

(39)



$$W^{0} = \Delta K + \Delta U_g + \Delta U_s^{0}$$ (C)

$v_i = 0$

$h_i = h = 1.5\,m$

(B)

$h_f = 0$

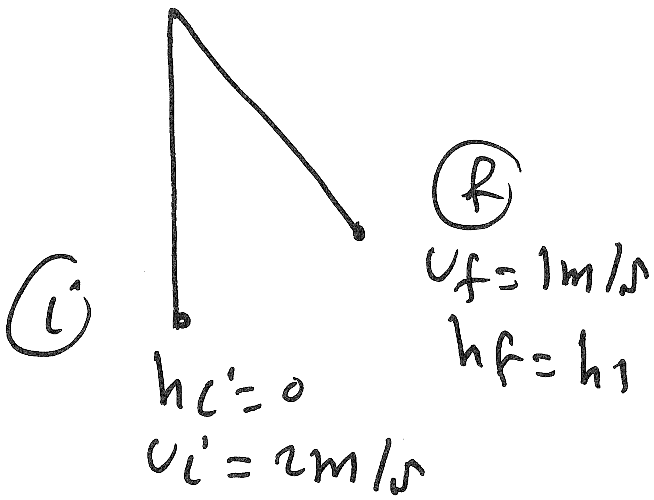
$v_f = ??$

$$\frac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i) = 0$$

$$\frac{1}{2}(v_f^2 - 0) + 9.8(0 - 1.5) = 0$$

$$v_f = 5.42\,m/s$$ (C)

(12)



$$\cancelto{0}{W} = \Delta K + \Delta U_g + \cancelto{0}{\Delta U_s}$$

$$\frac{1}{2}\cancel{m}(v_f^2 - v_i^2) + \cancel{m}g(h_f - h_i) = 0$$

$$\frac{1}{2}((1)^2 - (2)^2) + 9.8(h_1 - 0) = 0$$

$$h_1 = 0.15\,m$$ (E)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

EXAM CODE
A

Final	0/00/0000 H	Time: 120 min.

Student Name: Student no.: Section:

Q.1 How many meters are in 15.5 kilometers?
(A) 1.55 m (B) 15500 m (C) 1550 m (D) 1500 m (E) 155 m

Q.2 In the International System of Units, the unit of weight is:
(A) Newton (B) kilogram (C) pound (D) gram (E) slug

Q.3 The result of $\hat{j} \cdot \hat{j}$ is:
(A) zero (B) 3 (C) -1.0 (D) 1.0 (E) $\sqrt{3}$

Q.4 Three vectors $\vec{A} = 8\hat{i} + 6\hat{j}$, $\vec{B} = -8\hat{i}$ and $\vec{C}$ of unknown in magnitude and direction, have a resultant of the three vectors is 10 units along the positive y-axis, then vector $\vec{C}$ is:
(A) 18 (B) $4\hat{i}$ (C) $-4\hat{i}$ (D) $4\hat{j}$ (E) $4\hat{k}$

Q.5 Referring to question 4, the angle between $\vec{A}$ and the positive y-axis is:
(A) 90° (B) 126.9° (C) 180° (D) 53.1° (E) 36.9°

Q.6 Referring to question 4, a vector perpendicular to vector $\hat{A}$ is:
(A) $8\hat{j}$ (B) $6\hat{i} - 8\hat{j}$ (C) $8\hat{i} + 6\hat{j}$ (D) $8\hat{k}$ (E) $8\hat{i} - 6\hat{j}$

Q.7 Given the two vectors $\vec{A} = \hat{i} + \hat{j} + \hat{k}$, $\vec{B} = 4\hat{i} + 7\hat{j} - 4\hat{k}$ the vector $\vec{B} \cdot \vec{A}$ is:
(A) Zero (B) $64\hat{i}$ (C) 7 (D) $64\hat{j}$ (E) $4\hat{k}$

Q.8 The result of $\hat{j} \times \hat{i}$ is:
(A) zero (B) $\hat{j}$ (C) $\hat{i}$ (D) $-\hat{j}$ (E) $-\hat{k}$

Q.9 A particle moves with a constant acceleration of 6 m/s^2. Starts from rest, its velocity after 3 s is:
(A) -6 m/s (B) 20 m/s (C) 22.4 m/s (D) 18 m/s (E) 36 m/s

Q.10 A car travels with a constant acceleration is brought to stop from a speed of 10 m/s in a distance of 20 m. The acceleration is:
(A) 20 m/s^2 (B) 10 m/s^2 (C) -2.5 m/s^2 (D) 15 m/s^2 (E) 5 m/s^2

Q.11 A ball is projected with an initial speed of 20 m/s. The maximum range of the ball is:
(A) 793.8 m (B) 253.57 m (C) 88.2 m (D) 40.82 m (E) 400 m

Q.12 Referring to question 11, the maximum height of the bal is:
(A) 20 m (B) 40 m (C) 10.20 m (D) 200 m (E) 100 m

Q.13 Which of the following is a vector quantity?
(A) Speed (B) Velocity (C) Time (D) work (E) Distance

4

A

Q.14 A stone is thrown vertically upward with an initial velocity of 10 m/s. It will rise to a maximum height of:
(A) 9.5 m (B) 10 m (C) 5.1 m (D) 95 m (E) 20 m

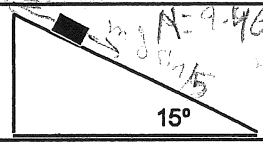
Q.15 If a particle is moving horizontally with constant velocity (v=10 m/s), then its acceleration is:
(A) 10 m/s^2 (B) 9.8 m/s^2 (C) 4.9 m/s^2 (D) Zero (E) 1 m/s^2

Q.16 A particle is thrown vertically upward with initial velocity of 40 m/s. The time it takes to reach its maximum height is:
(A) 10 s (B) 2.1 s (C) 1.3 s (D) 8.1 s (E) 4.1 s

Q.17 The position of a ball tossed vertically upward is described by the equation $y=12t-4.9t^2$, where y is in meters and t in second. The ball's initial speed v_0 at t=0 is:
(A) 8 m/s (B) 10 m/s (C) 2 m/s (D) 12 m/s (E) 18 m/s

Q.18 Referring to question 17, the magnitude of acceleration of the ball is:
(A) 19.6 m/s^2 (B) Zero (C) 8 m/s^2 (D) 4.9 m/s^2 (E) 9.8 m/s^2

Q.19 In the figure if the incline surface is frictionless, the acceleration of the block is:
(A) 2.54 m/s^2 (B) 9.5 m/s^2 (C) 6 m/s^2 (D) 1.67 m/s^2 (E) Zero



Q.20 Referring to question 19, if the incline surface is rough with $\mu_k=0.15$, the acceleration of the block is:
(A) 15 m/s^2 (B) 0.5 m/s^2 (C) Zero (D) 1.12 m/s^2 (E) 0.2 m/s^2

Q.21 A 3.2 kg box is moving with a constant speed of 24.7 m/s . The net force on the box is:
(A) 245.1 N (B) 190.2 N (C) Zero (D) 31.5 N (E) 70.7 N

Q.22 A spring has a force constant of 300 N/m. The work done on the spring to stretch it by 4 cm from its equilibrium position is:
(A) 122.7 J (B) 110 J (C) Zero (D) 98.1 J (E) 0.24 J

Q.23 A ball of mass 0.5 kg is dropped from a height 45 m above the ground. The work done by gravitational force is:
(A) 5 J (B) 40 J (C) 10 J (D) 4 J (E) 220.5 J

Q.24 A single constant force $\vec{F} = (2\hat{i} + 5\hat{j})$ N acts on a 4 kg particle. If the particle moves from the origin point with vector position $\vec{r} = (2\hat{i} + 3\hat{j})$ m. The work done by this force is:
(A) -9 J (B) 11 J (C) 5 J (D) Zero (E) 19 J

Q.25 A 5 kg block slides down on a frictionless inclined plane at an angle of 25°. The magnitude of the net force on it is:
(A) Zero (B) 44.4 N (C) 29 N (D) 62.2 N (E) 20.7 N

Q.26 A 5 kg block slides down on an inclined plane at an angle of 25°. The friction coefficient μ_k is 0.2. The magnitude of the net force on it is:
(A) 65.4 N (B) 16.6 N (C) 40.3 N (D) 11.8 N (E) Zero

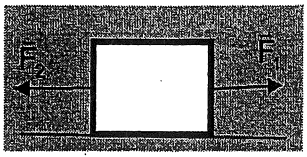
Q.27 A force accelerates a 5 kg particle of mass from rest to a speed of 12 m/s in 4 s. The magnitude of this force is:
(A) 10 N (B) Zero (C) 20 N (D) 25 N (E) 15 N

A

Q.28 A particle moves 6 m in the positive z direction while being acted upon by a constant force $\vec{F}=(4\hat{i}-2\hat{j}+4\hat{k})N$ The work done on the particle by this force is:

(A) 20 J (B) 10 J (C) 24 J (D) -20 J (E) none of these

Q.29 The block in the given figure stands on frictionless surface is in an equilibrium state when:



(A) $F_1>F_2$, (B) $F_2>F_1$ (C) $F_1=F_2$ (D) F_1 parallel F_2 (E) None of these

Q.29 A force of 20 N is applied to move a stationary body of mass 5 kg. The speed of the body after 4 s is:

(A) 1.25 m/s (B) 12.5 m/s (C) 16 m/s (D) 18 m/s (E) 8 m/s

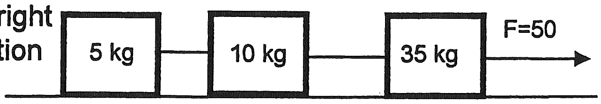
Q.30 Which one of the following equations is associated with Newton's second law?

(A) P=mv (B) F=ma (C) F=2ma (D) P= vi (E) F_1=-F_2

Q.31 Which of the following is a scalar quantity?

(A) Speed (B) Velocity (C) Displacement (D) Acceleration (E) force

Q.32 In the figure three blocks are connected and bulled to the right on a horizontal frictionless table by a force F. Then the acceleration of the system is:



(A) 2 m/s^2 (B) 1 m/s^2 (C) 9.8 m/s^2 (D) 6 m/s^2 (E) 0.97 m/s^2

Q.33 The formula for the friction force is:

(A) f=μ N (B) F=ma (C) w=mg (D) F=N (E) F=2f

Q.34 A player runs in a circular track of radius 75 m with constant speed of 15 m/s. The magnitude of his centripetal acceleration is:

(A) 5 m/s^2 (B) 3 m/s^2 (C) Zero (D) 1.5 m/s^2 (E) 1 m/s^2

Q.35 A particle moving from $\vec{r}_1=4\hat{i}+5\hat{j}+8\hat{k}$ to $\vec{r}_2=20\hat{i}+10\hat{j}+8\hat{k}$ then the displacement is:

(A) $10\hat{i}-3\hat{j}$ (B) $5\hat{j}+10\hat{k}$ (C) $16\hat{i}+5\hat{j}$ (D) $5\hat{j}$ (E) 8

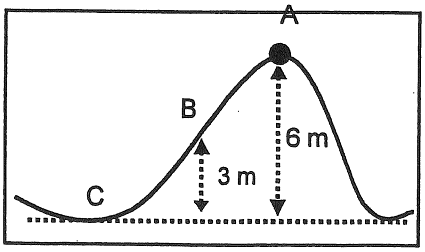
Q.36 If the work done on a particle is 24 J in 4 s. The power is:

(A) 36 W (B) 2 W (C) 1 W (D) 6 W (E) 12 W

Q.37 A 6 kg block is released from rest 80 m above the ground. When it has fallen 60 m its kinetic energy is:

(A) 360 J (B) 3528 J (C) 1200 J (D) 1764 J (E) 60 J

Q.38 A 0.2 kg bead slides from rest on a frictionless curved wire. (see Figure). The speed of the bead at **B** is:



