فيزياء ١٤١

الحل التفصيلي للدوائر الموجودة في

Test bank

إعداد الرباعي:

١.محمد المدلل (٦،٧،٨)

٢.عمر المحتسب (١،٩)

٣. وئام مكاوي(٢،٤،٥)

٤.لارا سامي (٣،١٠،١١)

لاتنسونا من صالح دعائكم بظهر الغيب

إعداد: عمر المحتسب

CHAPTER 1

1) Ans: E from the book "Note"

2) Ans: B "nS" nanosecond $= 10^{-9}$ s from the book

3) Ans: E the speed of light from the book

4) Ans: C The Def. relates the conversion...

5) Ans: C 1 yard $= \frac{3600}{3937}$ meter

1 yard $= 0.914 \approx 1$ m.

6) Ans: D "can be expressed in terms of $1 m^2$"

7) Ans: C kg

8) Ans: B 1 kg $= 10^{-3}$ kg

9) Ans: B 1 pound $= 0.453$ kg

* "خطأ في الجواب" $\leftarrow 0.5$ من الامتحان

10) Ans: C $(5.0 * 10^4)(3.0 * 10^6) =$

$= (5.0 * 3.0)\, 10^{6+4}$

$= 1.5 * 10^{10} = 1.5 * 10^{1}$

11) Ans: B "$1.5 * 10^{1}$" the same as 10

12) Ans: E $5.0 * 10^5 + 3.0 * 10^6 =$

$= 0.5 * 10^6 + 3.0 * 10^6 =$

$= 3.5 * 10^6$

13) Ans: E $(7.0 * 10^6)/(2.0 * 10^6) =$

$\left(\frac{7.0}{2.0}\right) 10^{6-(-6)} = 3.5 * 10^{12}$

14) Ans: B 0.00150 "3" signi. num.

15) Ans: C 150 "3" signi num.

16) Ans: C $3.2 * 2.72 = 8.64$

$8.64 \approx 8.6$

17) Ans: B $1.513 + 27.3 =$

$= 28.813 \approx 28.8$ the least ①

18) Ans: B 1 mi° $= 1609$ m

$55 = y$ m

$y = 55 * 1609 = 88.495$ m

88.495 meter/h $= \frac{88.495}{3600}$ meter/s

$= 24.58 \approx 25$

19) Ans: A $V_{sphere} = \frac{4}{3}\pi r^3$

$= \left(\frac{4}{3}\right)(3.14)(1.7 * 10^{-2})^3$

$= 20.569 \approx 21 * 10^{-5}$ m³

20) Ans: C $A_{sphere} = 4\pi r^2$

$= (4)(3.14)(1.7 * 10^{-2})^2$

$= 3.6298 \approx 3.6 * 10^{-3}$ m²

Ans: D

21) $V_{cylinder} = (\text{Area of base})(\text{height})$

$= (\pi r^2)(h)$

$= (\pi)(2.3 * 10^{-2})^2 (1.4)$

$= 2.3 * 10^{-3}\ m^2$

22) Ans: D $A_{cylinder} = "2"\ \text{Area base} + 2\pi r h$

$= 2\pi r^2 + 2\pi r h$

$= (2)(3.14)(2.3 * 10^{-2})^2 + (2)(3.14)(2.3 * 10^{-2})(1.4)$

$= 5.344 \simeq 5.3 * 10^{-3}\ m$

23) Ans: B $V_{cube} = L^3 = (1 * 10^{-2})^3 = 10^{-6}\ m^3$

24) Ans: B $A_{square} = L^2 = (1 * 10^{-2})^2 = 10^{-4}\ m^2$

25) Ans: B

$1\ m \longrightarrow 3.281\ ft$

$y\ m \longleftarrow 1.5\ ft$

$y = \frac{1.5}{3.281} = 0.457$

$V_{cube} = L^3 = (0.457)^3 = 0.0955 \simeq 0.096$

26) Ans: D $V = at^2 + bt^3$

$\Rightarrow$ V is in m/s

so at^2 is in m/s

$(a)(s^2) = m/s$

$a = \frac{s^3}{m}$

$\Rightarrow bt^3$ is in m/s

$(b)(s^3) = m/s$

$b = \frac{s^4}{m}$

27) Ans: A $A = BC \Rightarrow B = \frac{A}{C}$

$B = \frac{L/m}{L/T} = T/M$

28) Ans: D $A = B^n C^m$

$B = L^2 T^{-1} / A = LT / C = LT^2$

$(L^2 T^{-1})^n (L T^2)^m = L^1 T^1$

$L^{2n+m} = L^1$

$2n + m = 1$ [1]

$T^{-n+2m} = T^1$

$-n + 2m = 1$ [2]

2 * [1] − [2]

$4n + 2m = 1$

$-(-n + 2m = 1)$

$5n = 1 \quad n = \frac{1}{5}$

$(2)(\frac{1}{5}) + m = 1$

$m = 1 - \frac{2}{5} = \frac{3}{5}$

$m = \frac{3}{5}$

إعداد: وئام معاوية

chapter 2

1. $\Delta X = X_f - X_i$

So E because

$\Delta X = 4 - 4 = 8$ is the largest.

2. $\Delta X = X_f - X_i$

B because

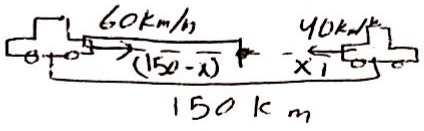
$\Delta X = -8 - 4 = -4$

It is the only negative result.

3. $S_{avg} = \frac{\text{total distance}}{\Delta t}$

So B

كل السيارات التي مشيتها في تلك الفترة على القرطاسية.

4. 

$a = 0$

$v_1 = 40 km/h = 11.1 m/s$

$v_2 = 60 km/h = 16.7 m/s$

$X_1 = v_{0}t + \frac{1}{2}at^2$ (a = 0)

$X_1 = 16.7t$

$X_2 = 150 \times 10^3 - X_1$

$X_2 = 150 \times 10^3 - v_{02}t - \frac{1}{2}at^2$

$= 150 \times 10^3 - 16.7t$

$150000 - 16.7t = 11.1t$

$150000 = 27.8t$

$t = \frac{5402\ s}{3600}$

$= 1.5\ h$

5. $S_{avg} = \frac{\text{total distance}}{\Delta t}$

$S_1 = \frac{d_1}{t_1}$

$\Delta t_1 = \frac{d_1}{S_1} = \frac{40}{80} = \frac{1}{2}\ h$

$\Delta t_2 = \frac{d_2}{S_2} = \frac{40}{40} = 1\ h$

the total time: $\frac{1}{2} + 1 = 1.5\ h$

عالبشنا كان الوقت صيرو 1 وصلنا 80 km صار الوقت 1.5

So $S_{avg} = \frac{80}{1.5} = 53.3$

D

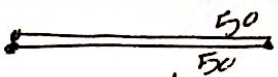
6. 

$V_{avg} = \frac{\Delta X}{\Delta t}$

وبما انه راجع وجيت لنفس النقطة

$\Delta X = 0$

اذن $V_{avg} = 0$



7. $S_{avg} = \frac{d}{\Delta t} = \frac{50+50}{2}\ km,\ 50\ km/h$

B

8. $X(t) = 16t - 30t^3$

$V(t) = 0$

$V(t) = X' = 16 - 9t^2$

$16 - 9t^2 = 0$

$9t^2 = 16$

$t^2 = \frac{16}{9}$

$t = \frac{4}{3} = 1.3s$

B

9. $V = bt^2$

$\therefore V = \frac{dx}{dt}$

$\int_0^t dx = \int v\,dt$

$X = \int bt^2\,dt$

$X(t) = \frac{b}{3}t^3$

B

10. $a_{avg} = \frac{\Delta V}{\Delta t} = \frac{V(8) - V(3)}{8 - 3}$

$= \frac{0 - 20}{8 - 3} = -4\ cm/s^2$

B

11. $X = 7t - 3t^2$

$V_{avg} = \frac{\Delta X}{\Delta t} = \frac{X(4) - X(0)}{4}$

$= \frac{-20 - 0}{4} = -5\ m/s$

B

12. $V = 4t - 3t^2$

$X = \int v.dt$

$\int 4t - 3t^2.dt$

$X = 2t^2 - t^3$

$V_{avg} = \frac{\Delta X}{\Delta t} = \frac{X(2) - X(0)}{2}$

$= \frac{8 - 8 - 0}{2} = \frac{0}{2} = 0$

A

B $X = 4t^2 - 3t^3$

$V = 8t - 9t^2$

$a_{avg} = \frac{\Delta V}{\Delta t}$

$= \frac{V(2) - V(0)}{2}$

$= \frac{16 - 36 - 0}{2}$

$= -10\ m/s^2$

C

14.

particle 1, 2 ✗

بكونوا اشتقيناهم مرتين

بضل فيه t يعني مش constant

(3) $\Rightarrow 3.5 + 2.7t^2$

$v = 5.4t$

$a = 5.4$ m/s.

(4) $\Rightarrow 3.5 - 3.4t - 2.7t^2$

$v = -3.4 - 5.4t$

$a = -5.4$ m/s

so only 3 and 4 ✓

(D)

15. particle 1 = $x(t) = 3.5 - 2.7t^3$

$v(t) = -8.1t^2$ / $a(t) = -16.2t$

← a v

(4) الجسم يتحرك بالاتجاه السالب والسرعة سالبة و اشارة بنفس الاتجاه اذن عم تزداد سرعته

particle 2 $\Rightarrow x(t) = 3.5 + 2.7t^3$

$V = 8.1t^2$ / $a(t) = 16.2t$

→ نفس الاتجاه بالاتجاه الموجب

particle 3 = $3.5 + 2.7t^2$

$V = 5.4t$ $a = 5.4$

نفس اشارة بالموجب ولو كان ثابتة

(4) $3.5 - 3.4t - 2.7t^2$ (4) A

16 $v_0 = 0$ $a = 4 \text{ m/s}^2$

$v_{avg} = \frac{\Delta x}{\Delta t}$

$x = x_0 + v_0 t + \frac{1}{2} a t^2$

$2 = 2t^2$

$t = 1$ s

$8 = 2t^2$

$t^2 = 4$

$t = 2$

$v_{avg} = \frac{\Delta x}{\Delta t} = \frac{8 - 2}{2 - 1} = 6$ m/s

17 E

مستحيل يكون جسم سارعوا ثابتة لانه

$a = \frac{dv}{dt}$

18 C

S & V increase

∵ $a \neq 0$ and $a \& v$ in the same direction

لأن بتزداد لأنهم يكونوا بنفس الاتجاه

والجواب الوحيد اللي زي الشبه.

C negative & negative

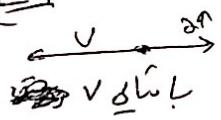
والاتنين Speed ما بتعتمد على الاتجاه

فما بتبين الاشارة.