(A) 7.70 m/s (B) 9.8 m/s (C) 2.52 m/s (D) 8.85 m/s (E) 6.6 m/s

Q.39 Referring to question 39, if the speed of the bead at **C** is 10.844 m/s, then the kinetic energy of the bead is:

(A) 11.76 J (B) 5.88 J (C) 15 J (D) 10.84 J (E) 60 J

Q.40 The potential energy of the bead at point **A** is:

(A) 6.76 J (B) 3.5 J (C) 14 J (D) 17 J (E) 11.76 J

(1) $15.5 km = 15.5 \times 1000 = 15500 m$ (B)

---

(2) weight ⟶ Newton (A)

---

(3) $\hat{j} \cdot \hat{j} = 1$ (D)

---

(4) $\vec{A} = 8\hat{i} + 6\hat{j}$ $\quad \vec{B} = -8\hat{i}$

$\vec{A} + \vec{B} + \vec{C} = 10\hat{j}$ $\quad (+y)$

$8\hat{i} + 6\hat{j} - 8\hat{i} + \vec{C} = 10\hat{j}$

$\vec{C} = 10\hat{j} - 6\hat{j} = 4\hat{j}$ (D)

---

(5) $\vec{A} = 8\hat{i} + 6\hat{j}$

$|\vec{A}| = \sqrt{(8)^2 + (6)^2} = \sqrt{64+36} = 10$

$\theta = \cos^{-1}\left(\frac{A_y}{|\vec{A}|}\right) = \cos^{-1}\left(\frac{6}{10}\right)$

$= 53.1°$ (D)

(2)

(6) $\vec{A} = 8i + 0j$

لا يحتوي على k المتجه العمودي لل A غ إذاه k

8k (D)

---

(7) $\vec{A} = i + j + k$

$\vec{B} = 4i + 7j - 4k$

$\vec{B} \cdot \vec{A} = 4 + 7 - 4 = 7$ (C)

$\vec{A} \cdot \vec{B} = \vec{B} \cdot A$

---

(8) $j \times i = -k$ (E)

---

(9) $a = 6 \, m/s^2$ $v_0 = 0$

$v = ?$ $t = 3s$

$v = v_0 + at = 0 + 6(3) = 18 \, m/s$

(D)

(10) $v_0 = 10\,m/s$ $\qquad v = 0$

$x = 20\,m$ $\qquad a = ?$

بالسالب (C) ← تباطؤ

$$v^2 = v_0^2 + 2ax$$

$$0 = (10)^2 + 2a(20)$$

$$a = -2.5\,m/s^2$$ (C)

---

(11) $v_0 = 20\,m/s$

$$R_{max} = \frac{v_0^2}{g} = \frac{(20)^2}{9.8} = 40.82\,m$$

(D)

---

(12) $v_0 = 20\,m/s$ $\qquad \theta = 45^\circ$ $\qquad$ max. range

$$H = \frac{v_0^2(\sin\theta)^2}{2g} = \frac{(20)^2(\sin 45)^2}{2(9.8)}$$

$$= 10.2\,m$$

(4)

(13) Velocity (B)

---

(14) $v_0 = 10\,m/s$ $a = -9.8\,m/s^2$

max. height $v = 0$ $y = ?$

$$v^2 = v_0^2 + 2ay$$

$$0 = (10)^2 + 2(-9.8)\,y$$

$$y = 5.1\,m$$ (C)

---

(15) constant velocity $\Rightarrow a = 0$

(D)

---

(16) $v_0 = 40\,m/s$ $a = -9.8\,m/s^2$

max. height $v = 0$ $t = ?$

$$v = v_0 + at \Rightarrow 0 = 40 - 9.8t$$

$$t = 4.1\,s$$ (E)

(5)

(17) $y = 12t - 4.9t^2$

↓ نشتق

$v = 12 - 9.8t$

$t = 0 \Rightarrow v_0 = 12 - 9.8(0) = 12\ m/s$ (D)

---

(18) $v = 12 - 9.8t$

↓ نشتق

$a = -9.8\ m/s^2$

$\text{magnitude} = |a| = 9.8\ m/s^2$ (E)

---

(19) $\theta = 15^\circ$ 　 $\mu_k = 0$ أو $f = 0$ 　 الجسم لا تؤثر عليه
واسطح أملس

$a = g\sin\theta = 9.8\sin 15^\circ = 2.54\ m/s^2$

---

(20) $\theta = 15^\circ$ 　 $\mu_k = 0.15$

$a = g\sin\theta - \mu_k g\cos\theta$

$= 9.8\sin 15^\circ - 0.15 \times 9.8\cos 15^\circ = 1.12\ m/s^2$ (D)

(6)

(21) constant speed $\Rightarrow$ net force $= 0$ (C)

---

(22) $k = 300\ N/m$ $x_i = 0$ $x_f = 0.04\ m$

on

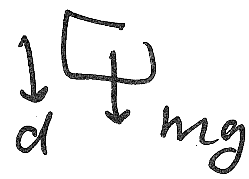
$$W = \frac{1}{2} k \left(x_f^2 - x_i^2\right)$$

$$= \frac{1}{2}(300)\left((0.04)^2 - (0)^2\right) = 0.24\ J$$ (E)

---

(23) $m = 0.5\ kg$ $d = 45\ m$

$$W = mgd$$



$$= 0.5 \times 9.8 \times 45$$

$$= 220.5\ J$$ (E)

---

(24) نقطة الأصل

$$\vec{d} = (2i + 3j) - (0,0) = 2i + 3j$$

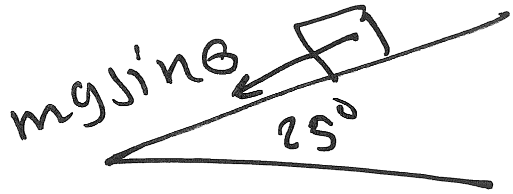
$$\vec{F} = 2i + 5j$$

$$\vec{d} = 2i + 3j$$

$$W = \vec{F} \cdot \vec{d} = 4 + 15 = 19\ J$$ (E)

(25)

$m = 5\,kg$



$a = g\sin\theta = 9.8\sin 25 = 4.14\ m/s^2$

$\Sigma f = ma = 5(4.14) = 20.7\ N$

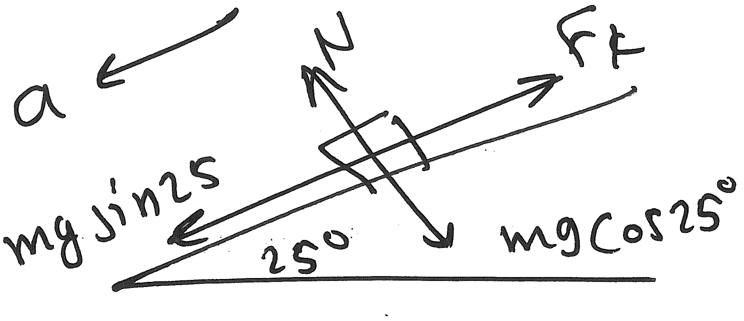
(E)

<u>or</u> $\Sigma f = mg\sin\theta = 5\times 9.8\sin 25 = 20.7\,N$

---

(26) $m = 5\,kg$

$\mu_k = 0.2$



$a = g\sin\theta - \mu_k g\cos\theta$

$= 9.8\sin 25 - 0.2\times 9.8\cos 25$

$= 2.365\ m/s^2$

$\Sigma f = ma = 5(2.365) = 11.825\ N$

(D)

<u>or</u> $\Sigma f = mg\sin\theta - F_k$

نوجدها أول

(27) $m = 5\,kg$

$v_0 = 0$ $\quad$ $v = 12\,m/s$

$t = 4\,s$ $\quad$ $a = ??$

$v = v_0 + at \Rightarrow 12 = 0 + a(4)$

$a = 3\,m/s^2$

$F = ma = 5(3) = 15\,N$ (E)

---

(28) $\vec{F} = 4i - 2j + 4k$

$\vec{d} = 6k$ $\quad$ $+z$

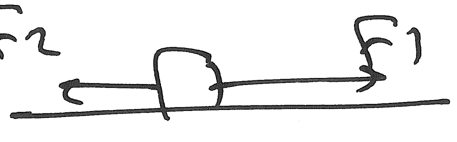
$W = \vec{F}\cdot\vec{d} = 0 + 0 + 24 = 24\,J$ (c)

تمرين

(29) in equilibrium

ساكن أو سرعة ثابتة

قانون نيوتن الأول



$F_1 = F_2$ (c)

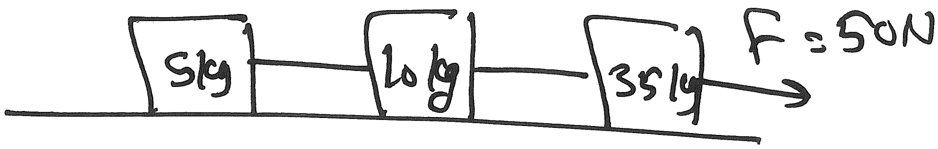
(30) $F = ma$ (B)

---

(31) speed (A)

---

(32)



$\Sigma F = ma$

$50 = (5 + 10 + 35)a \Rightarrow 50 = 50a$

$a = 1 m/s^2$ (B)

---

(33) $f = \mu N$ (A)

---

(34) $R = 75 m$ $v = 15 m/s^2$

$a = \frac{v^2}{R} = \frac{(15)^2}{75} = 3 m/s^2$ (B)

---

(35)
$\vec{r_2} = 20i + 10j + 8k$
$\vec{r_1} = 4i + 5j + 8k$

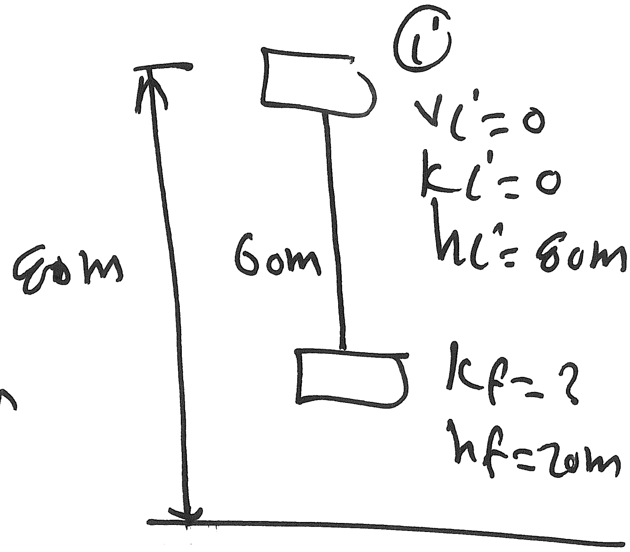
$\vec{\Delta r} = \vec{r_2} - \vec{r_1} = 16i + 5j$ (C)

(36) $W = 24\ J$ $\quad t = 4\ s$

$$P = \frac{W}{t} = \frac{24}{4} = 6\ W$$ (D)

---

(37) $m = 6\ kg$



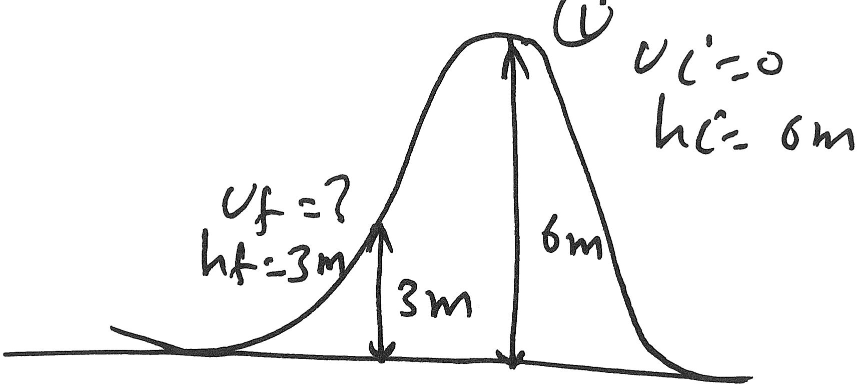
$$W^{0} = \Delta K + \Delta U_g + \Delta U_s^{0}$$

$$K_f - K_i + mg(h_f - h_i) = 0$$

$$K_f - 0 + 6 \times 9.8 (20 - 80) = 0$$

$$K_f = 3528\ J$$ (B)

(38) $m = 0.2\,kg$



$$\overset{0}{W} = \Delta K + \Delta U_g + \Delta \overset{0}{U_s}$$

$$\frac{1}{2} m (v_f^2 - v_i^2) + mg(h_f - h_i) = 0$$

$$\frac{1}{2}(0.2)(v_f^2 - 0) + 0.2 \times 9.8 (3 - 6) = 0$$

$$v_f = 7.7\ m/s \quad (A)$$

---

(39) $v = 10.844\ m/s$

$$K = \frac{1}{2} m v^2 = \frac{1}{2}(0.2)(10.844)^2$$

$$= 11.76\ J \quad (A)$$

---

(40) $h = 6m$ A لاحظ: أكبر طاقة وضع عند أعلى نقطة

$$U_g = mgh = 0.2 \times 9.8 \times 6 = 11.76\ J \quad (E)$$

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

B

Final Exam. 11/7/1434H **Time:120** min.

Student Name: Student no.: Section:

Q.1 The unit of power is:

(A) Watt (B) kg · m^2/s (C) m/s (D) $N \cdot m/s^3$

Q.2 The angle between vector $\vec{c} = 3\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{d} = -2\hat{i} - 2\hat{j} - 2\hat{k}$ is:

(A) 90° (B) 180° (C) zero (D) 270°

Q.3 If $\vec{A} = 3\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{B} = 4\hat{i} + 4\hat{j} + 4\hat{k}$ then $\vec{A} \bullet (\vec{B} \times \vec{A})$ is:

(A) 12 (B) 6 (C)zero (D) 20

Q.4 The x-component of vector $\vec{A}$ is -5 m and the y-component is 4 m then the magnitude $\vec{A}$ is:

(A) 16 m (B) 9 m (C) 7 m (D) 6.40 m

Q.5 Referring to question 4, the angle that vector $\vec{A}$ makes with the positive x-axis is:

A) 126.9° (B) 38.66° (C) 123.13° (D) 141.34°

Q.6 At the highest point, the y-component of the velocity of a projectile is

(A) 9.8 m/s^2 (B) 4.9 m/s^2 (C) zero (D) 19.6 m/s^2

Q.7 The SI unit of weight is:

(A) kg. m/s^2 (B) kilogram (C) pound (D) gram

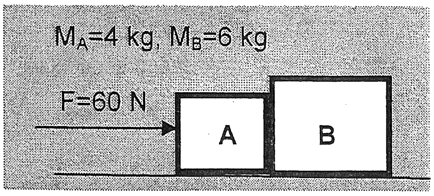
Q.8 A particle of mass 3 kg is located at a point (3 m, 3 m). Another particle of mass 4 kg is located at a point (-3 m, 9 m). The center of mass of these two particle is:

(A) (0.6 m, 6.43 m) (B) (-0.43 m,6.43 m) (C) (1.5 m, 3 m) (D) (-0.6 m, 6.2 m)

Q.9 A particle of mass 3 kg is moving with velocity $\vec{v}_1 = 5\hat{i} + 2\hat{j}$ m/s and another particle of mass 2 kg is moving with velocity $\vec{v}_2 = -5\hat{i} + 2\hat{j}$ m/s, then the velocity of the center of mass is:

(A) $(\hat{i} + 2\hat{j})$ m/s (B) $(2\hat{i} + \hat{j})$ m/s (C) $(-\hat{i} + 2\hat{j})$ m/s (D) $(2\hat{i} - 2\hat{j})$ m/s

Q.10 Two blocks (**A** and **B**) are in contact on a horizontal frictionless surface. A horizontal force is applied to the block **A** as shown in figure. The force that **A** exert on **B** is:



(A) 9.8 N (B) 40 N (C) 24 N (D) 36 N

Q.11 The result of $\hat{j} \bullet (\hat{j} \times \hat{k})$ is:

(A) zero (B) 3 (C) -1.0 (D) 1.0

Q.12 The physical quantity, which is equal to change in momentum is:

(A) force (B) velocity (C) acceleration (D) impulse

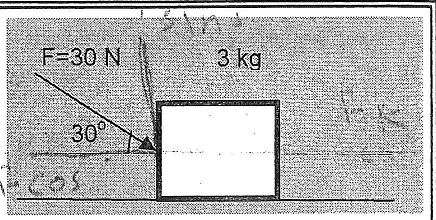
Q.13 The maximum range of a projected ball is 125 m, then its initial speed is:

(A) 793.8 m/s (B) 253.57 m/s (C) 35 m/s (D) 28.17 m/s

B

Q.14 3 kg block is pushed across a horizontal surface by a force as shown in the figure. If the coefficient of kinetic friction between the block and the surface is 0.30, the magnitude of the acceleration of the block is:

(A) 1.1 m/s^2 (B) 4.2 m/s^2 (C) 3.3 m/s^2 (D) 1.8 m/s^2



Q.15 A boy kicks a ball at an angle 40° to the horizontal with speed 18 m/s. The time it takes to reach its range is:

(A) 0.92 s (B) 1.84 s (C) 1.97 s (D) 2.36 s

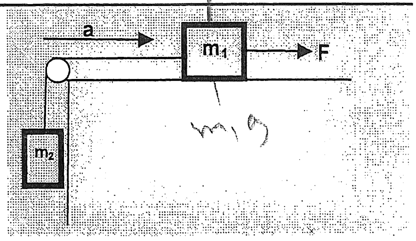
Q.16 A force of 20 N is applied to move a stationary body of mass 10 kg. The speed of the body after 6 s is:

(A) 1.25 m/s (B) 12 m/s (C) 16 m/s (D) 18 m/s

Q.17 A car moves 5 km north, 13 km 22.62° south of east, and then 12 km west. The car is finally at:

(A) where it started (B) 2.6 east (C) 9.9 south (D) 2.6 west

Q.18 In the figure, if m_1=4 kg and m_2=3 kg a horizontal force F acts on m_1. If the acceleration of the system 2.5 m/s^2 the value of F is:



(A) 9.8 N (B) 46.9 N (C) 60.2 N (D) Zero

Q.19 Referring to question 18, the normal force between m_1 and the plane is:

(A) Zero (B) 4 N (C) 19.6 N (D) 39.2 N

Q.20 Referring to question 18, the tension in the cord is:

(A) 53.2 N (B) 9.8 N (C) 36.9 N (D) 150 N

Q.21 Which of the following object has the greatest momentum.

(A) A 20 kg object moving at 20 m/s. (B) A 10 kg object moving at 30 m/s.
(C) A 1 kg object moving at 30 m/s. (D) A 100 kg object moving at 2 m/s.

Q.22 If an object has kinetic energy, then it also must have:

(A) force. (B) momentum. (C) acceleration. (D) none of these.

Q.23 The SI unit of work is:

(A) kg · m (B) kg·m^2/s^2 (C) kg · m/s (D) kg · m^2/s

Q.24 An object is moving on a circular path of radius π m at a constant speed of 1 m/s. The time required for one revolutions is:

(A) $2\pi^2$ s (B) $3\pi^2$ s (C) π^2 s (D) $4\pi^2$ s

Q.25 Which of the following quantities is a scalar quantity?

(A) force (B) velocity (C) time (D) displacement

Q.26 A box was pushed 4 m across the floor in 8 s by a horizontal force of 200 N. The amount of power is:

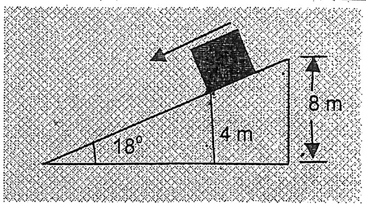
(A) 25 W (B) 100 W (C) 50 W (D) 150 W

Q.27 A particle is moving with initial velocity $\vec{v}_0 = 2\hat{i} - 4\hat{j}$ m/s and $\vec{a} = 2\hat{i} + \hat{j}$ m/s^2. The y-component of the final velocity at t=5 s is:

(A) -12 m/s (B) 4 m/s (C) 1 m/s (D) 12 m/s

B

Q.28 A 5 kg block initially rests at the top of an incline frictionless plane. If it is initially at a height of 8 m, its momentum at a height of 4 m is:



(A) 44.27 kg. m/s (B) 81.30 kg. m/s
(C) 1.30 kg. m/s (D) 38.34 kg. m/s

Q.29 A single constant force $\vec{F} = (5\hat{j} + 2\hat{k})$ N acts on a particle. If the particle moves from the origin point with vector position $\vec{r} = (6\hat{j} + 5\hat{k})$ m. The work done by this force is:
(A) 10 J (B) 20 J (C) 40 J (D) Zero

Q.30 A 6 kg particle is moving along x-axis with speed 4 m/s makes a completely inelastic collision with another stationary 2 kg particle . The speed of the two particles after collision is:
(A) 3.6 m/s (B) 6 m/s (C) 9 m/s (D) 3 m/s

Q.31 The gravitational potential energy of an object at height y is:
(A) mvt^2 (B) Fd cos θ (C) mgy (D) ma

Q.32 Which of the two given quantities have the same units.
(A) Impulse and force (B) Impulse and momentum.
(C) Momentum and energy. (D) Energy and force

Q.33 A 3 kg block starts from rest at the top of a 30° rough incline and slide a distance of 2 m down the incline in 1.5 s. The magnitude of the frictional force acting on the block is:
(A) 14.7 N (B) 9.8 N (C) 1.5 N (D) 9.36 N

Q.34 A toy train completes one revelation of its circular track in 10 s. If the radius of the track is 1 m the train's centripetal acceleration is:
(A) 0.197 m/s^2 (B) 9.8 m/s^2 (C) 1.0 m/s^2 (D) 0.39 m/s^2

Q.35 A particle starts motion at 18 m/s. If it moves 25 m in 2 s its final velocity is:
(A) 10 m/s (B) 5 m/s (C) 7 m/s (D) zero

Q.36 An object that has kinetic energy must be
(A) at rest. (B) falling. (C) moving. (D) none of these.