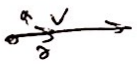
19

E

والاتنين



بإشارة v



مش شرط عشان صح

E

20 $y = at - 6t^2$

y position L

$a \rightarrow \frac{L}{T}$ $6 \rightarrow \frac{L}{T^2}$

C

21 $x = 6t^2$

E

والاتنين وحدة

$a = 6t$

بالشكل الاتجاه سالب

مش عشان $6t^2$ طارح

يكون سالب

و t طارح

يكون سالب عشان صيد بيشتغل

طارح يكون +

و $a = 9.8$

22 $x(t) = 27t - 4t^3$

$v = 27 - 12t^2$

$a = -24t$

$a(1) = -24 \ m/$

23 $x(t) = 27t - 4t^3$

$v(t) = 27 - 12t^2$

$v(0) = 27$

$a(t) = -24t$

$a(0) = 0$

C

24 $v = 16 \ m/s \rightarrow t = 0$

$a = -0.5t$

$a = \frac{dv}{dt}$

$v = \int a \, dt$

$v = -\frac{0.5}{2}t^2 + c$

24) $v = -0.25t^2 + c$

$v(0) = c$

$c = 16$

$v = -0.25t^2 + 16$

$-0.25t^2 + 16 = 0$

$0.25t^2 = 16$

$t^2 = 64$

$t = 8$

D

25) نفس السؤال

24

$v = -0.25t^2 + 16$

$x = \int_0^t v \, dt$

$\Delta x = \frac{-0.25}{3} t^3 + 16t$

$\Delta x = 58.7 = 59\ m$

E

26) نفس السؤال السابق

24, 52

It stopped at $t = 8$

So $\Delta y = \frac{-0.25}{3} t^3 + 16t = \underline{85}$

D

27) $v(t) = 98 - 2t^2$

$98 - 2t^2 = 0$

$2t^2 = 98$

$t^2 = 49$

$t = 7$

$a(t) = -4t$

$= -4 \times 7 = -28\ m/s^2$

D

28) $x(t) = 75t - 1t^3$

$v(t) = 75 - 3t^2$

$75 - 3t^2 = 0$

$3t^2 = 75$

$t^2 = 25$

$t = 5$

$a(t) = -6t$

$= -6 \times 5 = -30\ m/s$

C

29) 20 m in 4s

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

$20 = 0 + \frac{1}{2} a (16)$

$a = \frac{20}{8} = 2.5\ m/s^2$

C

30) $V^2 = V_0^2 + 2ax$

$2500 = 100 + 2(60)a$

$2400 = 120a$

$a = 20\ m/s^2$

$V = V_0 + at$

$50 = 10 + 20t$

$40 = 20t$

$t = 2s$

A) صح جواب

B) خ

خ

$S_{avg} = \frac{d}{\Delta t}$

$\frac{10+50}{2} = \frac{60}{\Delta t}$

$30 = \frac{60}{\Delta t}$

$\Delta t = 2s$

خ

31) $a = 5\ m/s^2$

$V = V_0 + at$

$= 5 \times 5 = 25\ m/s$

C

32) $V_0 = 25\ m/s$ ↑

$a = 3\ m/s^2$ ↓

$V = V_0 + at$

$V = 25 - 3(6)$

$25 - 18 = 7\ m/s$

A

33) $V_0 = 12\ m/s$ ←

$a = 4\ m/s^2$ ←

$\Delta x = V_0 t + \frac{1}{2}at^2$

$\Delta x = 12(3) + \frac{1}{2}(4)(3)^2$

$= 36 + 18 = 54\ m$

D

34) $V_0 = 2\ m/s$ ← 6s

$a = 2\ m/s^2$

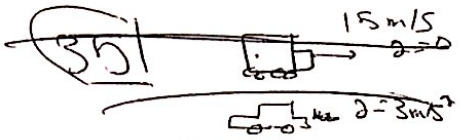
$\Delta x = V_0 t + \frac{1}{2}at^2$

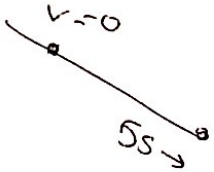
$\Delta x = 2(6) + \frac{1}{2}(2)(6)^2$

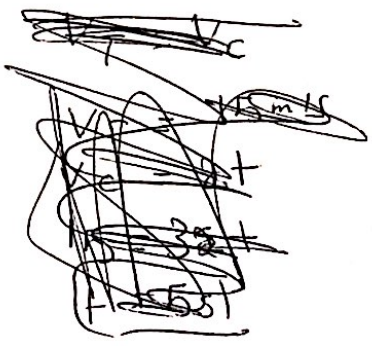
$= 12 + 36 = 48\ m$

E

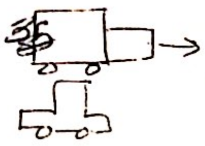
35)







35.



$x_T = x_c$

$v_T t + \frac{1}{2} a_T t^2 = v_c t + \frac{1}{2} a_c t^2$

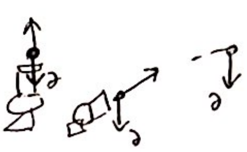
$v_T t = \frac{1}{2} a_c t^2$

$15 = \frac{3}{2} t$

$t = \frac{30}{3} = 10s$

B

36



downward

دائمًا بكون تسارع [illegible] تشمّ كان في الصعود او في النزول.

A

37

$+\uparrow$ 2 ascent الصعود, 1

$\Delta x = x_f - x_i = x_2 - x_1 = +$ $(x_2 > x_1)$

disascent $\Delta x = x_f - x_i = x_1 - x_2 = -$

صور موجب بالصعود وسالب بالهبوط

38

$v = 0$, $a = g$

g دائمًا in free fall

39

$v_{avg} = \frac{\Delta x}{\Delta t}$

$\Delta x = v_i t + \frac{1}{2} g t^2$

$\Delta x = 4.9 t^2$

$\Delta x(1) = 4.9$

$v_{avg} = \frac{4.9 - 0}{1} = 4.9$ m/s

(A) ✓

توضيح

(B) ✗ لانو الجسم بسقط كل ثانية بمقدار 4.9m

(C) ✗ لانو accelartion is constant and equall = 9.8 ما بتغير كل ثانية بمقدار 9.8

(D) ✗ بسقط بمقدار 4.5m مش 9.8m كل ثانية

(E) ✗ a constant وثابت $a = g$ وما الها علاقة للوزن بالموضوع.

40 C $a = 9.8\ m/s^2$

اذن السرعه رح تزداد
كل ثانية بمقدار 9.8

$V = 0 + 9.8t$

$v = 9.8t$ C ✓

وعادة انه شغوف اذن ↓
رح يكون اتجاه السرعه للاسفل عشان
هيك درح تتزايد مش تتناقص
زي جوابE

41 ↑ v, ↓ a

B

↑ v ↓ a

← دائما بتكون للاسفل

42 ↑ 50m/s

46 (level ground)

$\Delta X = X_0 + V_0t - \frac{1}{2}gt^2$

$X = 50(1) - 5(1)$

$= 45\ m$

B

(42) نفس السؤال

43 $X = 50(6) - 5(6)^2$

$= 300 - 180$

$= 120\ m$

E

وهكذا

44 ↓ 1m/s

$\Delta X = V_0t + \frac{1}{2}gt^2$

$= 1(5) + \frac{1}{2}9.8(5)^2$

$= 5 + 122.5$

$= 127.5\ m$

لانه v_0 و a بنفس الاتجاه
بتكون الاشاره (+)

B

45 ↑ 35m/s

$V = V_0 + at$

$V = 35 - 10(5)$

$= 35 - 50 = -15\ m/s$

15 down

B

46 C لانه تسارع
دائما بضل ثابت بالسقوط الحر

47 $\Delta X = V_0t + \frac{1}{2}gt^2$

~~$\Delta X = V_0t + \frac{1}{2}gt^2$~~
~~$= \frac{9.8}{2}(1)^2$~~
~~$= 4.9$~~
~~$\Delta X = \frac{9.8}{2}(2)^2$~~
~~$= 19.6$~~

~~$\Delta X_2 = 3\Delta X_1$~~

~~$\Delta X = \frac{9.9}{2}(2)^2$~~
~~$= 19.6$~~

47

$v(1) = v_0 + gt = g$

$v(2) = v_0 + g(2) = 2g$

$v_{avg} = \frac{2g+g}{2} = \frac{3g}{2}$

Distance moved in second second is $\frac{3g}{2} \times (1) = \frac{3g}{2} = \frac{3\times10}{2} = 15\,m$

$v_{avg} = \frac{\Delta x}{\Delta t}$

$v_{avg}\Delta t = \Delta x$

(C)

48 $v_0 = 0$

$v(4) = v_0 + g(4) = 4g$

$v(3) = 3g$

$v_{avg} = \frac{(4+3)g}{2} = \frac{7}{2}g$

$v_{avg} = \frac{d}{\Delta t}$

$d = v_{avg}\cdot\Delta t$

$= \frac{7}{2}g \times (4-3) = 34.3\,m$

(D)

49

عادنة الصاروخ
تزداد هذه القذيفة .g
بالتالي لا يوجد
شارع منا الى شارع الجارنه
الارض الذي

50

عادنا اطلقنا من البالون فهو سرعته يكون بنفس

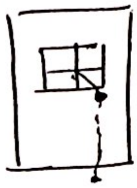
$v_0 = 10\,m/s$

$v = v_0 + gt$

$= 10 + 9.8(20)$

$= 206\,m/s$

51



12s

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

$= 0 + \frac{1}{2}(9.8)(12)^2$

$= 705.6\,m$

(E)

52

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

$175 = \frac{1}{2}(9.8)t^2$

$t^2 = 35.7$

$t = 5.9 = 6\,s$

(C)

53 $v_0 = 19.5\,m/s$

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

① $\Delta x = 19.5t - 4.9t^2$

② v at the top $= 0$

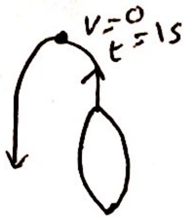
$v = v_0 + gt$

$v_0 = gt$

$t = \frac{19.5}{9.8} = 2s$

(C) $\Delta x = 39 - 19.6 = 19.4$

54



2s

$v = v_0 + gt$ (with $v = 0$)

$v_0 = 9.8(1) = 9.8\ m/s$

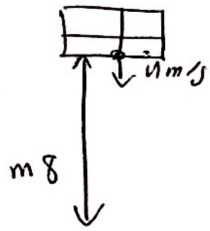
$\Delta X = v_0 t - \frac{1}{2} g t^2$

$\Delta X = 9.8t - 4.9t^2$

$= 9.8(1) - 4.9(1) = 4.9$

(A)

55



$\Delta X = v_0 t + \frac{1}{2} g t^2$

$8 = 4t + 4.9t^2$

$4.9t^2 + 4t - 8 = 0$

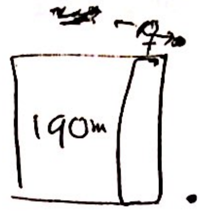
$t = \frac{-4 \mp \sqrt{16 + 156.8}}{9.8}$

$= \frac{-4 \mp 13.145}{9.8}$

$t = 0.93$ — $t = -X$ (لانو سالب)

(B)

56



$v^2 = v_0^2 + 2gX$

$v^2 = 0 + 2g(190)$

$v = 61\ m/s$

(B)

57

$a_n = 19.6 = 2g$

~~$\Delta X_n = v_0 t - \frac{1}{2} g t^2$~~

~~$= v_0 t - \frac{1}{2} g t^2$~~

~~$v = v_0 - at$~~

~~$v_0 = 2gt$~~

~~$= 2gt^2 - gt^2$~~

~~$\Delta X_n = g t^2$~~

~~$v_0 = gt$~~

~~$\Delta X_E = v_0 t - \frac{1}{2} g t^2$~~

~~$= gt^2 - \frac{1}{2} g t^2$~~

~~$\Delta X_E = \frac{1}{2} g t^2$~~

$\Delta X_n = v_0 t - \frac{1}{2} a_n t^2$

$\Delta X_n = v_0 t - g t^2$ where $a_n = 2g$

إشارة ↕

$\Delta X_E = v_0 t - \frac{1}{2} g t^2$

الشرط

في الارض رح يرتفع اعلى بمرتين من الكوكب الثاني

ما تنسى بالكوكب رح يرتفع نفس الارتفاع اللي برتفعه في الارض اذا كان الهم نفس السرعة الابتدائية

58. $v_f^2 = v_i^2 - 2gx$

case 1 $0 = v_i^2 - 2(100)g$

① $v_i^2 = 200g$

case 2

$v^2 = (2v_i)^2 - 2gx$

$0 = 4v_i^2 - 2gx$

$4v_i^2 = 2gx$

$x = \frac{4(200g)}{2g}$

$= 400\ m$

E

59. ↑ 100 m/s ↑ 10 m/s

$v^2 = v_i^2 - 2gx$

$x = \frac{v_i^2}{2g}$

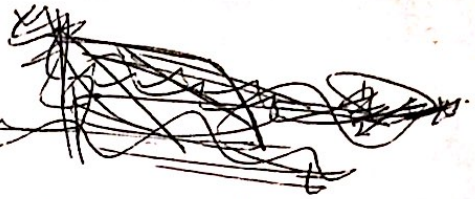
$x_1 = \frac{10000}{2g}$

$x_2 = \frac{100}{2g}$

$\frac{x_1}{x_2} = 100$

B

60.



$v = \frac{dx}{dt}$

$\int dx = \int v\,dt$

$x = \int v\,dt$

displacement

61. D لنفكر

62. $a = 3\ m/s^2$

$a = \frac{dv}{dt}$

$dv = a\,dt$

$v = \int_0^t 3\,dt$

$v = 3t$

but $v = \frac{dx}{dt}$

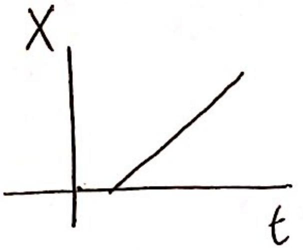
$x = \int_0^t v\,dt$

$= \int_0^t 3t\,dt$

$x = \frac{3}{2}t^2$

So It is increase with time

63



slope = $\frac{dx}{dt}$

$V = \frac{dx}{dt}$

و عبالة a stright line

اذن رح يكون V

ثابته لانو مستقيم

معادله اوليه تحليو رقم.

64 (B) تغير التسارع

constant

اذن رح ندور على الخط

مجموع يكون non zero

افقي او عمودي

حاصل غير (B)

65 (–) constant velocity

means $a = 0$

so (E)

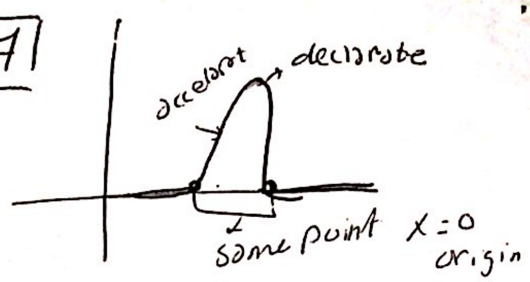
66 speed increasing

(أ) اذن مش خط مستقيم.

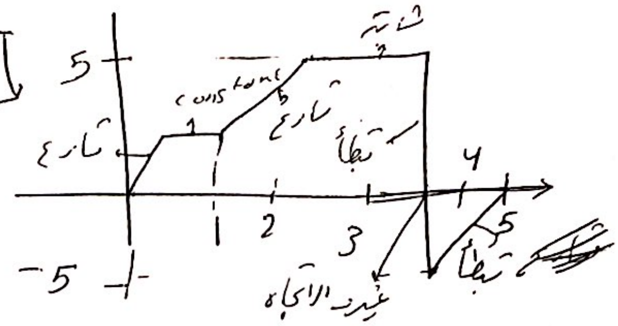
(ب) ميله موجب

(A)

67



68



ازا كانت V = 0 لازم يكون

ماشي بأعلى تسارع والا غير هيك بكون

شي غلط سرعه.

(E)

69

هوا الاولي بس بيطلع رح يكون

بطلع ... سرعه

نفس سرعه الصعود بالتالي

رح يرتفع شوي ويرجع

$\Delta x = V_0 t - \frac{1}{2} g t^2$ بينزل

(معادلة التسارع)

نفس فكرة سؤال 76
75

هيكون الجواب

C

لانه

$V \propto t$

بيزاد مع الزمن

77

$V = V_i - gt$

When $t = 0$

$V = V_i$

والسرعة الوحيدة

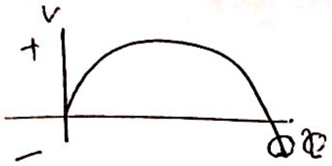
اى مش بتلاشه

من نقطة الاصل هي

C

وهي هي

70 E

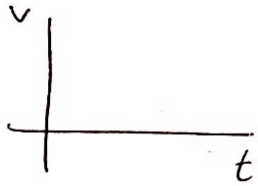


يكون اشارة ⓓ بالسالبة
عشان صارت تتحرك بسرعة ولكن
بالاتجاه العكسي

71 C

بالشارع
لانه الميل موجب

72



Δx ??

$\Delta X = \int V \, dt$

= Area under the curve

$= 3 \times 12 = 36$ m

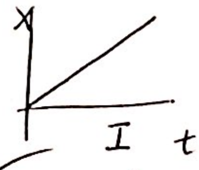
D

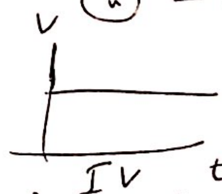
73 ~~E~~ A خطأ لانه متساوي

لعدة يمشي بسرعة ثابتة وبعدين يتباطأ

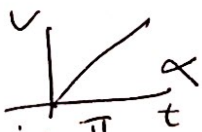
B $a = \frac{dv}{dt}$ (slope) $= \frac{12-0}{2-0} = 6\ m/s^2$ ✓

74 ⓐ I and IV E



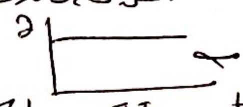


السرعة ثابتة مع الزمن



لانه السرعة تتزايد مع الزمن

لانه الجسم يتسارع ويقل السرعة تزداد



(A) تسارع ثابت يعني سرعة متزايدة بمقدار ثابت

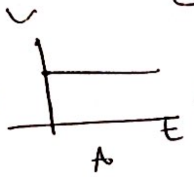
75

↓ $V_i = 0$

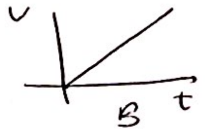
ⓐ $V = gt$

ⓑ $y = \frac{1}{2} g t^2$

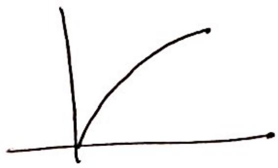
ⓒ $V^2 = 2gX$



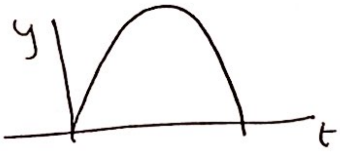
لانه $V \propto t$ تتزايد مع الزمن



$V \propto t$ ~~$V \propto t^2$~~ خطأ



$\propto$ $(V \propto t)$



$y = \frac{1}{2} g t^2$
وعبارة
اعتمادا الاتجاه
السالب موجب او لا لازم
يكون القطع المكافئ للاعلى
ورح يكون نصفه فقط

B

By: Lara Sami

Chapter 3: Vectors

Test bank solutions

1 Ans: B 2 Ans: D 3 Ans: A

4 Ans: C → The magnitude of the resultant must be somewhere between 5 and 45 only 12 satisfy this.

5 Ans: A Because $T+6>12$ so $T>6$ and $T-6<12$ so $T<18$

6 Ans: D 7 Ans: C $\vec{V}_1 + \vec{V}_3 = \vec{V}_2$ so $\vec{V}_3 = \vec{V}_2 - \vec{V}_1$

8 Ans: E 9 Ans: A 10 Ans: B

11 Ans: B 12 Ans: C 13 Ans: D $y_{\text{component}} = 12\sin 30 = -6$

14 Ans: A

15 Ans: D $4 \times \sqrt{100} = 4 \times 10 = 40$ 16 Ans B $\sqrt{(10)^2+(10)^2+(5)^2} \neq 15$

17 Magnitude $= \sqrt{(2)^2+(6)^2+(3)^2} = 7$ Ans: C

18 $25\cos\theta = 12 \Rightarrow \theta = 61°$ Ans C

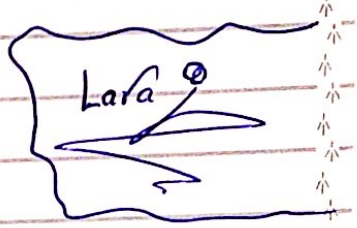
19 $\theta = \tan^{-1}\frac{45}{25} = 61°$ Ans: B

20 $\theta = \tan^{-1}\frac{45}{25} = 61° \Rightarrow \theta = 180 - 61 = 119$ Ans: C

21 Ans: A $S = (2+4)\hat{i} + (6+2)\hat{j} + (-3+1)\hat{k}$

22 Ans: B $D = (2-4)\hat{i} + (6-2)\hat{j} + (-3-1)\hat{k}$

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



23 ans: A $= (2\hat{i} - 3\hat{j}) - (2(1)\hat{i} - 2(2)\hat{j})$

$= 2\hat{i} - 3\hat{j} - 2\hat{i} + 4\hat{j} = +1\hat{j}$

24 Ans: C $(A+B)_x = A\cos\theta + B\cos\theta = 12(\cos 45) + B(\cos 60) \approx 12$

25 $A\cos\theta = 4$ —① $\tan\theta = \frac{10}{4}$ $\theta = 68°$ } then $A = \frac{4}{\cos 68} = 10.7$

$A\sin\theta = 10$ —②

Finally $A\cos\theta_2 = 8 \Rightarrow (10.7)\cos\theta_2 = 8 \Rightarrow \cos\theta = \frac{8}{10.7} \Rightarrow \theta_2 = 41.6$

So the y componet $= A\sin\theta_2 = 10.6 \sin 41.6 \approx 7.2$

Ans: B

26 Ans: C $A.B = |A||B|\cos\theta = (L)(L)\left(\frac{\sqrt{3}}{2}\right) = \frac{\sqrt{3}L^2}{2}$

27 Ans: D $\vec{A}.\vec{B} = (2)(4) + (6)(2) + (-3)(1) =$ 17 m²

28 Ans: C $A.B = (10)(15)\cos 65° = 63$ m ??

29 Ans: D $AB\cos\theta = A.B$

$(3)(5)\cos\theta = (1)(3) + (2)(4) = 11 \Rightarrow \cos\theta = \frac{11}{15}$

$\theta = \cos^{-1}\frac{11}{15}$

30 Ans: D $\cos(B) = -\cos(B+20)$ so $B + B + 20 = 180$

$2B = 160$

$B = 80°$

31 Ans: A 32 Ans: E 33 ans: C $AB\sin\theta$

34 Ans: B $\sin(\theta+20) = 2\sin\theta$

بتجربوا الخيارات بالآلة الحاسبة
والخيار اللي بزبط بتختاروه وهوت $18°$ هي
الصح

35 Ans: E

36 (اجته بصورة قبل)

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -2 & 0 \\ 2 & 3 & -2 \end{vmatrix} = \hat{i}(4-0) + -\hat{j}(-6-0) + \hat{k}(9-4)$$

$$= 4\hat{i} + 6\hat{j} + 13\hat{k}$$

Ans: A

37 Ans: E 38 Ans: B $\hat{i}.(\hat{j}\times\hat{k}) = \hat{i}.\hat{i} = 1$

39 Ans: A $\hat{k}.(\hat{k}\times\hat{i}) = \hat{k}.\hat{j} = 0$

لا تنسونا من دعائكم بظهر الغيب

Lara

Chapter 4

إعداد: وئام معاوية

1. $v = \frac{dx}{dt} = \frac{\Delta x}{\Delta t}$
معدل التغير للإزاحة بالنسبة للزمن (A)

2. $a = \frac{dv}{dt}$
معدل التغير للسرعة بالنسبة للزمن
(C)

3. speed (nonscaler quantity) قياسية

4. (E) ولا وحدة كمية متجه

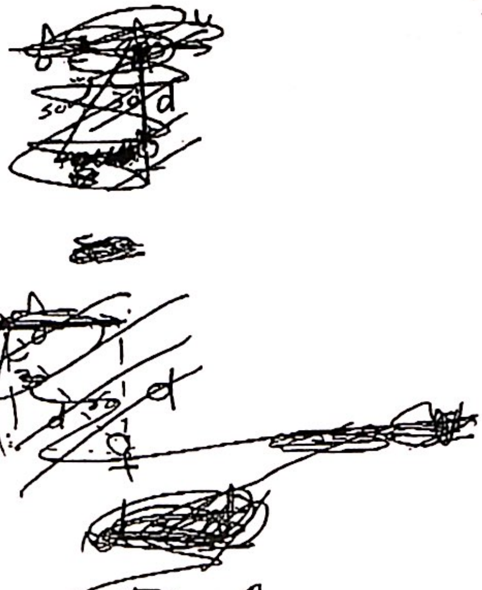
5. (E) المركبة الأفقية المقذوفات دائمًا بتكون نفس السرعة الابتدائية ثابتة
إذن (التسارع a_x = 0)

6. $r = -2\hat{i} + 3\hat{j} + 1\hat{k}$
to
$r = 3\hat{i} - 1\hat{j} + 4\hat{k}$

$\Delta r = r_2 - r_1$

$\Delta r = 5\hat{i} - 4\hat{j} + 3\hat{k}$

(B)

7. 

$\cos 30 = \frac{H}{Y}$

Y it is the distance that sound wawes have travel

$Y = \frac{H}{\cos 30}$

$Y = \frac{H}{\frac{\sqrt{3}}{2}}$

$Y = \frac{2}{\sqrt{3}} H$

but

X is the distance that plane have triveld

$\tan 30 = \frac{X}{H}$

$X = \tan 30 \, H$

و حالته

$\delta = \frac{d}{\Delta t}$

و قطع الصوت والطيارة هذه المسافة بنفس الزمن تقريبا

$X = \frac{1}{\sqrt{3}} H$

$Y = \frac{2}{\sqrt{3}} H$

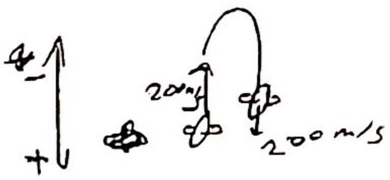
$\frac{X}{Y} = 2$

$\frac{1}{\sqrt{3}} \div \frac{2}{\sqrt{3}}$

$\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2} = \frac{1}{2}$

plane $X = \frac{1}{2} y$

B half the speed of sound.

8. 