Q.37 A man of mass 105 kg climbs a stair of 4 m height. The work done by the man is:
(A) 4116 J (B) 510 J (C) 4998 J (D) 2499 J

Q.38 An elevator cabin of mass 3000 kg moves downward with acceleration 1 m/s^2, the tension in the cable is:
(A) 330 N (B) 26400 N (C) 3 N (D) 32400 N

Q.39 An object is thrown vertically upward from the ground. When it reaches half of its maximum height, it has a speed of 19.6 m/s. The maximum height reached is:
(A) 49.4 m (B) 39.2 m (C) 44 m (D) 41.4 m

Q.40 A spring with spring constant of 4 N/m is compressed by a force of 1.2 N. The elastic potential energy stored in the spring is:
(A) 0.18 J (B) 0.60 J (C) 4.8 J (D) 0.36 J

(1) (A)

---

(2) $\vec{c} = 3i + 3j + 3k$

$\vec{d} = -2i - 2j - 2k$

$\vec{c} \cdot \vec{d} = -6 - 6 - 6 = -18$

$|\vec{c}| = \sqrt{9+9+9} = \sqrt{27}$

$|\vec{d}| = \sqrt{4+4+4} = \sqrt{12}$

$$\cos\theta = \frac{\vec{c}\cdot\vec{d}}{|\vec{c}||\vec{d}|} = \frac{-18}{\sqrt{27}\sqrt{12}} = -1$$

$\theta = \cos^{-1}(-1) = 180^\circ$ (B)

---

(3)

دائماً $(\vec{B} \times \vec{A})$ عمودي على $\vec{A}, \vec{B}$

$\therefore \vec{A} \cdot (\vec{B} \times \vec{A}) = 0$ (C) متعامدان

③

حل آخر

$\vec{A} = 3i + 3j + 3k$

$\vec{B} = 4i + 4j + 4k$

$$\vec{B} \times \vec{A} = \begin{vmatrix} +i & -j & +k \\ 4 & 4 & 4 \\ 3 & 3 & 3 \end{vmatrix}$$

$= i(12-12) - j(12-12) + k(12-12)$

$= 0$

$\therefore \vec{A} \cdot (\vec{B} \times \vec{A}) = 0$ Ⓒ

---

④ $A_x = -5$ $A_y = 4m$

$|\vec{A}| = \sqrt{25+16} = 6.4$ Ⓓ

---

⑤ $\theta = \tan^{-1} \left| \frac{A_y}{A_x} \right| = \tan^{-1} \left| \frac{4}{-5} \right|$

$= 180^\circ - 38.36^\circ = 141.34^\circ$ Ⓓ

(6) at the highest point $v_y = 0$ (C)

---

(7) Weight ⟹ Newton = $kg.m/s^2$ (A)

المتوسط

---

(8)

$$x_{cm} = \frac{\Sigma m x}{\Sigma m}$$

$$= \frac{(3)(3) + 4(-3)}{3+4}$$

$$= -0.43 \text{ m}$$

m	x	y
3	3	3
4	-3	9

$$y_{cm} = \frac{\Sigma m y}{\Sigma m} = \frac{(3)(3) + 4(9)}{3+4} = 6.43 \text{ m}$$

the center of mass is $(-0.43, 6.43)$ (B)

---

(9)

$m_1 = 3\ kg$ $\vec{v}_1 = (5i + 2j)\ m/s$

$m_2 = 2\ kg$ $\vec{v}_2 = (-5i + 2j)\ m/s$

$$m_1 \vec{v}_1 + m_2 \vec{v}_2 = (m_1 + m_2)\vec{v}$$

$$3(5i + 2j) + 2(-5i + 2j) = (3+2)\vec{v}$$

(4)

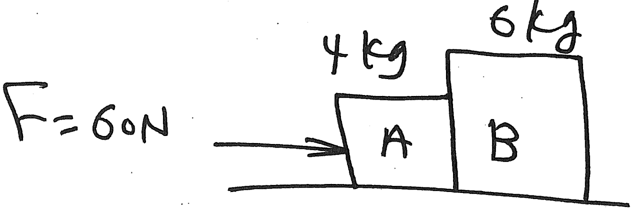
$15i + 6j - 10i + 4j = 5\vec{v}$

$5i + 10j = 5\vec{v}$ $\quad \div 5$

$\boxed{\vec{v} = (i + 2j)\ m/s}$ (A)

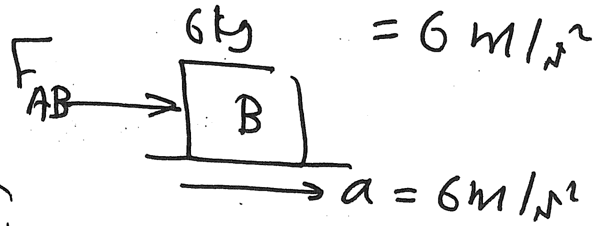
---

(10)



$\Sigma F = ma \Rightarrow 60 = (4+6)a \Rightarrow a = \frac{60}{10} = 6\ m/s^2$

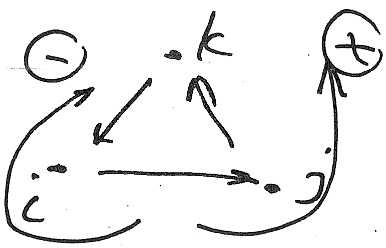
$F_{AB} = 6(6) = 36\ N$



(D)

---

(11) $j \cdot (j \times k) = j \cdot i = 0$ (A)



---

(12) $\vec{J} = \Delta \vec{P}$ $\quad \vec{J}$ = impulse الدفع

(D)

(13) $R_{max} = 125m$ $\quad v_0 = ??$

$$R_{max} = \frac{v_0^2}{g} \Rightarrow 125 = \frac{v_0^2}{9.8}$$

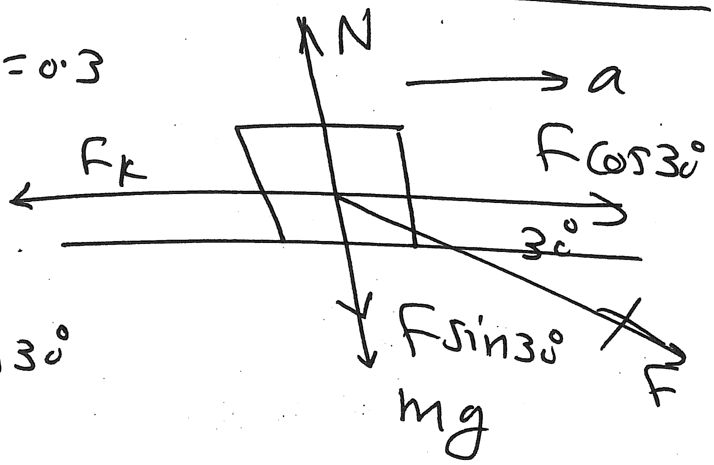
$$v_0^2 = (125)(9.8) = 1225 \xrightarrow{\text{"}\sqrt{\ }\text{"}} v_0 = \sqrt{1225} = 35\ m/s$$

(C)

---

(14) $m = 3kg$ $\quad \mu_k = 0.3$

$F = 30N$



$N = mg + F\sin 30°$

$= 3 \times 9.8 + 30\sin 30°$

$= 44.4\ N$

$$F_k = \mu_k N = (0.3)(44.4) = 13.32\ N$$

$$\Sigma F = ma \Rightarrow F\cos 30° - F_k = ma$$

$$30\cos 30° - 13.32 = 3a$$

$$12.66 = 3a \Rightarrow a = 4.22\ m/s^2$$ (B)

---

(15) $\theta = 40°$ $\quad v_0 = 18\ m/s$

$$t = \frac{2v_0 \sin\theta}{g} = \frac{2(18)\sin 40°}{9.8} = 2.36\ s$$ (D)

⑥

(16) $F = 20\,N$ $m = 10\,kg$

$\Sigma F = ma \Rightarrow 20 = 10a \Rightarrow a = \frac{20}{10} = 2\,m/s^2$

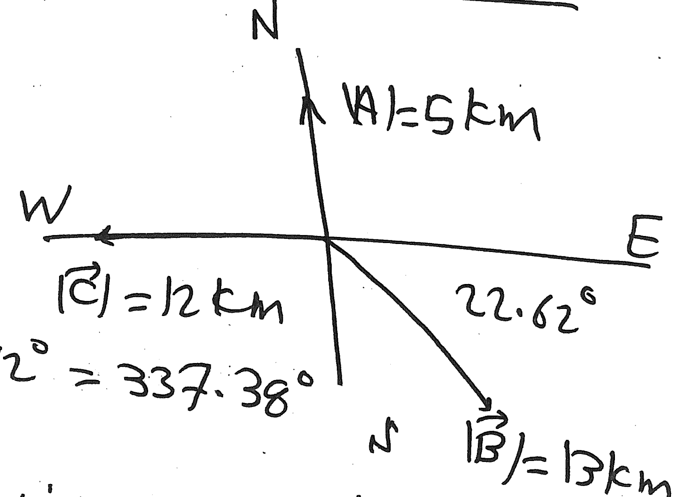
ساكن

$v_0 = 0$ (stationary) $a = 2\,m/s^2$ $t = 6\,s$ $v = ?$

$v = v_0 + at = 0 + 2(6) = 12\,m/s$ (B)

---

(17)



$\boxed{\vec{A} = 5j}$ (North)

$|\vec{B}| = 13\,km$ $\theta = 360° - 22.62° = 337.38°$

$\vec{B} = 13\cos 337.38°\,i + 13\sin 337.38°\,j$

$\boxed{\vec{B} = 12i - 5j}$

$\boxed{\vec{C} = -12i}$ (west)

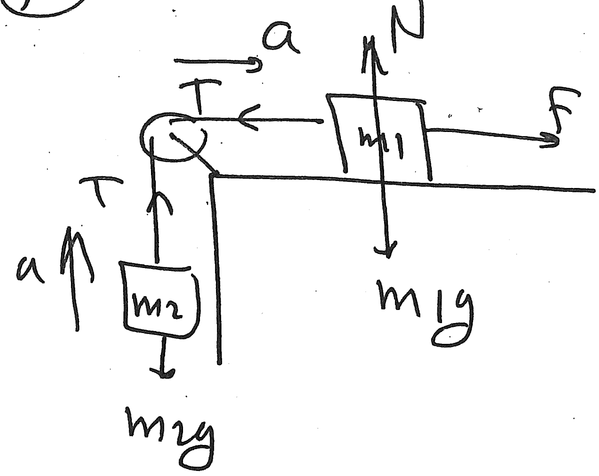
$\vec{R} = \vec{A} + \vec{B} + \vec{C} = 5j + 12i - 5j - 12i = 0$

عاد لنقطة البداية ← حيث بدأت

The car is finally at <u>where it started</u>

(A)

⑦



(18) $m_1 = 4\ kg$

$m_2 = 3\ kg$

$a = 2.5\ m/s^2$

$\Sigma F = ma$

For m_1 $\quad F - T = m_1 a$ ①

For m_2 $\quad T - m_2 g = m_2 a$ ②

بالجمع

$F - m_2 g = m_1 a + m_2 a$

$F - 3 \times 9.8 = 4(2.5) + 3(2.5)$

$F = 46.9\ N$ Ⓑ

---

(19) $N = m_1 g = 4 \times 9.8 = 39.2\ N$ Ⓓ

---

(20) عوض في المعادلة ②

$T - m_2 g = m_2 a \implies T = m_2 g + m_2 a$

$T = 3 \times 9.8 + 3(2.5) = 36.9\ N$ Ⓒ

(21) $P_1 = m_1 v_1 = (20)(20) = 400\ kg.m/s$ أعلاهم

$P_2 = m_2 v_2 = (10)(30) = 300\ kg.m/s$

$P_3 = m_3 v_3 = (1)(30) = 30\ kg.m/s$

$P_4 = m_4 v_4 = (100)(2) = 200\ kg.m/s$

(A)

---

(22) $K = \frac{1}{2} m v^2 \Rightarrow v \neq 0 \Rightarrow P \neq 0 \Rightarrow$ (B)

---

(23) work $\Rightarrow$ Joul $= kg.\ m^2/s^2$ (B)

---

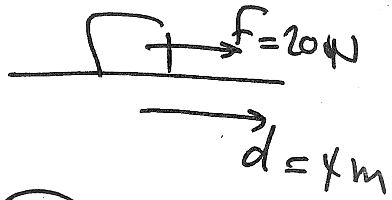
(24) $R = \pi$ $v = 1\ m/s$

$T = \frac{2\pi R}{v} = \frac{2\pi(\pi)}{1} = 2\pi^2\ s$ (A)

---

(25) (C)

$t = 8s$



(26) $W = Fd = (200)(4) = 800\ J$

$P = \frac{W}{t} = \frac{800}{8} = 100\ W$ (B)