$\Delta V = V_2 - V_1$
$= 200 - -200$
$= 400$ m/s south

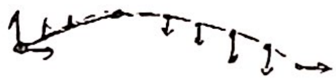
موجه south

9 

بما انه التسارع الى الاسفل اذا كان الافقي اذن ما بأثر على وقت ضربه بالارض فرح يضربها مع بعض بالتساوي

(A)

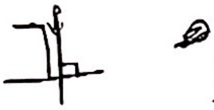
10 



(D) constantly increasing downward velocity (gt)

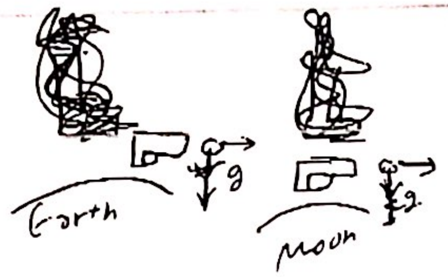
- because the gravity will accelerate the object down which increase downward velocity. $V = V_i + g$

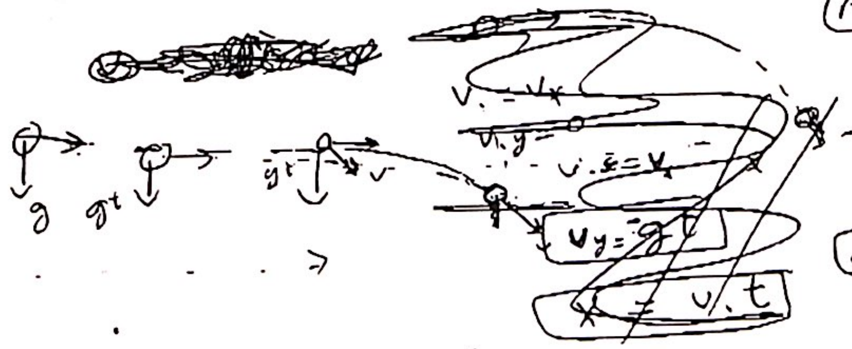
بشكل عام

11 

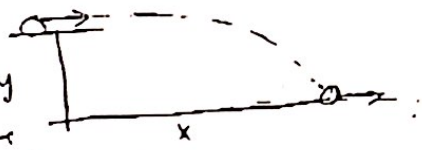
عمودي

12





الفرق عبارة الرصاصات رح يتأثروا بجاذبية بتكون الجاذبية بالقمر اقل من الارض اذن الرصاصة اليسار تقطعها الرصاصة بالقمر رح تكون اكبر من الحالة في الارض والزمن اكبر كمان I and II



below
$V_\circ = V_x$

$V_{y_0} = 0$

after
$V_x = V_\circ$

$V_y = -gt$

$y = \frac{g}{2}t^2$

$t = \sqrt{\frac{2y}{g}}$

وبالتالي y متساوية

[illegible]

(i)
$X = V_\circ t$

$X_E = V_\circ\sqrt{\frac{2y}{g}}$

$X_m = V_\circ\sqrt{\frac{2y}{g}}$ لما بتكون اصغر

$X_m > X_E$

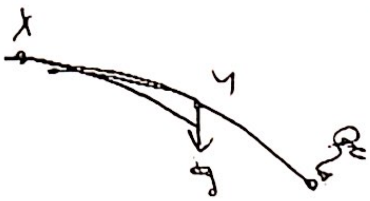
(ii)
$t_E = \sqrt{\frac{2y}{g}}$

$t_m = \sqrt{\frac{2y}{g}}$ الاصغر

$t_m > t_E$

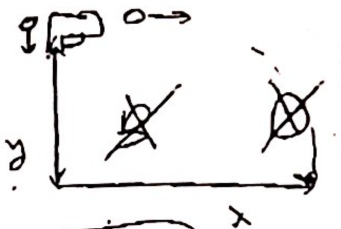
I and II

13



(A)

14



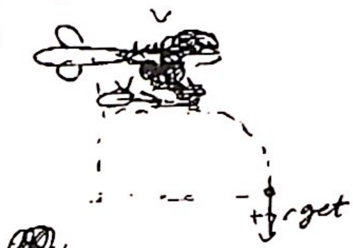
projectile
$t = \sqrt{\frac{2y}{g}}$

$y = \frac{1}{2}gt^2$

dropped
$t = \sqrt{\frac{2y}{g}}$

C

15



B ✓ C A D ✓ E ✓

$X = V_0 t = V_0\sqrt{\frac{2y}{g}}$

$t = \sqrt{\frac{2y}{g}}$

$V = V_0$

$X = V_\circ t - \frac{1}{2}at^2$

$X = V_\circ\sqrt{\frac{2y}{g}}$

A ✓

اذن الجواب C

16

$y = v_0 \sqrt{\frac{2y}{g}}$

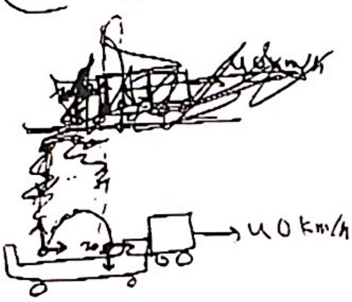
$X = \frac{1500}{36} \sqrt{\frac{250}{10}}$

$X = 41.7 \times 10$

$X = 417\ m$

(C) $\approx 420m$

17



(C) On the flatcar because the object has both horizontal and vertical components

اعركبه الافقيه لسرعه subject
platform as 5 =

اذن احنا اعطينا ارتفاع وجيه
اثرنا عليه

18

$v_x = v_y$

$v \sin 45 = v \cos 45$

$v_x = v$ ✓

I need to find (v_y)

$v_{oy} = 0$

$v_y^2 = v_{oy}^2 - 2gy$

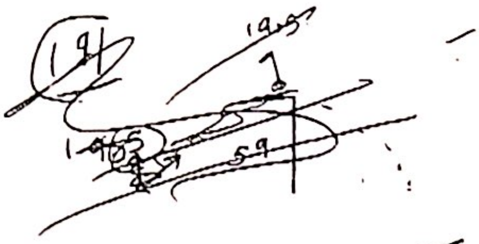
$v_y^2 = 0 - 2g\,20$

$v_y = \sqrt{400}$

$= 20\ m/s$

$v_x = v_0 = 20\ m/s$

19



~~$v_y^2 = v_{oy}^2 + 2gy$~~

~~$v_y^2 = 380.25 + 1158$~~

~~$v_y = 39.4$~~

~~$v_y = v_0 - gt$~~

~~$39.5 = 19.5 - 10t$~~

$\frac{20}{10} = t$

$t = 2\ s$

19 $y = v_y t - \frac{1}{2} g t^2$

$y = 19.5t - 5t^2$

$-59.4 = 19.5t - 5t^2$

$5t^2 - 19.5t + 59.4 = 0$

$t^2 - 3.9t + 11.9 = 0$

$$\frac{3.9 \pm \sqrt{15.21 + 47.6}}{2}$$

$$\frac{3.9 \pm 7.9}{2}$$

$t = 5.9$

$t = 6$

20

$v_x = 980 \times \cos 30$

$= 848.7$ m/s

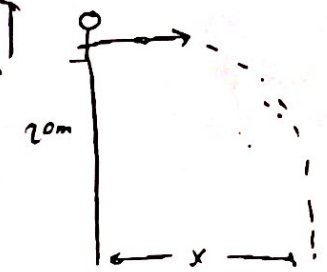
$R = v_x t$

$6t$

$0 = v \sin\theta - gt$

$t = \frac{980 \sin 30}{g} \Rightarrow t = 2 \times 50 = 100$

21



$y = 20$

$y = v_{0y} t - \frac{1}{2} g t^2$

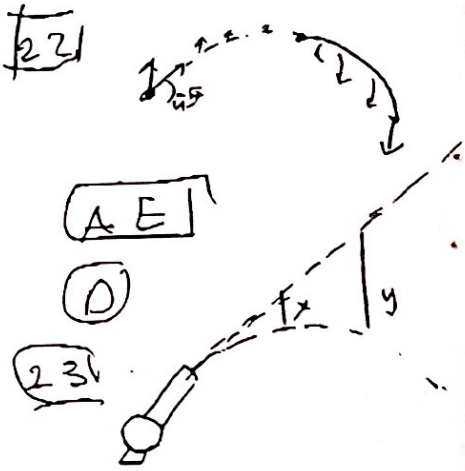
$-20 = -\frac{1}{2} g t^2$

$t = 2$ s

$x = v_0 t$

$= 20 \times 2 = 40$m

22



23

تغلب الكرة:

$v_x = v_0 \cos\theta$

$v_y = v_0 \sin\theta$

بعد الكرة:

$v_y = v \sin\theta - gt$

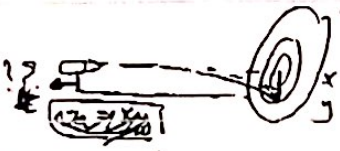
بوجود الكرة $y = v_{0y} t - \frac{1}{2} g t^2$

بغياب الكرة $y = v_{0y} t$

$v_{0t} - y = \frac{1}{2} g t^2$

$x = \frac{1}{2} \times 10 \times 5$ m

24)



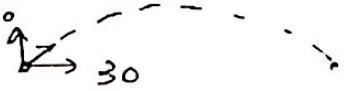
$t = ?\ s$

$y = \frac{1}{2} g t^2$

$y = \frac{1}{2} 10 (?)^2$

$y = 0.05\ m$

25)



$v_y = v_{oy} - gt$

$0 = 20 - 10t$

$t = 2\ s$

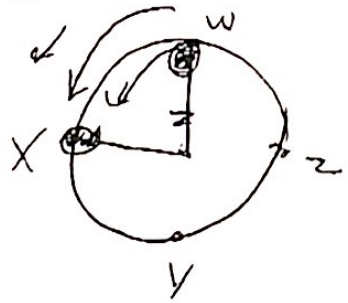
$t_{\text{كلي}} = 2 \times$ زمن الصعود

$= 2 \times 2 = 4\ s$

$X = v_x t$

$= 30 \times 4 = 120\ m$

26)

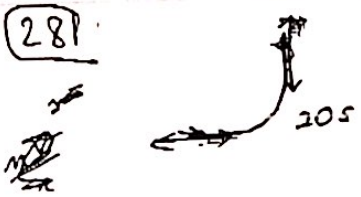


27)

$x = 0 \quad y = 3$

$v = 6\hat{i}$

28)



$v = 200\ m/s$

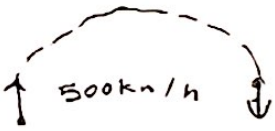
$a_{avg} = \frac{v_2 - v_1}{\Delta t}$

$= \frac{200\hat{j} + 200\hat{i}}{\Delta t}$

$= \frac{\sqrt{240000}}{20}$

$= 14\ m/s^2$

29)

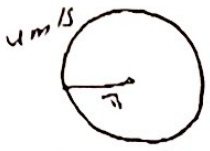


$a_{avg} = \frac{500 + 500}{40}$

$= \frac{1000}{40}$

$= 25\ km/h^2$

30)



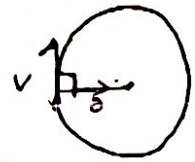
$V = \frac{\Delta x}{\Delta t}$

$\Delta t = \frac{\Delta V}{a_x} =$

$\Delta t = \frac{\pi r}{2}$

$= \frac{\pi^2}{2}\ s$

~~30~~

31 

C

32 

$v_2 = 2v_1$

Same R

$a_1 = \frac{v^2}{R}$

$a_2 = \frac{v_2^2}{R}$

$\frac{a_1}{a_2} = \frac{v_1^2}{4v_1^2}$

$4a_1 = a_2$

C ✓

33 @ have same a

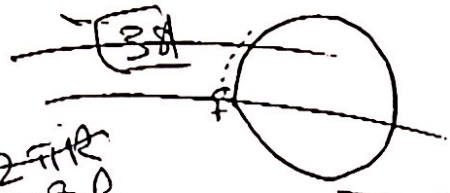
(A) $v_A = 2v_B$

$a_A = \frac{2v_B}{}$

$\frac{v_A^2}{R_A} = \frac{v_B^2}{R_B}$

$\frac{4v_B^2}{R_A} = \frac{v_B^2}{R_B}$

$4R_B = R_A$

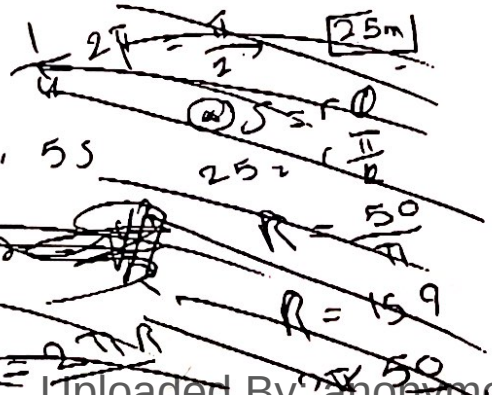
34 

$C = 2\pi R$

$25 = \frac{\pi}{2} R$

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

$= \frac{400}{15.9} = 25.15 \text{ m/s}^2$



35 $a = \frac{v^2}{R} = \frac{16}{25} = 32$ up m/s^2

36 $a = \frac{v^2}{R} = \frac{100}{20} = 5 \text{ m/s}^2$

37 

$a = 25g$

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

$v^2 = aR$

$v = \sqrt{25g}$

$= 16 \text{ m/s}$.