(27) $\vec{v}_0 = (2i - 4j)\ m/s$ $\qquad \vec{a} = (2i + j)\ m/s$

$t = 5\ s$ $\qquad \vec{v} = ?$

$\vec{v} = \vec{v}_0 + \vec{a}t = (2i - 4j) + 5(2i + j)$

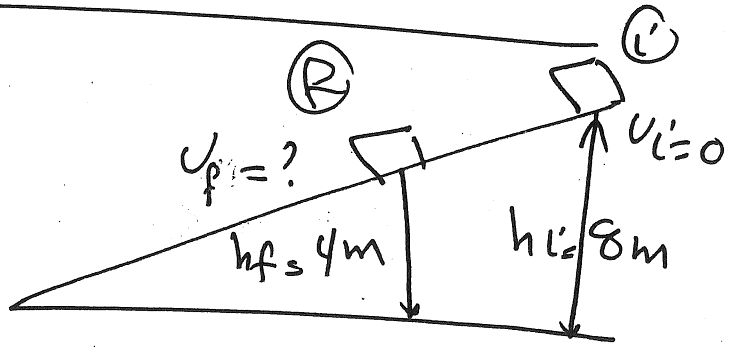
$= 2i - 4j + 10i + 5j = (12i + j)\ m/s$

$v_y = 1\ m/s$ (C)

---

(28) $m = 5\ kg$

$\cancel{W}^{0} = \Delta K + \Delta U_g + \cancel{\Delta U_s}^{0}$



$\frac{1}{2} m (v_f^2 - v_i^2) + mg(h_f - h_i) = 0$

$\frac{1}{2}(5)(v_f^2 - 0) + 5(9.8)(4 - 8) = 0$

$2.5\ v_f^2 = 196 \quad \Rightarrow v_f^2 = 78.4$ $\sqrt{\ }$

$v_f = 8.85\ m/s$

$P_f = m v_f = 5(8.85) = 44.27\ kg.m/s$

(A)

(29) $\vec{F} = (5j + 2k)\ N$

$(0,0) \longrightarrow (6j + 5k)\ m$

$\vec{d} = 6j + 5k$

$W = \vec{F} \cdot \vec{d} = (5)(6) + 2(5) = 30 + 10$

$= 40\ J$ (C)

---

(30) $m_1 = 6\ kg$ $\quad v_{1i} = 4\ m/s$

$m_2 = 2\ kg$ $\quad v_{2i} = 0$ $\quad$ ~~C~~

$v = ?$

$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v$

$6(4) + 0 = (6 + 2) v$

$24 = 8v \implies v = \frac{24}{8} = 3\ m/s$

(D)

---

(31) $U_g = mgy$ (C)

(32) momentum $\Rightarrow$ kg.m/s

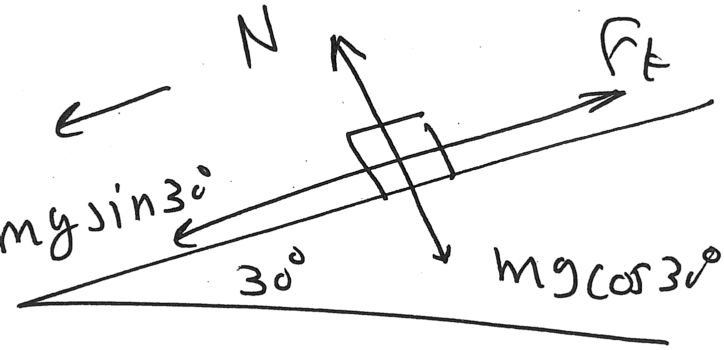
impulse $\Rightarrow$ kg.m/s (B)

---

(33) $m = 3\,kg$

$v_0 = 0$ $x = 2m$

$t = 1.5\,s$ $a = ?$



$x = v_0 t + \frac{1}{2}at^2 \Rightarrow 2 = 0 + \frac{1}{2}(a)(1.5)^2$

$a = \frac{2}{1.125} = 1.78\ m/s^2$

$\Sigma F = ma \Rightarrow mg\sin 30 - F_k = ma$

$F_k = mg\sin 30 - ma = 3 \times 9.8 \sin 30° - 3(1.78)$

$F_k = 9.36\ N$ (D)

---

(34) $T = \frac{10}{1} = 10\,s$ $R = 1m$

$T = \frac{2\pi R}{v} \Rightarrow 10 = \frac{2 \times 3.14 \times 1}{v}$

(12)

$$v = \frac{2 \times 3.14 \times 1}{10} = 0.628 \text{ m/s}$$

$$a = \frac{v^2}{R} = \frac{(0.628)^2}{1} = 0.39 \text{ m/s}^2$$

(D)

---

(35) $v_0 = 18$ m/s $\quad x = 25$ m

$t = 2$ s $\quad v = ?$

$$x = \frac{v + v_0}{2} t \Rightarrow 25 = \frac{v + 18}{2} (2)$$

$v + 18 = 25 \qquad v = 25 - 18 = 7$ m/s (C)

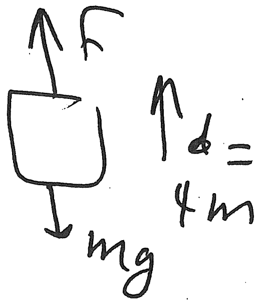
---

(36) (C)

---

(37) $F = mg = 105 \times 9.8 = 1029$ N

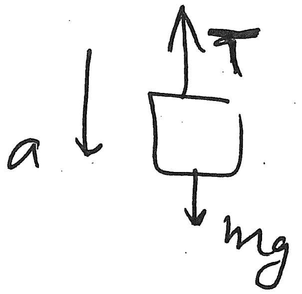
$W_F = Fd = (1029)(4) = 4116$ J



(A)

(38) $m = 3000\ kg$ $a = 1\ m/s^2$

$\Sigma F = ma$



$mg - T = ma$

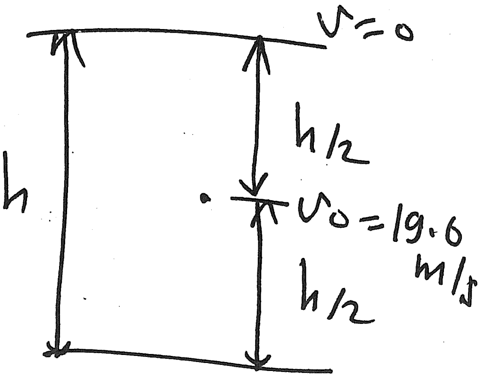
$T = mg - ma = 3000 \times 9.8 - 3000(1)$

$= 26400\ N$ (B)

---

(39) $v_0 = 19.6\ m/s$ $v = 0$

$a = -9.8\ m/s$ $y = h/2$



$v^2 = v_0^2 + 2ay$

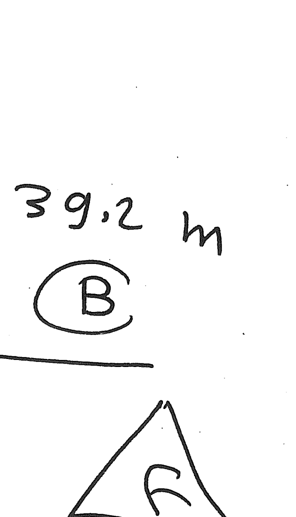
$0 = (19.6)^2 + 2(-9.8)\left(\frac{h}{2}\right)$

$9.8h = (19.6)^2 \Rightarrow h = \frac{(19.6)^2}{9.8} = 39.2\ m$

(B)

---

(40) $k = 4\ N/m$ $F = 1.2\ N$



$x = \frac{F}{k} = \frac{1.2}{4} = 0.3\ m$

$U_s = \frac{1}{2}kx^2 = \frac{1}{2}(4)(0.3)^2 = 0.18\ J$ (A)

King Abdulaziz University
Faculty of Science
Physics Dept.
Physics 110

D

Final Exam	29/2/1435 H	Time:120 min.
Student Name:	Student no.:	Section:

Q.1 Which unit of these is used to measure the speed?
(A) kg (B) m/s^2 (C) m/s (D) m

Q.2 A square table has an area of 4500 cm^2. Its length in SI units is:
(A) 0.592 m (B) 0.671 m (C) 0.742 m (D) 0.806 m

Q.3 A particle moves along the x-axis according to the equation $x = 6t + 2t^2$, where x is in meters and t is in seconds. The instantaneous speed at t = 5 sec. is:
(A) 14 m/s (B) 18 m/s (C) 22 m/s (D) 26 m/s

Q.4 A train uniformly changes its speed from 60 m/s to 20 m/s in 10 s. Its acceleration is:
(A) – 5.0 m/s^2 (B) – 4.0 m/s^2 (C) – 2.5 m/s^2 (D) – 2.0 m/s^2

Q.5 An object falling toward the earth's surface will have velocity that its magnitude is:
(A) Increasing (B) Zero (C) 9.8 m/s^2 (D) Decreasing

Q.6 An object was thrown vertically upward with 19 m/s from the top of a building. If it took 7 seconds to reach the ground. The magnitude of the velocity of the ball when it reaches the ground is:
(A) 5.1 m/s (B) 49.6 m/s (C) 14.85 m/s (D) 38.2 m/s

Q.7 A stone is falling down from rest, it reaches the ground after 4.1 s from a height (above the ground) of:
(A) 41.2 m (B) 50.2 m (C) 67.1 m (D) 82.4 m

Q.8 Which of the following quantities is not a vector quantity?
(A) Distance (B) Velocity (C) Acceleration (D) Displacement

Q.9 The components of vector $\vec{A}$ are given as $A_x = -18.3$ m and $A_y = 17.6$ m. The magnitude of vector $\vec{A}$ is:
(A) 25.4 m (B) 22.2 m (C) 20.5 m (D) 18.6 m

Q.10 Given $\vec{A} = -3\hat{i} + \hat{j} + 4\hat{k}$, $\vec{B} = 3\hat{i} + 3\hat{j} - 2\hat{k}$, $\vec{C} = -2\hat{i} - 2\hat{j} - \hat{k}$. Then the vector $\vec{D} = -2\vec{A} - \vec{B} + 3\vec{C}$ is:
(A) $17\hat{i} + 5\hat{j} - 15\hat{k}$ (B) $-16\hat{i} - 12\hat{j} + 8\hat{k}$ (C) $-3\hat{i} - 11\hat{j} - 9\hat{k}$ (D) $-15\hat{i} - 11\hat{j} + 5\hat{k}$

Q.11 If $\vec{A}$ and $\vec{B}$ are non-zero vectors, then the angle between the vectors $\vec{A}$ and $\vec{B}$ when $\vec{A} \cdot \vec{B} = 0$ is:
(A) 90° (B) Zero (C) 180° (D) 45°

Q.12 Consider two vectors $\vec{V} = 3\hat{i} + 3\hat{j}$ and $\vec{W} = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$, where θ is measured counter clockwise with respect to the positive x-axis. For what value of θ (in degrees) is $\vec{V} \times \vec{W} = 0$:
(A) 20° (B) 135° (C) 45° (D) 90°

Q.13 A particle moves from position $\vec{r}_1 = 3\hat{i} - 8\hat{j} + 6\hat{k}$ to $\vec{r}_2 = 9\hat{i} + 10\hat{j} - 6\hat{k}$, the average velocity of the particle in 3 s is:
(A) $9\hat{j} - 6\hat{k}$ (B) $3\hat{i} + 9\hat{j} - 6\hat{k}$ (C) $3\hat{j} - 6\hat{k}$ (D) $2\hat{i} + 6\hat{j} - 4\hat{k}$

Q.14 A particle moves so that its position (in meters) as a function of time (in seconds) is $\vec{r} = 2t^2\hat{i} - t^3\hat{j} + 8t\hat{k}$, its acceleration at 1.5 s in unit vector notation is:
(A) $4\hat{i} - 6\hat{j}$ (B) $4\hat{i} - 12\hat{j}$ (C) $4\hat{i} - 3\hat{j}$ (D) $4\hat{i} - 9\hat{j}$

Q.15 A projectile, fired over a level ground, reaches a maximum height of 40.0 m and hits the ground 300 m from its launching point. Find its initial velocity in unit vector notation.