38 $v = 4 \text{ m/s}$

$a = \frac{v^2}{R} = \frac{16}{5}$

$= 32 \text{ m/s}^2$ down

39 $a = \frac{v^2}{R} = \frac{16}{25} = 32$ up m/s^2

40 $a = \frac{v^2}{R} = \frac{100}{20} = 5 \text{ m/s}^2$

41 

$T = 2\pi r$

38

$\frac{\pi}{2} \theta = \frac{3.14}{2} = 1.57$ rad

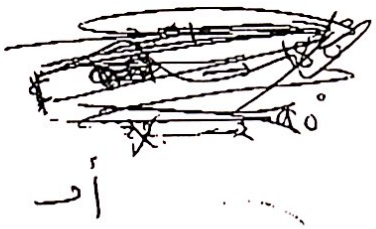
1.57

$V = \frac{2\pi r}{T}$

$V = \frac{2\pi \times 15.9}{5} = \frac{100}{5} = 20$

$\omega = \frac{\pi}{\frac{2}{T}} = \frac{\pi}{2T} = 0.314$ rad/s

$a = r\omega^2 = 15.9\ (0.314)^2 = 1.57 m/s^2$
$= 1.6 m/s^2$



$V = \frac{25}{5} = 5 m/s$

$a = \frac{v^2}{R} = \frac{25}{15.9} = 1.57 m/s^2$

$2\pi R = 25$

$R = 15.9$

39

$= 2 \times 3.14 \times 1.5$

$= 9.42$

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

1 s → 2π

? → 5 s

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

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

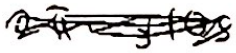
$= \frac{2 \times 3.14 \times 1.5}{5}$

$= 18.84 m/s$

$a = \frac{v^2}{R} = 237$

$= 240 m/s^2$

40 R = 8



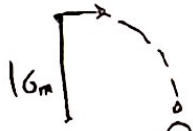
T = 10s

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

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

$= \frac{2 \times 3.14 \times 8}{10}$

$= 5\ m/s$



$R = vt$

$6vt$

$y = \frac{1}{2}gt^2$

$\frac{2 \times 16}{g} = t^2$

$t = 1.8\ s$

$R = 5 \times 1.8$

$= 9.1m$

41

$t_1 = \frac{x}{v}$

$t = \frac{3000}{(V_{AV} + V_b)}$

$\frac{3000}{25} = 120s$

$t_2 = \frac{x}{v} = \frac{3000}{20-5} =$

$t = t_1 + t_2 = 320s$

42 $V_{bR} = 14 km/h$

$V_{Rb} = 6 km/h$

$V_{mb} = 6 km/h$

$V_{mR} = V_{mb} + V_{bR}$

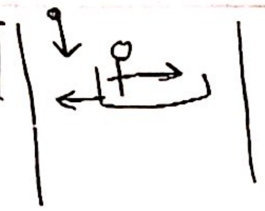
$= 6 + 14$

$= 20 km/h$

$V_{mG} = V_{mR} + V_{RG}$

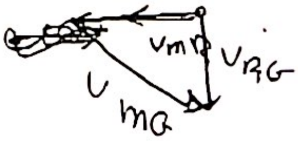
$= 20 + 6 = 26 km/h$

42



$V_{mR} = V_{BR} - V_{mb}$

$V_{mR} = 14 - 6 = 8 \text{ km/h}$

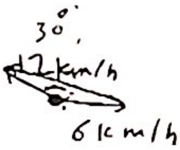


$V_{mG} = V_{RG} + V_{mR}$

$= \sqrt{6^2_j + 8^2_i}$

$= 10 \text{ km/h}.$

43

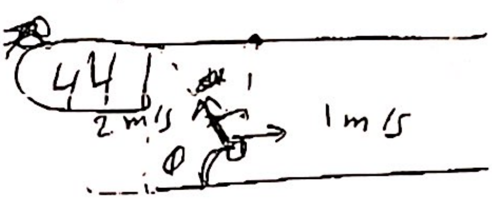


~~$V_{BG} = V_{BR} + V_{RG}$~~

~~$V_{BG} = \sqrt{12^2 + 6^2 + 2 \times 12 \times 6 \cos 120}$~~

ازا كان القارب ع بيحر 30° من اتجاه نحو الغرب اذن هو عم يقطع منطقة شمال غرب و عم يروح حيرة كأن التيار

44



لأنه 90°

طالب أكل وقت أطول

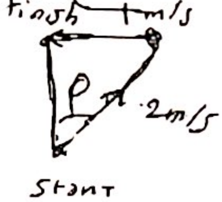
حتى يقدر يوصل

أسرع شي عنه

وعشان طالب طول الخانة

90° طالع

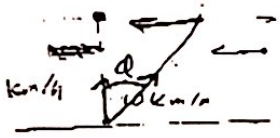
45



$\sin\phi = \frac{1}{2}$

$\phi = 30°$

46



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

$\theta = 30^\circ$

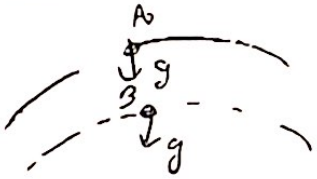
من بالرسم

W of N

E of N

B

47



$a_{AB} = a_{AO} - a_{BO}$

$= g - g = 0$

تم بحمد الله

وأخيراً تحيات

إعداد: وئام معاويه

Chapter 5

[1] [B]
لانه اذا لا يوجد قوه تأثر على الجسم
$F = \Sigma ma$
اذن $a = 0$
وعليه اما يكون ساكن ويظل ساكن او ويتحرك بسرعه ثابته ويظل نفس الاشي
وهذا تعريف القصور الذاتي

[2]
نفس الفكره
ح 2 ذ
D
$F_{net} = 0$

[3]
$F_{a} = ma$
so [D]

[4] [A] mass

[5] [D] $F = kg\frac{m^2}{s^2}$

[6] ↗ و [7] نفس الفكره

[8] $F = ma$
$F = 5.6 \times 1$
$= 5.6\ m/s^2$

[9] [D] net force
$F_{net} = ma$
ثابته وموجبه
اذن $F\ a$ same direction

[10] [B] الاشيه
لانه الاشيه فساسيا لا الكتلة
القصور الذاتي Inertia لانها
عبارة تغير حركة الجسم
فاذا اثرنا على جسم بقوه
$F = ma$
m كل ما زادت
لازم نزيد القوه
عشان نحركه او نغير
من اتجاهه.

[11] [C]
يلغي
اي يكون
كان ساكن او متحرك
وبالعكس

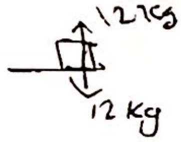
[12] [C] لانها
مع الطائره
قصور سرعتها
بحيث انه لو اطلقه
القوه رح يتأثر بس
الخط التحتاني بدون
مابتأثر الطالب

[13]
$1kg \rightarrow 5\ m/s^2$
$?? \rightarrow 1\ m/s^2$
$F_a = F_B$
$m_a a_a = m_B a_B$

[14] [B]
$W = mg$
يعني $F = ma$

[15]
الكتله نفسها
وبين بالرحله
وهي اسمه [C]
في freefall

[16]
$W = 9.8\ m$
$\frac{W}{m} = 9.8$
وهذا يعني
[E]
الصح
لانها نسبه ثابته
جسم صغير حجم يزيد الطاقه

[17]

scale $W = 120\ N$
$m = \frac{W}{g} = \frac{120}{10}$
$m = 12\ kg$
$W = mg$
$= 12 \times \frac{1}{6}$
$= 2$

(18) $m_1 < 3m_2$

$v = gt + v_0$

يعني ما بتفرق الكتلة

(19) $a = \frac{F}{m} = \frac{ma}{m}$

$a = \frac{g}{6}$ $a = \frac{1}{6}g$

(B) the same

(20) $a = 0$

$F = ma$

$F = 0$

$5 - 3 - f = 0$

$f = 5 - 3$

$f = 2N$

left word

(B)

(21) (A)

$5 - 3 = 2$

اما بالعكس

22 1- $N = mg$

2- $N + 10\sin\theta = mg$

3- $N + 10 = mg$

$3 < 2 < 1$

(23) $N_i = mg$

$N_{ii} = mg\cos 20$

(C) (less)

(24) $m_B = 3m_A$

$F_B = F_A$

$m_B a_B = m_A a_A$

$3 m_A a_B = m_A a_A$

$3a_B = a_A$

(A)

(25) zero

$a = 0$

$F_{net} \to a$

بنفس الاتجاه

(26) $F = 8N$

4s

16kg

$\left(\frac{F}{m}\right) a = \frac{\Delta v}{\Delta t}$

$(4s)\frac{8}{16} = \Delta v$

$\Delta v = 2$ m/s

(B)

$\Delta v = 0.5$

in this case

(27) ↑12N

(A) $a = \frac{F}{m}$

$= 2$ m/s²

North

(28) $W = 9000N$

$F = 500N$

$F = ma$

$a = \frac{F}{m}$

$= \frac{500}{900}$

$= .55$ (B)

(29) always

$F = ma$

$F_{app} - 0 = ma$

أزلنا

(30) 25kg

$F = 20N$ 20°

$a = \frac{F\cos 20}{m} = \frac{20}{25} = \frac{4}{5}$

$= .75$ m/s

(31) $W = 1.5N$

30°

$v_0 = 12$ m/s

$F = mg = 1.5N$

(32) 5kg

↑ 8N

$F_{net} = \sqrt{8^2 + 6^2}$

$= 10N$

ما انه مش محدد الاتجاه

ازنا ما ما ضيق الزاوية

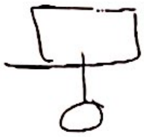
نسبه هو

(33)

$T = 400\,N$

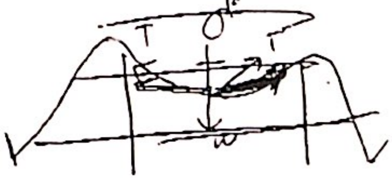
$T = mg = w = 400$

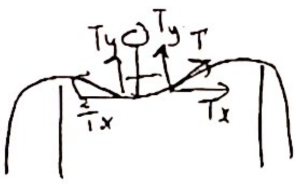
(34) $A = \text{zero}$



لانو
اشي عم ينزل
بسرعة ثابتة

(35)





معادلة لانو ال T

component y و x

كشف ألف

$T_y = mg$

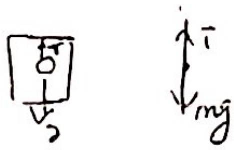
دايما ال x بتلغي
component تلغي هيك
بتكون اكبر من w

(36) 1000 kg

$a = 3\,m/s^2$

$f_{net} = ma$

37



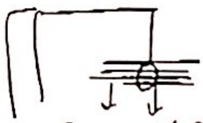
$T = ma + mg$

$T = m(a+g)$

$= m(-3+9.8)$

$= 34\,N$

(38)



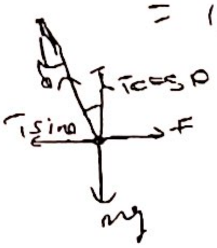
$T - mg = -ma$

$T = mg - ma$

$T = 16000(9.8-3)$

$= 11000\,N$

(39)