(A) $(28.0\hat{j})$ m/s (B) $(28.0\hat{i} + 52.5\hat{j})$ m/s (C) $(30.5\hat{i} + 28.0\hat{j})$ m/s (D) $(52.5\hat{i} + 28.0\hat{j})$ m/s

Q.16 An airplane travels west at constant velocity. The net force on the plan is:

(A) greater than zero (B) less than zero (C) 9.8 N (D) zero

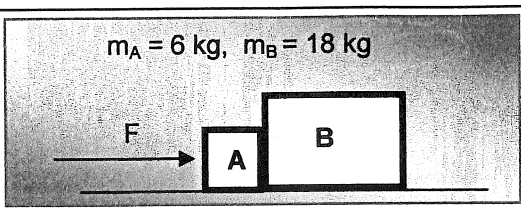
Q.17 Acceleration is always in the direction of the:

(A) displacement (B) net force (C) final velocity (D) initial velocity

Q.18 A man weighing 690 N is in an elevator that is accelerating upward at 4 m/s^2. The magnitude of the force exerted on him by the elevator's floor is:

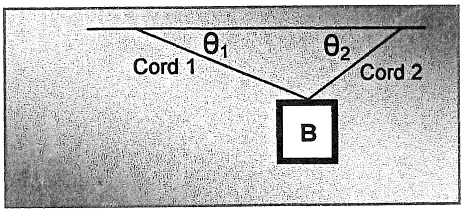
(A) 929.4 N (B) 943.5 N (C) 957.6 N (D) 971.6 N

Q.19 Two blocks (A and B) are in contact on a horizontal frictionless surface. A 46 N constant force is applied to A as shown. The acceleration of B is:



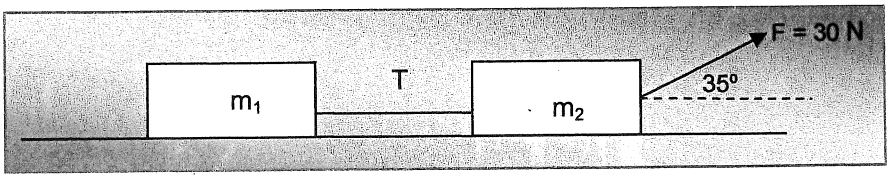
(A) 1.92 m/s^2 (B) 1.75 m/s^2 (C) 1.54 m/s^2 (D) 1.42 m/s^2

Q.20 In the figure a block B of unknown mass M hangs from the ceiling by two cords. The angle $\theta_1 = 20°$ and $\theta_2 = 40°$. If the tension in cord 1 is 50 N, then the tension in cord 2 is:



(A) 61.3N (B) 73.6 N (C) 85.9 N (D) 98.1 N

Q.21 As shown in the figure $m_1 = 9$ kg and $m_2 = 12$ kg, if the two blocks are moving on frictionless surface and connected with a rope of negligible mass. The tension T in that rope is:



(A) 14.0 N (B) 16.4 N (C) 18.4 N (D) 19.7 N

Q.22 A box stands on a rough incline plane. The plane is inclined at an angle of 2θ. If the box moves with constant speed, the friction force is:

(A) mg sin2θ (B) mg cosθ (C) mg cos2θ (D) mgsinθ

Q.23 A car is traveling at 8 m/s on a horizontal highway. If the coefficient of friction between the road and tires on rainy day is 0.1, the distance in which the car will stop is:

(A) 114.8 m (B) 73.47 m (C) 51.02 m (D) 32.65 m

Q.24 A1200 kg car is travelling at constant speed of 18 m/s around circular track of radius 250 m. The magnitude of the centripetal force is:

(A) 1732.8 N (B) 1555.2 N (C) 1387.2 N (D) 1228.8 N

Q.25 A moving particle of mass 6 Kg, has Kinetic energy of 15 J. Its speed is:

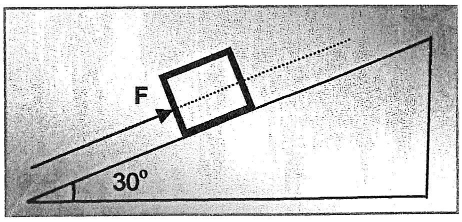
(A) 2.08 m/s (B) 2.24 m/s (C) 2.38 m/s (D) 2.52 m/s

Q.26 The SI unit of work is:

(A) $kg.m^2/s$ (B) kg.m (C) kg.m/s (D) $kg.m^2/s^2$

Q.27 A 1100 kg car moves from rest to speed of 18 m/s. The net work done is: (1 kJ = 1000 J)
(A) 79.2 kJ (B) 107.8 kJ (C) 140.8 kJ (D) 178.2 kJ

Q.28 In the figure, a 6 kg block is pushed up on a frictionless inclined plane, by a force F. As the block moves 3 m, the work done by the gravitational force on the block is:



(A) - 29.4 J (B) - 58.8 J (C) - 88.2 J (D) 117.6 J

Q.29 Referring to **Q.28**, If F = 35 N and the block moves 4 m, the work done by the applied force is:
(A) 120 J (B) 140 J (C) 160 J (D) 180 J

Q.30 A block is attached to a spring and placed horizontally with one end fixed. If the spring constant is 500 N/m, the work done by the horizontal force to pull the spring slowly through an extension of 8 cm is:
(A) 0.9 J (B) 1.23 J (C) 1.6 J (D) 2.03 J

Q.31 The position of a 3 kg object as a function of time is given by $x = -6t - 3t^2 + t^3$, with x in meters and t in seconds. Find the net work done on the object from $t = 0$ to $t = 2$ s.
(A) -36 J (B) zero (C) 45 J (D) 72 J

Q.32 Which one of the following choices is a unit of power?
(A) J/s (B) N .m/s^2 (C) m/s (D) kg .m^2/s

Q.33 If the work done on a particle is 18 J in 7 s. The power is:
(A) 6.0 W (B) 3.6 W (C) 2.6 W (D) 2.0 W

Q.34 A spring with spring constant of 20 N/m is compressed by a force of 13 N. The potential energy stored in the spring is:
(A) 4.90 J (B) 4.23 J (C) 3.60 J (D) 3.03 J

Q.35 The potential energy of a falling object from height h is:
(A) mgh (B) $Fd \cos \theta$ (C) ma (D) mvt^2

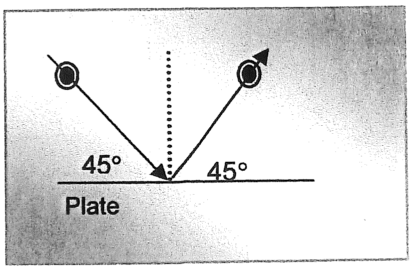
Q.36 Work done by a frictional force is:
(A) All of the these (B) positive (C) zero (D) negative

Q.37 If a restoring force of a stretched spring is 17 N. The work done in stretching the spring 0.5 m is:
(A) 2.8 J (B) 3.3 J (C) 3.8 J (D) 4.3 J

Q.38 An object of mass 6 kg is located at a point (2 m, 4 m). Another object of mass 4 kg is located at a point (-5m, 7m). The center of mass of these two objects is:
(A) (-0.6 m, 5.1 m) (B) (-0.8 m, 5.2 m) (C) (-1.9 m, 5.7 m) (D) (-2.7 m, 6.0 m)

Q.39 If the object has kinetic energy, then it also must have:
(A) force (B) non of these (C) acceleration (D) momentum

Q.40 A 2 kg ball with a speed of 50 m/s strikes a plate at an angle of 45° and rebounds at the same speed and angle, as shown in Figure. Find the change in the linear momentum of the ball.



A) 100 kg·m/s at 45.0° to the plate
B) 100 kg·m/s perpendicular to the plate
C) 141 kg·m/s at 45.0° to the plate
D) 141 kg·m/s perpendicular to the plate

Words Meanings:

Above	فوق	Down	تحت	Mass	كتله	Straight	مستقيم
Acceleration	تسارع	Degree	درجه	Massless	عديم الكتلة	String	وتر
Achieve	يحصل على	Earth	أرض	Maximum	حد أقصى	Surface	سطح
Airplane	طائرة	Equation	معادلة	Meter	متر	Suspend	معلق
Always	دائماً	East	شرق	Moon	قمر	System	نظام
Angle	زاوية	Equilibrium	أتزان	Motion	حركة	Table	طاولة
Applied	مؤثر	Equivalent	مكافيء	Move	يتحرك	Tall	طويل
Automobile	عربة	Exerted	مبذول	Man	رجل	Tension	شد
Average	متوسط	Energy	طاقه	Measure	يقيس	Through	خلال
Axis	محور	Extension	يتمدد	Mile	ميل	Thrown	قذف
According	طبقاً لـ	Figure	رسم بياني	Momentum	كميه حركيه	Time	زمن
After	بعد	Final	نهائي	Must	يجب	Top	أعلى
Along	على طول	Follow	يتبع	Net	محصلة	Toy	لعبة
Area	مساحة	Force	قوة	Normal	رد الفعل	Travel	يرحل
attach	تعليق	Friction	إحتكاك	North	شمال	Truck	شاحنة
Also	ايضا	Frictionless	عديم الإحتكاك	Notation	صيغه	Train	قطار
Around	حول	Function	دالة	Object	جسم	Toward	بإتجاه
Ball	كره	Falling	يسقط	Parabolic	على شكل قطع مكافئ	Up	فوق
Between	بين	Figure	رسم بياني	Parallel	موازي	Upward	نحو الأعلى
Block	قالب	Following	التالي	Particle	جسيم	Used	يستعمل
Body	جسم	Football	كرة قدم	Path	مسار	Uniform	منتظم
Box	صندوق	Find	اوجد	Perpendicular	متعامد	Unit	وحدة
Building	مبنى	Fixed	مثبت	Person	شخص	Velocity	سرعة
Bicycle	دراجة	Given	معطى	Position	موضع	Weigh	يزن
Boy	ولد	Gram	جرام	Projectile	مقذوفة	Weight	وزن
Bridge	جسر	Ground	سطح الارض	Point	نقطة	West	غرب
Cable	كبل	Gravitational	جاذبي	Product	ناتج	When	عندما
Called	يسمى	Gravity	جاذبية	plate	صفيحه	Vector	متجه
Car	سيارة	Greater	أكبر	push	دفع	Velocity	سرعة
Ceiling	سقف	Hold	يمسك	power	قدره	Vertically	عمودياً
Centripetal	مركزي	Horizontal	أفقي	pull	سحب	Volume	حجم
Change	تغير	Height	إرتفاع	Positive	موجب	x-axis	محور السينات
Circular	دائري	Hour	ساعة	Quantity	كمية		
Coefficient	معامل	highway	طريق سريع	Reach	يصل		
Component	مركبة	hang	علق	Resistance	مقاومة		
Connected	متصل	Ignore	أهمل	Respectively	على التوالي		
Constant	ثابت	Increasing	تزايد	Result	نتيجة		
Coordinate	أحداثي	Initial	ابتدائي	Pulley	بكرة		
Cord	حبل	Instantaneous	لحظي	Radius	نصف قطر		
Curve	منحنى	incline	مائل	Range	مدى		
Classroom	فصل دراسي	Length	طول	Referring to	بالرجوع إلى		
Cover	يغطي	Level	مستوى	Road	طريق		
Cross	ضرب اتجاهي	Magnitude	مقدار	Rolling	تدحرج		
Cube	مكعب	Kinetic	حركي	Rough	خشن		
Clockwise	في اتجاه عقارب الساعه	Launch	يطلق	Run	يجري		
Consider	اعتبر	Leave	يترك	Round	يدور		
Choices	خيارات	Less	أقل	Second	ثانية		
Crate	قفص	Limiting	محدد	SI	نظام دولي		
Descend	يهبط	Line	خط	Second	ثانية		
Differed	مختلف	Level	مستوى	Shown	موضح		
Direction	إتجاه	Less	اقل	Slide	ينزلق		
Displacement	إزاحة	Linear	خطي	Speed	سرعة		
Downward	اسفل	Located	يقع	Stand	يقف		
Decreasing	يتناقص	Magnitude	مقدار	Start	يبدأ		
Distance	إزاحة	Make	يصنع	Static	سكوني		

Some Used Formula:

$\Delta x = x_2 - x_1.$	$v = v_0 + at.$	
$v_{avg} = \dfrac{\Delta x}{\Delta t} = \dfrac{x_2 - x_1}{t_2 - t_1}.$	$x - x_0 = v_0 t + \frac{1}{2}at^2.$ $v^2 = v_0^2 + 2a(x - x_0).$	
$s_{avg} = \dfrac{\text{total distance}}{\Delta t}.$	$x - x_0 = \frac{1}{2}(v_0 + v)t.$ $x - x_0 = vt - \frac{1}{2}at^2.$	for free full $a = -g = -9.8\ \text{m/s}^2$
$v = \lim_{\Delta t \to 0} \dfrac{\Delta x}{\Delta t} = \dfrac{dx}{dt}.$	$a_x = a\cos\theta$ and $a_y = a\sin\theta.$	$\vec{a}\cdot\vec{b} = a_x b_x + a_y b_y + a_z b_z.$
$a_{avg} = \dfrac{\Delta v}{\Delta t}.$	$a = \sqrt{a_x^2 + a_y^2}$ and $\tan\theta = \dfrac{a_y}{a_x}.$	$\vec{a}\times\vec{b} = ab\sin\phi.$
$a = \dfrac{dv}{dt} = \dfrac{d^2x}{dt^2}.$	$\vec{a}\cdot\vec{b} = ab\cos\phi.$	$\dfrac{d}{dx}x^m = mx^{m-1}$
$\vec{a}\times\vec{b} = (a_y b_z - b_y a_z)\hat{i} + (a_z b_x - b_z a_x)\hat{j} + (a_x b_y - b_x a_y)\hat{k}.$		
$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$	$x - x_0 = (v_0\cos\theta_0)t,$ $y - y_0 = (v_0\sin\theta_0)t - \frac{1}{2}gt^2.$	$T = \dfrac{2\pi r}{v}$
$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$	$v_y = v_0\sin\theta_0 - gt.$	$\vec{F}_{net} = m\vec{a}$
$\vec{v}_{avg} = \dfrac{\Delta\vec{r}}{\Delta t}$	$v_y^2 = (v_0\sin\theta_0)^2 - 2g(y - y_0).$	$W = mg.$
$\vec{v} = \dfrac{d\vec{r}}{dt},$	$y = (\tan\theta_0)x - \dfrac{gx^2}{2(v_0\cos\theta_0)^2}$	$f_{s,max} = \mu_s F_N,$
$\vec{a}_{avg} = \dfrac{\vec{v}_2 - \vec{v}_1}{\Delta t} = \dfrac{\Delta\vec{v}}{\Delta t}$	$R = \dfrac{v_0^2}{g}\sin 2\theta_0$	$f_k = \mu_k F_N.$
$\vec{a} = \dfrac{d\vec{v}}{dt}$	$a = \dfrac{v^2}{r}$	$F = \dfrac{mv^2}{R}$
$K = \frac{1}{2}mv^2$	$U(y) = mgy.$	$\Delta E_{th} = f_k d.$
$W = Fd\cos\phi = \vec{F}\cdot\vec{d}$	$U(x) = \frac{1}{2}kx^2.$	$W = \Delta E = \Delta E_{mec} + \Delta E_{th} + \Delta E_{int}.$
$\Delta K = K_f - K_i = W$	$K_2 + U_2 = K_1 + U_1.$	$P_{avg} = \dfrac{\Delta E}{\Delta t}.$
$W_g = mgd\cos\phi.$	$\Delta E_{mec} = \Delta K + \Delta U = 0.$	$P = \dfrac{dE}{dt}.$
$W_s = \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2.$	$K(x) = E_{mec} - U(x).$	$\vec{r}_{com} = \dfrac{1}{M}\sum_{i=1}^{n} m_i\vec{r}_i.$
$W = \displaystyle\int_{x_i}^{x_f} F(x)\,dx.$	$\Delta U = -\displaystyle\int_{x_i}^{x_f} F(x)\,dx.$	$\vec{p} = m\vec{v}.$
$P_{avg} = \dfrac{W}{\Delta t}.$	$\Delta U = -W.$	$\vec{P} = \text{constant}$
$P = \dfrac{dW}{dt}.$	$W = \Delta E_{mec} = \Delta K + \Delta U.$	$\vec{P}_i = \vec{P}_f$
$P = Fv\cos\phi = \vec{F}\cdot\vec{v}.$	$W = \Delta E_{mec} + \Delta E_{th}.$	

(1) speed (m/s) (C)

---

(2) $A = l^2 = 4500\ cm^2$ "$\sqrt{\ }$"

$l = \sqrt{4500} = 67.1\ cm$

$\div 100 \to = 0.671\ m$ (B)

---

(3) $x = 6t + 2t^2$

نشتق ($v = \frac{dx}{dt} = 6 + 4t$

$t = 5\ s \Rightarrow v = 6 + 4(5) = 20\ m/s$ (D)

---

(4) $v_0 = 60\ m/s$ $v = 20\ m/s$
$t = 10\ s$ $a = ?$

$v = v_0 + at \Rightarrow 20 = 60 + a(10)$ (B)

$-10a = 60 - 20 = 40$ $\boxed{a = -4\ m/s^2}$

(2)

(5)

الجسم ساقط لأسفل ⇐ مقدار السرعة يزداد

increasing (A)

---

(6) $v_0 = 19\ m/s$ $\qquad t = 7\ s$

$a = -9.8\ m/s^2$ $\qquad v = ?$

$v = v_0 + at = 19 - 9.8(7)$

$= -49.6\ m/s$

$|v| = 49.6\ m/s$ (B)

---

(7) $v_0 = 0$ $\qquad a = -9.8\ m/s^2$

$t = 4.1\ s$ $\qquad |y| = ??$

$y = v_0 t + \frac{1}{2}at^2 = 0 + \frac{1}{2}(-9.8)(4.1)^2$

$y = -82.4\ m \Rightarrow height = |y| = 82.4\ m$

(D)

(3)

(8) distance is <u>not</u> a vector quantity

المسافة ليست كمية متجهة

(A)

---

(9) $A_x = -18.3\ m$ $A_y = 17.6\ m$

$$|A| = \sqrt{A_x^2 + A_y^2} = \sqrt{(18.3)^2 + (17.6)^2}$$

$$= 25.4\ m$$ (A)

---

(10) $\vec{A} = -3i + j + 4k$

$\vec{B} = 3i + 3j - 2k$

$\vec{C} = -2i - 2j - k$

$-2\vec{A} = 6i - 2j - 8k$

$-\vec{B} = -3i - 3j + 2k$

$3\vec{C} = -6i - 6j - 3k$

$\vec{D} = -2\vec{A} - \vec{B} + 3\vec{C} = -3i - 11j - 9k$ (C)

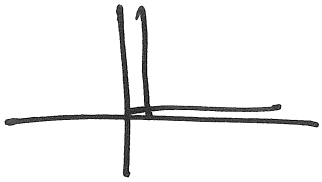
(4)

(11) $\vec{A} \cdot \vec{B} = 0 \implies \boxed{\theta = 90^\circ}$ (A)

---

(12) $\vec{V} \times \vec{W} = \vec{0} \implies \vec{V} \parallel \vec{W}$

$\vec{V} = 3i + 3j$



$\theta = \tan^{-1} \left| \frac{3}{3} \right| = 45^\circ$

$\vec{V} \times \vec{W} = 0$ المتجهان متوازيان لأن

$\therefore \vec{W}$ له نفس الزاوية

$\boxed{\theta = 45^\circ}$ (C)

---

(13) $\vec{r_2} = 9i + 10j - 6k$ $\quad \Delta t = 3s$

$\vec{r_1} = 3i - 8j + 6k$

$\vec{\Delta r} = \vec{r_2} - \vec{r_1} = 6i + 18j - 12k$

$$V_{ave} = \frac{\vec{\Delta r}}{\Delta t} = \frac{6i + 18j - 12k}{3}$$

$= 2i + 6j - 4k$ (D)

(5)

(14) $\vec{r} = 2t^2 i - t^3 j + 8t k$

نشتق

$\vec{v} = \frac{d\vec{r}}{dt} = 4t i - 3t^2 j + 8k$

نشتق

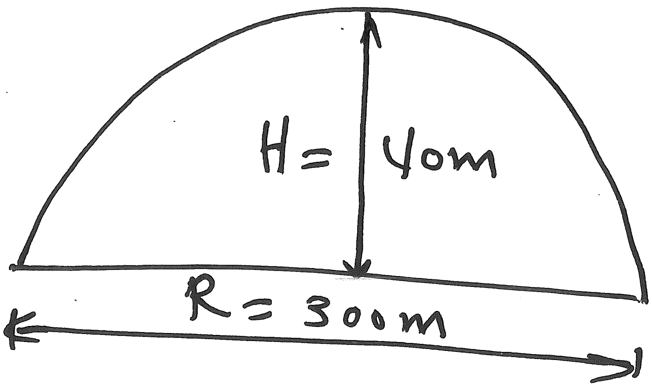
$\vec{a} = \frac{d\vec{v}}{dt} = 4i - 6t j$

$t = 1.5\ s \Rightarrow \vec{a} = 4i - 6(1.5) j$

$\boxed{\vec{a} = (4i - 9j)\ m/s^2}$ (D)

---

(15) $\tan\theta = \frac{4H}{R}$



$= \frac{4(40)}{300}$

$= 0.533$

$\theta = \tan^{-1}(0.533) = 28.1^\circ$

$R = \frac{v_0^2 \sin(2\theta)}{g} \Rightarrow 300 = \frac{v_0^2 \sin(2 \times 28.1)}{9.8}$

$v_0^2 = \frac{(300)(9.8)}{\sin(56.2)} = 4257.6 \Rightarrow \boxed{v_0 = 65.25\ m/s}$

(6)

$\vec{V_0} = V_0 \cos\theta\, i + V_0 \sin\theta\, j$

$= 65.25 \sin(28.1) i + 65.25 \sin(28.1) j$

$\vec{V_0} = (57.56 i + 30.73 j)\ m/s$

---

(16) Constant velocity $\Rightarrow$

net force = 0 (D)

---

(17) Acceleration is always in the direction of the <u>net force</u> (B)

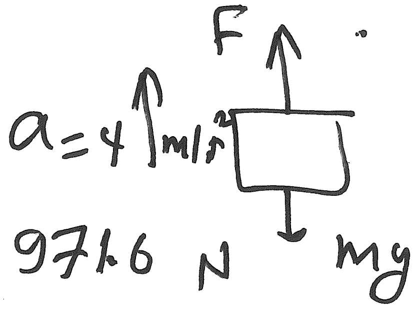
---

(18) $mg = 690\ N \Rightarrow m = \frac{690}{9.8} = 70.41\ kg$

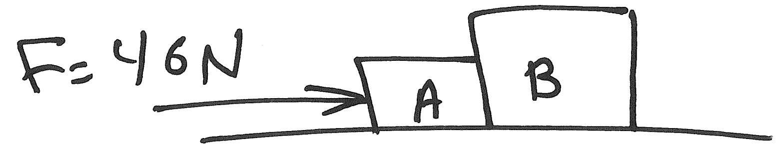
$F - mg = ma$

$F - 690 = 70.41(4)$

$F = 690 + (70.41)(4) = 971.6\ N$



(19)