$T^2 \cos^2\theta = mg^2$

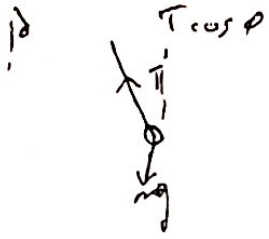
① $T^2\cos^2\theta = 1$

\+

$T \sin\theta =$ ② $T^2\sin^2\theta = 4$

①+② ... $T^2 = 5$

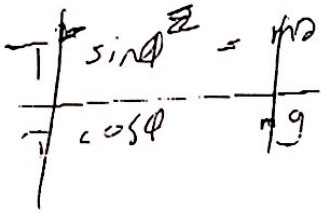
40



$F_{net} = ma$

$T\sin\theta = ma$

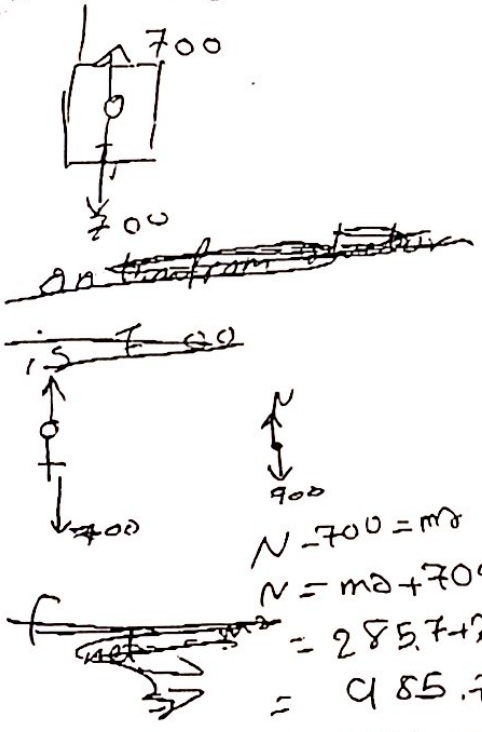
$T\cos\theta = mg$



$\tan\theta = 0.306$

$\theta = 17°$

41 $a = 4\ m/s^2$



$N - 700 = ma$

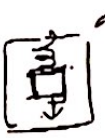
$N = ma + 700$

$= 285.7 + 700$

$= 985.7$

$\approx 990\ N$

42



(A) $T = m(g+a)$

(B) $T = m(g-a)$

(C) $T = mg$

(D) $T = m(g-a)$

(E) $T = mg$

43

(A) $N = m(g-a)$

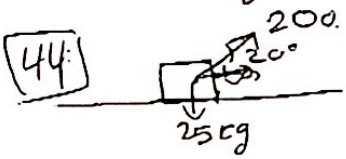
(B) $N = m(g+a)$

(C) $N = mg$

(D) $N = m(g-a)$

(E) $N = mg$

44



$N = mg + 200\sin 20$

$= 245 + 68.4$

$= 313$

$\approx 310\ N$

45

$kmg\sin\theta = km a$

$a = 4.9\ m/s^2$

$490\ cm/s^2$

46

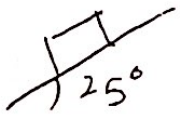
$N = mg\cos\varphi$

$= 25\cos 25$

$= 22.6$

$= 23N$

47



$F - mg\sin\theta = 0$

$F = mg\sin\theta$

$= 25\sin 25$

$= 10.5\ N$

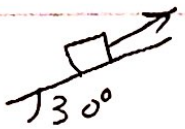
$\approx 11\ N$

48

$N = mg\cos$

$= 23N$

49



$F - mg\sin\theta = ma$

$32 - 4.9m = 0$

$4.9m = 32$

$= 6.5\,kg$

50

$mg\sin\theta - f = ma$

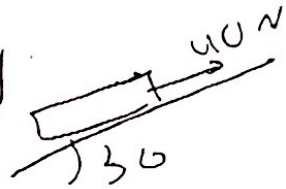
$4.9m - 40 = 2m$

$2.9m = 40$

$m = 13.79$

E

51



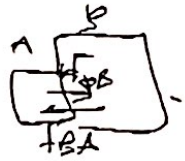
$F - mg\sin\theta = ma$

$40 - 4.9m = 2m$

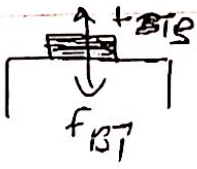
$40 = 6.9m$

$m = \frac{40}{6.9}\,kg$

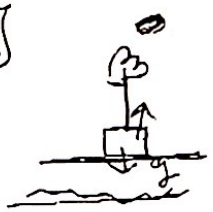
52 B



53



54



The block on Earth

55

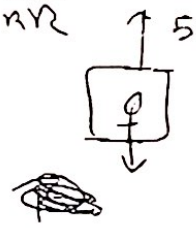
$F - mg = ma$

$f = mg - ma$

$F_{RB} = 35\,N$ up

$f_{BR} = 35\,N$ down

56



$F = mg$

$= 90 \times 9.8$

$= 880\,N$

57

$F - mg = ma$

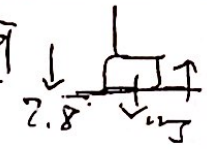
$F = m(g + a)$

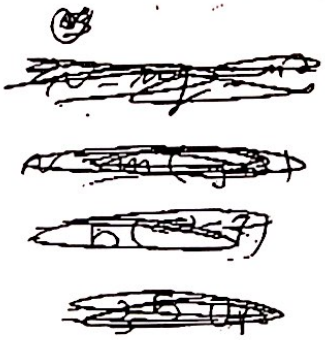
$F = 90(10 + 1.4)$

$= 774$

$\approx 760\,N$

58



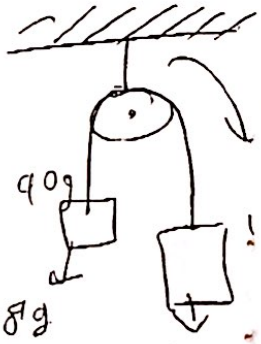


$F_{BG} = mg$

$= 49\,N$

$f_{G-B} = 49\,N$

59



$1,07 - T = 110$

$+$

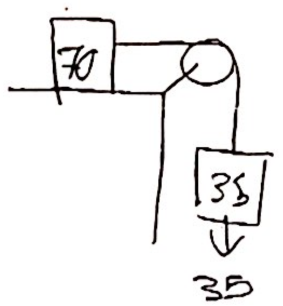
$T - 882 = 98$

$1,07 - 882 = 188$

$a = 1.03$

$\approx 0.98\,m$

60



35 − T = 3.6 a

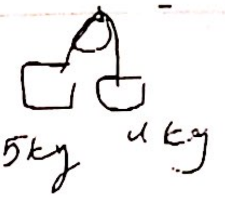
T = 7.14 a

35 − 7.14 a = 3.6 a

35 = 10.7 a

a = 3.25 m/s²
= 3.3

62



5g − T = 5a

T − 4g = 4a

1g = 9a

a = g/9

(C) ←

63

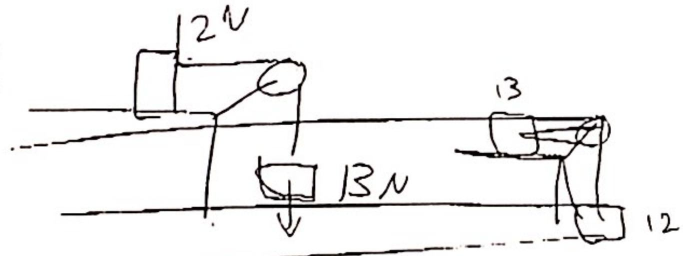
350 − T = 35 a
T − 250 = 25 a

100 = 60 a

a = 1.66 m/s²

T = 41.7 + 250
= 290 N

61



13 − T = 1.3 a

~~T = 1.2 a~~

~~12 − T = 1.2 a~~

~~12 − 1.3 a = 1.2 a~~

~~13 − 1.2 a = 1.3 a~~

~~a = 2.5 a~~

~~4.8~~

~~a = 2.5 2~~

(A) but for free falling body

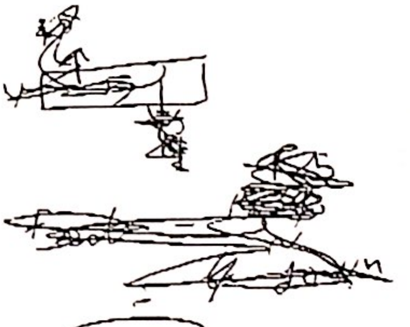
a = 2 kg
= 9.8

13 − T = 1.3 a
T = 1.2 a

a = 1/25 = .04

.04/9.8 ≈ 1/25

64



zero

لانو لو كان
الى f ع
يكون الوسارع
ز كان ع تحرك
لسبا هو ثابتة

65

9 = X, Y ...

66

$F - T_1 = Ma$

$T_1 - T_2 = Ma$

$T_2 = Ma$

$F = 3Ma$

$F_{net_B} = Ma$

$= \frac{F}{3}$

B

67

$F - f_{Mm} = Ma$

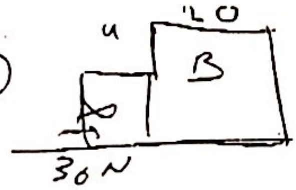
$f_{Mm} = ma$

$F = (M+m)a$

$f_{Mm} = ma$

$f_{Mm} = \frac{mF}{(m+M)}$

68



$F - f_{AB} = ma$

$f_{AB} = Ma$

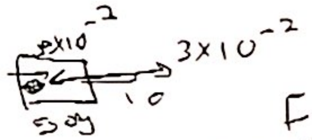
$F = (m+M)a$

$36 = 24a$

$a = 1.5\ m/s^2$

$F_{AB} = 1.5 \times 20 = 30\ N$

69



$F = M_T a$

$3\times10^{-2} = 50a$

$a = .6$

$F - f_{ST} = ma$

$f_{ST} = F - ma$

$= 3\times10^{-2} - m_S a$

$= M_T a - m_S a$

$= (50a - 10a)$

$.03 - .006$

$= 0.024$

$= 2.4\times10^{-2}$

$= 2.5\times10^{-2}\ N$

Chapter 6

اعداد: محمد الهدلق

(1) $f_s = M_s N = M_s mg$

بتاثير زيادة الكتلة يؤدي الى زيادة f_s

(2) M_K :

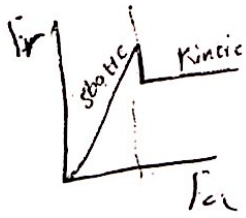
① ليس له وحدة

② ليس له اتجاه

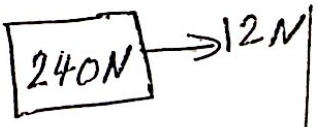
(3)

The greatest retarding force $= f_{s\,max}$

وذلك قبل بدء الانزلاق



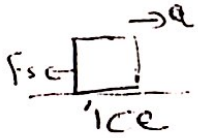
(4)



$f = M_K N$

$M_K = \frac{f}{N} = \frac{12}{240} = 0.05$

(5)



$f_s = ma$

$\mu_K N = ma$

$\mu_K mg = ma$

$\mu_K = \frac{a}{g} = \frac{0.16}{9.8} = 0.0622$

(6) $f_s = 10N$

في الحالة الاولى:

$f_s = (10N)\cos 0$

في الحالة الثانية:

$f_s = 2e.6$

في الحالة الثالثة:

$1 > 2 > 3$

(7)

$F = M_s N = M_s(mg - F')$

$= (0.4)(50 - F')$

$F' = 50 - 25 = 25.1$

(8) اذا كانت $F > f_{s\,max}$ تكون

$f_s = \mu_K N$

اما اذا كانت $F < f_{s\,max}$ تكون

$f_s = F$

$f_{s\,max} = M_s N = (0.5)(40) = 20N$

$f_{s\,max} > F$

تبالي

$f_s = f = 12\,N$

(9) (نفس فكرة السؤال 8)

$f_{s\,max} = M_s N = (0.5)(40) = 20\,N$

$F > f_{s\,max}$

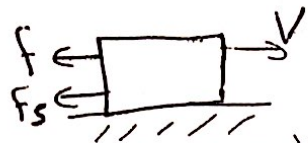
$f_s = \mu_K N = (0.4)(40) = 16\,N$

(10) $f_{s\,max} = 200N$

$M_s N = 200$

$M_s = \frac{200}{N} = \frac{200}{800} = 0.25$

(11) $f > f_{smax}$ (معطيات)



بما ان القوة اثرت باتجاه يعاكس اتجاه الحركة بتالي سرعة الجسم سوف تقل حتى تصبح صفر ثم تزداد بعد ذلك

(12) $F = f_{s\,max} = \mu_s N = 0.5mg$

$f - f_K = ma$

$0.5mg - 0.4mg = ma$

$a = 0.1g = (0.1)(9.8)$

$a = 0.98$

(13) $v_f = v_i + at$

$0 = 15 + a(4)$

$a = -\frac{15}{4} = -3.75\ m/s^2$

$F_K = \mu_K N = \mu_K mg$

لحظات توقف الجلد عن الدوران

$f_K = ma$

$\mu_K mg = ma$

$\mu_K = \frac{a}{g} = \frac{3.75}{9.8} = 0.3826$

(14) بما ان السرعة ثابتة بتالي المتزايج ليس هناك صفر

$P - F = ma = 0$

$\boxed{P = F}$

$N - F_g = 0$

$\boxed{N = F_g}$

(15) $P\cos\theta - f = ma = 0$

$P\cos\theta = f$

$-1 < \cos\theta < 1$ بما ان بتالي

$\boxed{P > F}$

$P\sin\theta + N - F_g = 0$

$N = F_g - P\sin\theta$

$N < F_g$

(16) بما ان الجسم يتحرك بسرعة ثابتة

$f\cos\theta - f_K = ma = 0$

$f\cos\theta = F_K$

$f\cos\theta = \mu_K N = \mu_K(mg - f\sin\theta)$

$(0.8)f = (0.4)(400 - (0.6)f)$

$(0.8)f = 160 - (0.6)(f)(0.4)$

$(0.8)f + (0.24)f = 160$

$(1.04)f = 160$

$f = \frac{160}{1.04} = 153.8 = 150\ N$

(17) بما ان الجسم يتحرك بسرعة ثابتة

$T\cos\theta - f_K = ma = 0$

$F_K = T\cos\theta$

(18) $T\sin\theta + N - mg = 0$

$T\sin\theta = mg - N$

$N = mg - T\sin\theta$ المطلوب

(N) (المركبة العمودية للقوة التي تؤثر على الارض عكس اتجاه الوزن)

(19) اقل قوة تكون لتحريك الجسم عندما

$F\cos\theta = f_{s\,max}$

$F\cos\theta = \mu_s N = \mu_s(mg + F\sin\theta)$

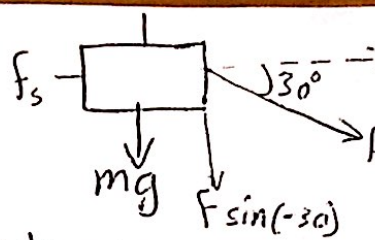
$F\cos(30) = (0.4)((12)(9.8) + (0.5)F)$

$F = \frac{47.04}{\cos 30} = 54.317\ N = 54$

$F\cos 30 = 47.04 + (0.5)F$

$F\cos(30) - (0.5)F = 47.04$

$F = \frac{47.04}{\cos 30 - \sin 30} =$



اقل قوة تلزم لتحريك الجسم عندما تكون

$F\cos(-30) = f_{smax} = \mu_s N = \mu_s(mg + F\sin(-30))$

$F\cos(30) = (0.4)((12)(9.8) + (-0.5)F)$

$F\cos 30 = 47.04 + (0.5F)(0.4)$

$F = \frac{47.04}{\cos(30) + \sin(30)} = \frac{47.04}{0.366}$

$F\cos 30 - 0.2F = 47.04$

$F = \frac{47.04}{\cos 30 - 0.2} = 70.627\ N$

(20) $\tan\theta = \mu_s$

$\theta = \tan^{-1}(0.4)$

$= 22^\circ$

(21) $\tan\theta = \mu_s$

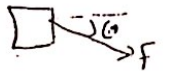
$\theta = \tan^{-1}(0.5)$

$\theta = 26.6 \approx 27^\circ$

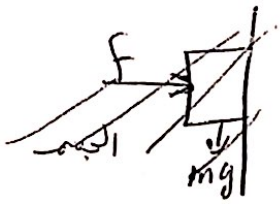
عند هذه الزاوية تكون القوة
و بتالي اكبر تتارع

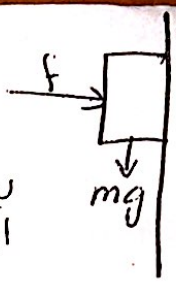
(22) تزداد قوة الاحتكاك عند سحب الجسم بقوة تصنع زاوية تحت الاتجاه الافقي نتيجة زيادة N

$f_s = \mu_s N$



(23)





يتحرك الجسم للاسفل
اذا كانت

$mg > f_{smax}$

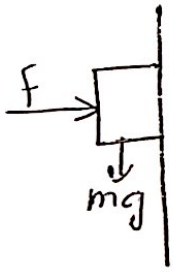
$f_{smax} = \mu_s N = \mu_s f$
$= (0.6)(12)$
$= 7.2$

$f_{smax} > mg$

بتالي:

$f_s = mg$
$= (0.5)(9.8) = 4.9$

(24)



نبحث اذا كان الجسم تحرك
للاسفل ام لا

$mg = (0.5)(9.8) = 4.9\ N$

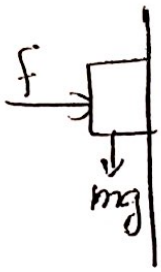
$f_{smax} = \mu_s f = (0.6)(5) = 3N$

$mg > f_{smax}$

بتالي تحرك الجسم للاسفل

$F_s = \mu_K N = \mu_K f = (0.8)(5) = 4N$

(25) نبحث اذا كان الجسم قد تحرك ام لا



$mg = (0.5)(9.8) = 4.9$

$f_{smax} = \mu_s f = (0.6)(12) = 7.2$

$f_{smax} > mg$

و بتالي الجسم لم يتحرك
التتارع يساوي صفر

(26)

$mg = 4.9$

$f_{smax} = (0.6)(5) = 3$

$mg > f_{smax}$

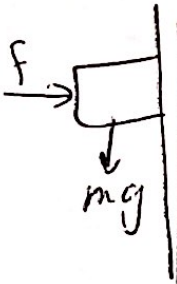
بتالي الجسم تحرك للاسفل

$mg - f_K = ma$

$mg - \mu_K f = ma$

$4.9 - (0.8)(5) = (0.5)a$

$a = \frac{0.9}{0.5} = 1.8$



(27) في الحالة الاولى

$F_1 = f_{s_1} + ma$

في الحالة الثانية

$F_2 = f_{s_2} + mg\sin\theta + ma$

بما ان:

$F_1 = F_2$

$f_{s_1} + ma = f_{s_2} + mg\sin\theta + ma$

$f_{s_1} = f_{s_2} + mg\sin\theta$

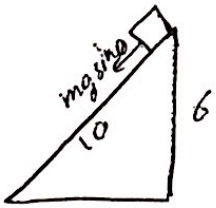
بما ان

$mg\sin\theta > 0$

بتالي

$f_{s_1} > f_{s_2}$

(28)



$mg\sin\theta = f_s = \mu_s N$

$mg\sin\theta = \mu_s (mg\cos\theta)$

$\mu_s = \tan\theta$

$\mu_s = \tan(37^\circ) = 0.75$

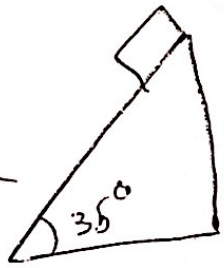
(30)

$mg\sin\theta - f_K = 0$

$mg\sin\theta = (\mu_K)(mg\cos\theta)$

$\mu_K = \tan\theta = 0.577$

(31)



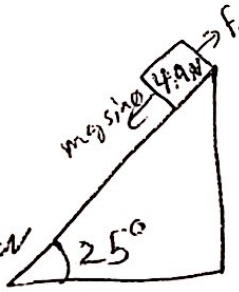
$mg\sin\theta - f_K = ma$

$mg\sin\theta - \mu_K(mg\cos\theta) = ma$

$g\sin 35 - (0.4)(g)(\cos 35) = a$

$a = 2.409$

(32)



نبحث اذا تحرك الجسم للاسفل ام لا

$mg\sin\theta = (49)(\sin 25) = 20.7N$

$f_{s\,max} = \mu_s N = \mu_s mg\cos\theta = ((0.5)(44.4)$

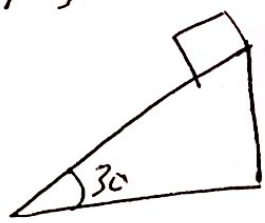
$f_{s\,max} = 22.2$

$f_{s\,max} > mg\sin\theta$

بتالي الجسم لا يتحرك

$f_s = mg\sin\theta = 20.7 < 22$

(33)



نبحث اذا تحرك الجسم للاسفل ام لا

$mg\sin\theta = 24.5N$

$f_{s\,max} = (0.5)(49)(\cos 30) = 21.2$

$mg\sin\theta > f_{s\,max}$

بتالي الجسم تحرك للاسفل

$f_K = \mu_K N = (0.4)(49)(\cos 30)$

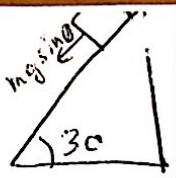
$= 17N$

$mg\sin\theta = 24.5\ N$

$f_{s\max} = 21.2\ N$

$mg\sin\theta > f_{s\max}$

بما ان الجسم يتحرك للاسفل
ولكي يثبت الجسم يجب ان
تؤثر القوة باتجاه يعاكس لاتجاه
$mg\sin\theta$



$mg\sin\theta - F - f_s = ma = 0$

$= mg\sin\theta - \mu_s(mg\cos\theta)$

$= 24.5 - 21.2$

$F = 3.3\ N$

(35) $mg\sin\theta = 24.5\ N$

$f_{s\max} = 21.2$

$mg\sin\theta + f_s - F = ma = 0$

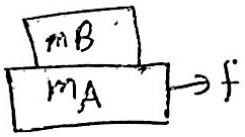
$F = mg\sin\theta + f_{s\max}$

$= 24.5 + 21.2$

$= 46\ N$

وضعنا f_s باتجاه $mg\sin\theta$ لان اي زيادة
في قليلة في f سوف تؤدي الى حركة
الجسم للاعلى وبالتالي يكون f_s معاكسا
باتجاه معاكس لـ f

(36)



ملاحظة: اذا كانت

$F \leq f_{s\max}$ بين A و B

ينفصل الجسمان

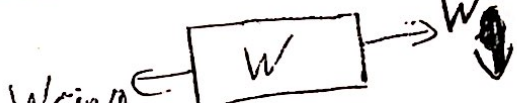
اما اذا كانت

$F > f_{s\max}$

ينفصل الجسمان

$f_{s\max} = \mu_s N = \mu_s((m_A + m_B)g)$

(37)



$W\sin\theta$

بما ان الغلاح ساكن

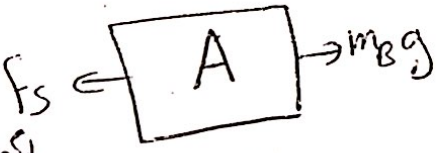
$W\sin\theta + f_s - W = 0$

$f_s = W - W\sin 37$

$= 20 - 20\left(\frac{3}{5}\right)$

$f_s = 8\ N$

(38)



لكون الجسم على وشك ان
يتحرك فان

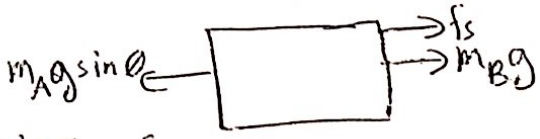
$m_B g = f_{s\max}$

$f_{s\max} = \mu_s N = (0.4)(490) = 196$

$m_B g = f_{s\max} = 196$

$m_B = \frac{196}{9.8} = 20\ kg$

(39)



$m_A g\sin\theta - f_s - m_B g = 0$

$m_B = \frac{m_A g\sin\theta - f_s}{g} = \frac{m_A g\sin\theta - \mu_s mg\cos\theta}{g}$

$m_B = (10)(\sin 35) - (0.4)(10)(\cos 35)$

$m_B = 5.735 - 3.276$

$m_B = 2.458 \rightarrow 2.5$

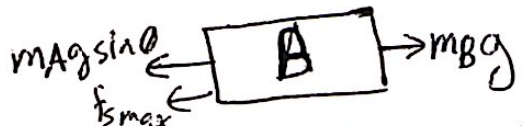
(40)

$m_B g = m_A g \sin\theta + f_s = m_A g \sin\theta + \mu_K (m_A g \cos\theta)$

$m_B g = (10)(9.8)(\sin 35) + (0.4)((10)(9.8)(\cos 35)) = 88.32$

$m_B = \frac{88.32}{9.8} = 9.01$ Kg

(41)



$m_A g \sin\theta = 49\,N$ ← $m_A g \sin\theta$ اكبر من $m_B g$ لهذا ان بالتالي تكون الحركة باتجاه

$m_B g = 78.4$ ← $m_B g$ والاتجاه باتجاه عكس

$f_K = \mu_K N = (0.2)(mg\cos 30)$

$f_K = (0.2)(98)(\cos 30) = 16.7\,N$

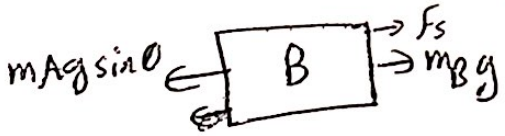
$m_B g - m_A g \sin\theta - f_K = m_{(A+B)} a$

$12.7 = (18)a$

$a = 0.69$ باتجاه $m_B g$

(42) $m_A g \sin\theta = 49$ ← $m_A g \sin\theta$ اكبر من $m_B g$ لهذا ان بالتالي تكون الحركة باتجاه $m_A g \sin\theta$ وتكون f_s باتجاه $m_B g$

$m_B g = 29.4$



$m_A g \sin\theta - m_B g - f_K = m_{(B)} a$

$49 - 29.4 - 16.7 = (13)a$

$a = 20$

$m_A g \sin\theta$ باتجاه

up

(43) $\sum f = ma$

بما ان السرعة ثابتة بالتالي التسارع يساوي صفر وعليه F_{net} تساوي صفر

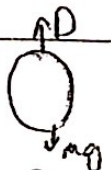
(44)

لان مقاومة الهواء لسقوط المطر تصل إلى قيمتها العظمى عندما تصبح تساوي (mg) ولا يمكن ان تزيد عن هذا المقدار.