$m_A = 6\,kg$ $\qquad m_B = 18\,kg$

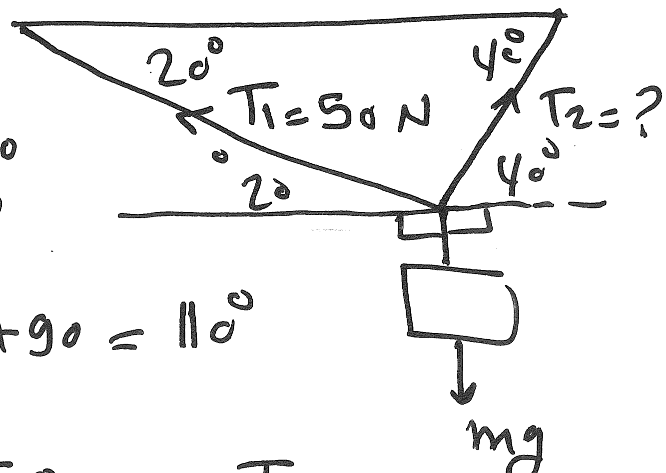
$\Sigma F = ma \implies 46 = (6+18)a$

$46 = 24a$

$a = \frac{46}{24} \implies a = 1.92\ m/s^2$ (A)

---

(20)



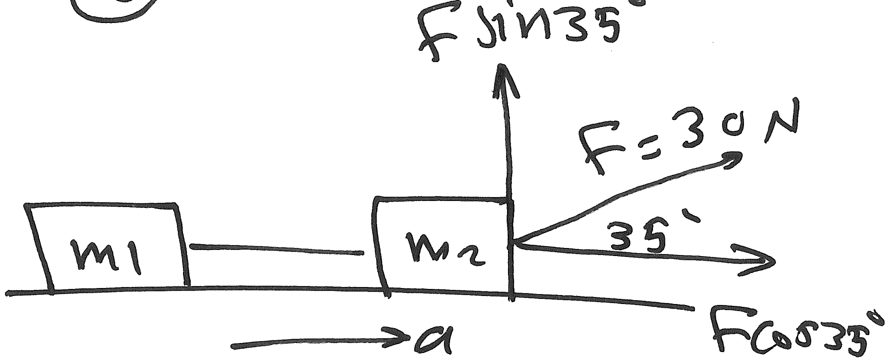
$T_1 = 50\ N$ $\qquad \theta_1 = 40 + 90 = 130°$

$T_2 = ??$ $\qquad \theta_2 = 20 + 90 = 110°$

$\frac{T_1}{\sin\theta_1} = \frac{T_2}{\sin\theta_2} \implies \frac{50}{\sin 130°} = \frac{T_2}{\sin 110°}$

$T_2 = \frac{50 \sin 110°}{\sin 130°} = 61.3\ N$ (A)

(21)



القوة F لها تأثير

$m_1 = 9\ kg$

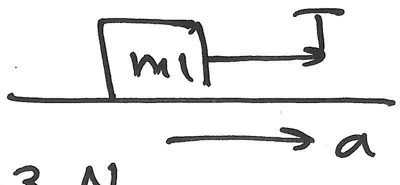
$m_2 = 12 kg$

$\Sigma F = ma \Rightarrow F \cos 35° = ma$

$30 \cos 35° = (9 + 12)\ a$

$24.57 = 21\ a$

$a = \frac{24.57}{21} = 1.17\ m/s^2$



$T = m_1 a$

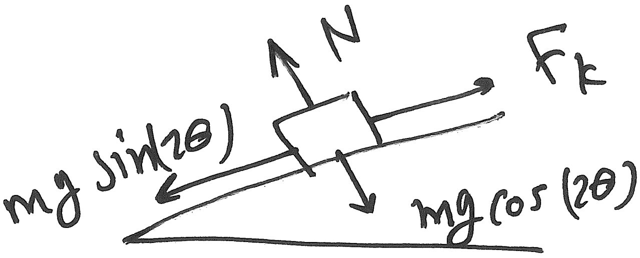
$= 9(1.17) = 10.53\ N$

---

(22)

Constant speed

$F_k = mg \sin(2\theta)$



(A)

(23) $v_0 = 8\ m/s$ $v = 0$

$x = ??$ $\mu_k = 0.1$

$a = -\mu_k g = -(0.1)(9.8) = -0.98\ m/s^2$

$v^2 = v_0^2 + 2ax$

$0 = (8)^2 + 2(-0.98)x$

$1.96x = 64 \Rightarrow x = \frac{64}{1.96} = 32.65\ m$ (D)

---

(24) $m = 1200\ kg$ $v = 18\ m/s$

$R = 250\ m$

$F_\perp = m\frac{v^2}{R} = (1200)\left(\frac{(18)^2}{250}\right)$

$= 1555.2\ N$

(25) $m = 6\,kg$ $K = 15\,J$

$K = \frac{1}{2} m v^2 \Rightarrow 16 = \frac{1}{2}(6) v^2$

$v^2 = \frac{16}{3} = 5$ "√"

$v = 2.24\,m/s$ (B)

---

(26) The SI unit of work is

$kg \cdot m^2/s^2$ (D)

---

(27) $m = 1100\,kg$ $v_i = 0$ $v_f = 18\,m/s$

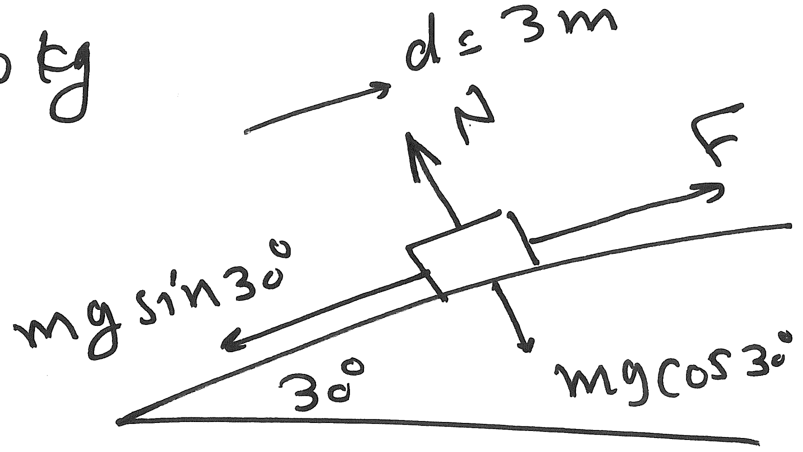
$W_{net} = \Delta K = \frac{1}{2} m (v_f^2 - v_i^2)$

$= \frac{1}{2}(1100)((18)^2 - (0)^2) = 178200\,J$

$= 178.2\,kJ$ (D)

$\div 1000$

(28) $m = 6\,kg$



$$W_{mg} = -(mg\sin 30)\,d$$

$$= -(6 \times 9.8 \sin 30)(3) = -88.2\,J$$ (C)

---

(29) $F = 35\,N$ $d = 4\,m$

$$W_F = Fd = (35)(4) = 140\,J$$ (B)

---

(30) $k = 500\,N/m$ $x_f = 0.08\,m$ $x_i = 0$

$$W_F = \frac{1}{2}k(x_f^2 - x_i^2) = \frac{1}{2}(500)((0.08)^2 - 0)$$

$$= 1.6\,J$$ (C)

(31) $m = 3\,kg$

$x = -6t - 3t^2 + t^3$

نشتق

$v = \frac{dx}{dt} = -6 - 6t + 3t^2$

$t = 0 \Rightarrow v_i = -6 - 0 + 0 = -6\ m/s$

$t = 2s \Rightarrow v_f = -6 - 6(2) + 3(2)^2$

$= -6 - 12 + 12 = -6\ m/s$

$W = \frac{1}{2} m (v_f^2 - v_i^2) = \frac{1}{2}(3)((-6)^2 - (-6)^2)$

$= 0$ (B)

---

(32) $P = \frac{W}{t} \Rightarrow J/s$ (A)

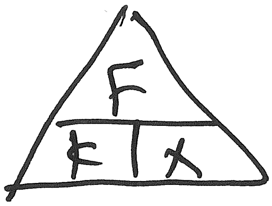
---

(33) $W = 18\,J$ $t = 7\,s$

$P = \frac{W}{t} = \frac{18}{7} = 2.6\ W$ (C)

(34) $k = 20\ N/m \qquad F = 13\ N$

$$x = \frac{F}{k} = \frac{13}{20} = 0.65\ m$$



$$U_s = \frac{1}{2}kx^2 = \frac{1}{2}(20)(0.65)^2$$

$$= 4.23\ J \qquad \text{(B)}$$

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(35) $U_g = mgh$ (A)

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(36) $W_{F_k} = -F_k d$

دائماً سالب

لأنّ F_k عكس الإزاحة d

(D)

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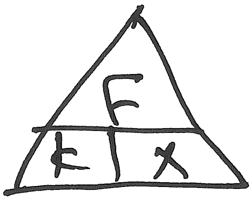
(37) $F = 17\ N \qquad x_f = 0.5\ m \qquad x_i = 0$



$$k = \frac{F}{k} = \frac{17}{0.5} = 34\ N/m$$

$$W = \frac{1}{2}k(x_f^2 - x_i^2) = \frac{1}{2}(34)((0.5)^2 - 0)$$

$$= 4.3\ J \qquad \text{(D)}$$

(38)

m	x	y
6	2	4
4	-5	7

$$x_{cm} = \frac{\Sigma m x}{\Sigma m}$$

$$= \frac{(6)(2) + 4(-5)}{6+4}$$

$$= -0.8\,m$$ (B)

$$y_{cm} = \frac{\Sigma m y}{\Sigma m} = \frac{(6)(4) + 4(7)}{6+4} = 5.2\,m$$ (B)

The center of mass is (-0.8 m , 5.2 m)

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(39) $K = \frac{1}{2} m v^2$ — $K \neq 0 \Rightarrow v \neq 0$

$P = mv$ $\quad v \neq 0 \Rightarrow P \neq 0$

عندما يكون الجسم له طاقة حركة وبالتالي له

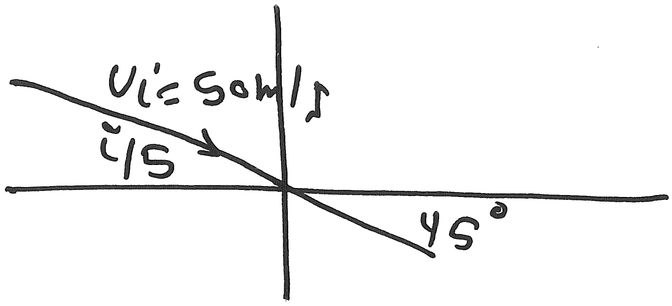
سرعة وأيضاً له كمية حركة

$P = mv$

(D)

(15)

(40) $m = 2\,kg$



$v_i = 50\ m/s$

$\theta = 360 - 45 = 315^\circ$

$\vec{v_i} = 50 \cos 315\, i + 50 \sin 315\, j$

$\vec{v_i} = 35.36\, i - 35.36\, j \quad m/s$

$v_f = 50\, m/s \qquad \theta = 45^\circ$

$\vec{v_f} = 50 \cos 45\, i + 50 \sin 45\, j$

$\vec{v_f} = 35.36\, i + 35.36\, j$

$\vec{DP} = m(\vec{v_f} - \vec{v_i})$

$= 2(35.36\, i + 35.36\, j - (35.36\, i - 35.36\, j))$

$= 2(35.36 + 35.36\, j - 35.36\, i + 35.36\, j)$

$= 141.44\, j \qquad DP = 141.44\ kg.m/s$

$j \Longrightarrow$ Perpendicular to the plate (D)