(45) بما ان سرعته البدائية تساوي ثلاث اضعاف V_T بالتالي فان السرعة سوف تقل حتى تصبح تساوي V_T ومن ثم تثبت وبما ان السرعة تقل بالتالي التسارع سالب حيث يكون اتجاهه للأعلى وبما ان اتجاه التسارع للأعلى

$a > g$

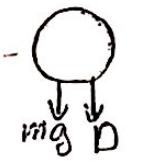
(46) (حالة) $V < V_T$ (اعلى ارتفاع)



$mg = D \Leftarrow V = V_T$

$mg > D$

$V > V_T$



(44) $a = \frac{V}{R}$

بما ان السرعة ثابت وكذلك نصف قطر الدائرة ثابت فان الجسم يتحرك بتسارع ثابت

(49) D=0

mg

mg = D
V = V_T

mg D

D

mg

V < V_T
mg > D

V > V_T
mg

mg D

V = V_T
mg = D

(50) $a = \frac{V^2}{r}$

لا تعتمد على كتلة الجسم

(51) $F = \frac{m v^2}{R}$

$F = \frac{(0.04)(0.6)^2}{1}$

$F = 0.0144\ N$

(52) $T = \frac{mv^2}{r}$

$V = 150\ rev/minute = \frac{150(2\pi r)}{60}$ m/s

$V = 9.42$

$T = \frac{(0.2)(9.42)^2}{0.6} = 30\ N$

(53) $a = \frac{V^2}{r}$

بما ان السرعة ثابتة بتالي فان زيادة r تؤدي الى نقصان قيمة التسارع.

a

r

(54) $T_1 = \frac{mV^2}{r}$

$T_2 = \frac{mV^2}{2r} = \frac{1}{2}\frac{mV^2}{r} = \frac{1}{2}T_1$

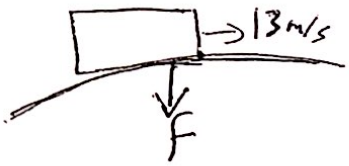
$T_2 = \frac{1}{2}T_1$

(55) $T_1 = \frac{mV^2}{r}$

$T_2 = \frac{(3m)(\frac{1}{2}V)^2}{r} = (3)(\frac{1}{4})\frac{mV^2}{r} = \frac{3}{4}T_1$

(56) التسارع في اطار الدائري يكون دائما باتجاه المركز

(57)



لكي يفتح باب السيارة يجب ان تكون F = 800N وعندما كان السيارة تتحرك بسرعة 13m/s

$F = \frac{mV^2}{R}$

$200 = \frac{(\frac{800}{10})(13)^2}{R} \Rightarrow R = 67.6$

لكي يفتح الباب يجب ان تكون F تساوي 800N

$800 = \frac{(80)(V^2)}{67.6} \Rightarrow V = \sqrt{676} = 26$

(58) $f = \frac{mv^2}{r}$

$r_1 = \frac{mv^2}{F}$

$r_2 = \frac{m(2v)^2}{f} = 4\frac{mv^2}{f}$

$r_2 = 4r_1$

(59) $f_s = \mu_s N = \frac{mv^2}{r}$

$(0.5)mg = \frac{mv^2}{30}$

$v^2 = 147$

$v = 12\ m/s$

(60) $f_s = \frac{m v_{max}^2}{R}$

$v_{max}^2 = \frac{(f_s)(R)}{m} = \frac{(900)(1000)}{1000} = 90$

$v_{max} = \sqrt{90} = 9.48\ m/s$

تبقى السيارة تتحرك على الطريق طالما سرعتها اقل او تساوي v_{max} وطالما السيارة دخلت الطريق بسرعة اكبر من 9 وهي 10 بتالي تخرج السيارة من الطريق

(61) $a = \frac{v^2}{R}$

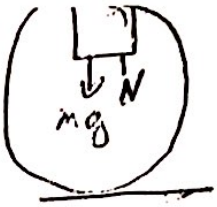
$a = \frac{(18)^2}{75} = 4.32\ m/s^2$

$\tan\theta = \frac{a}{g} = \frac{4.32}{9.8}$

$\theta = \tan^{-1}\left(\frac{4.32}{9.8}\right)$

$\theta = 23.788 \approx 24^\circ$

(62)



$\Sigma f = mg + N$

وعندما ان

$0 = mg$

$\Sigma f = 2mg$

(63) من السؤال السابق

$\Sigma f_{net} = 2mg = ma$

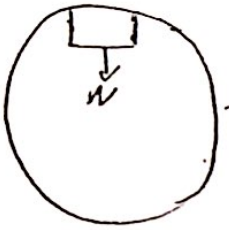
$a = (2)(9.8) = 19.6\ m/s^2$

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

$V^2 = (a)(R) = (19.6)(20) = 392$

$V = 19.8 \approx 20$

(64)

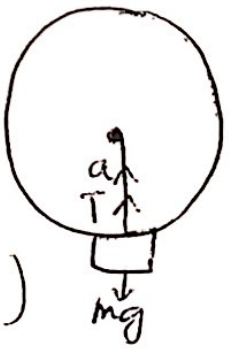


$f_g = N = mg$

$f_b = 0$ ← تبقى محفوظة طالما الدولاب يدور

$f_s = 0$

(65)



$T - mg = ma$

$T = mg + ma$

$= (2)(9.8) + (12)\left(\frac{v^2}{R}\right)$

$= 19.6 + 2\left(\frac{16}{1}\right)$

$= 19.6 + 32$

$= 51.6 \simeq 52.1$

(66)

$T + mg = ma$

$T = m\left(\frac{v^2}{R}\right) - mg$

$= 32 - 19.6$

$= 12.4 = 12\,N$

(67)

$N = mg = \text{constant}$

$f_{s\,max} = \mu_s N$

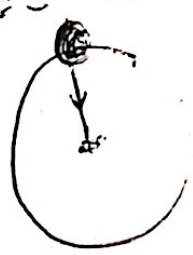
بما ان N ثابتة اذن

$f_{s\,max}$ = ثابت

$f_s = ma = \frac{mv^2}{R}$

بما ان f تزيد حتى تصبح تساوي $f_{s\,max}$ وأي زيادة بعدها تؤدي إلى انزلاق العملة

(68)



$T = mg$

$\frac{mv^2}{R} = mg$

$v^2 = (0.7)(9.8)$

$v^2 = 6.86$

$v = 2.61\ m/s$

(69)

$a = \frac{V}{R} = \frac{(22)^2}{45} = 10.755$

$\tan\theta = \frac{a}{g}$

$= \frac{10.755}{9.8}$

$\theta = 47.66$

(70)

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

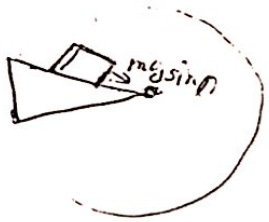
$R = \frac{v^2}{a}$

بما ان السرعة زادت إلى ~~الضعف~~ بما ان $2V$

$(2V)^2 = 4V^2$

بما ان R تزداد اربع اضعاف

(71)



$mg\sin\theta = ma$

$mg\sin\theta = \frac{mv^2}{R}$

$\theta = \sin^{-1}\frac{v^2}{(g)(R)}$

$\theta = 17^\circ$

erg ، الارغ وحدة قياس الطاقة ✓
وحدتها $W = \Delta K.E$

ft lb قدم رطل ✓

Watt وحدة قياس القدرة X

$J.m \Rightarrow W = F.d = N.m$

$Joule \Rightarrow W = \Delta K.E = J$

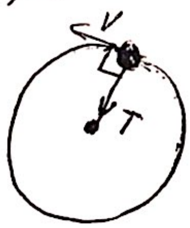
1) (scalar quantity)
power / speed
energy / / distance
time

vector quantity)
velocity / force / displacement
acceleration / force /
weight

3) $W = \vec{F} \cdot \vec{d}$
بما ان الازاحة تساوي صفر
بالتالي الشغل يساوي صفر

4) في الحالة الاولى
$W = F.d = (10)(10) = 100$
في الحالة الثانية
$W = (F\cos\theta)(10) < 100$
في الحالة الثالثة
$W = (F)(d)(\cos 90) = 0$
$1 > 2 > 3$

5)



الشغل القوة المركزية يساوي صفر
لان الزاوية بين (V) و (T)
دائما تساوي $90°$ وبالتالي
$\cos 90 = 0$
$W = 0$

6) $W = 0$ (نفس فكرة سؤال 5)

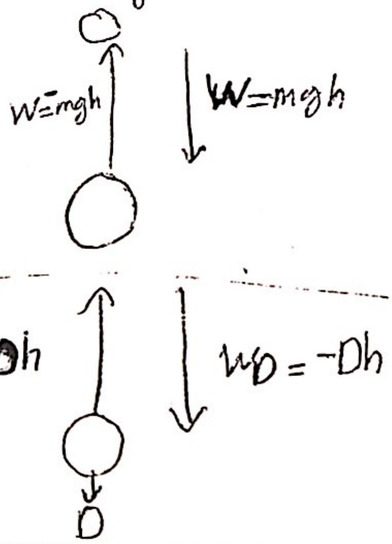
7) $W_{mg} = \Delta K$
V_f دائماً موجبة لان
اكبر من V_i

8) $W = mgh$
بما ان V_i اكبر من V_f
تكون ΔK سالبة

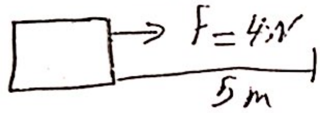
إعداد
محمد
العدله

9) $W_{mg} = mgh - mgh = 0$

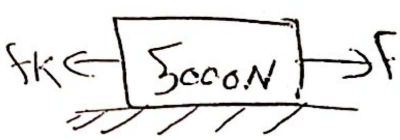
$W_D = -Dh - Dh = -2Dh$



10) $W_F = F.d = (4)(5) = 20 J$



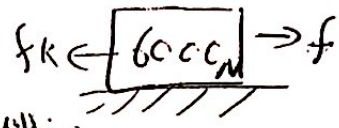
11)
بما ان السرعة ثابتة بالتالي
التسارع يساوي صفر



$F - f_K = ma = 0$
$F = f_K = \mu_K N = (0.05)(5000) = 250 N$

$W_F = F.d = (250)(1000) = 2.5 \times 10^5 J$

(12)

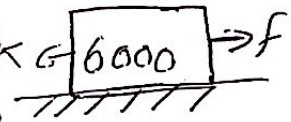


بما ان السرعة ثابتة

$f = f_K = \mu_K N = (0.05)(6000) = 300$

$W_f = f \cdot d = (300)(1000) = 3 \times 10^5$

(13)



$a = 0.2 m/s^2$

$f - f_K = ma$

$F = f_K + ma = 300 + \left(\frac{6000}{10}\right)(0.2)$

$f = 420 N$

$W_f = f \cdot d = (420)(1000) = 4.2 \times 10^5$

(14) $F_b = mg = (1)(10) = 10 N$

$W_b = f \cdot d = (10)(1) = 10 J$

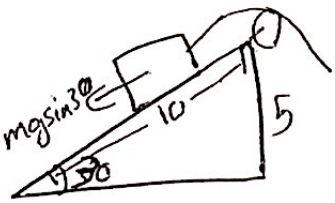
(15)

$d = circumference = 2r\pi = 15.7 m$

$W_f = f \cdot d = Fd\cos\theta$

$= (3)(15.7) = 47.1$

(16)



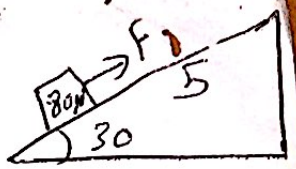
بما ان السرعة ثابتة
بتاثير الشارع
بساوي صفر

$f_m - mg\sin 30 = 0$

$f_m = mg\sin 30 = (100)(0.5) = 50 N$

$W_m = f_m \cdot d = (50)(100) = 5000 J$

(17) $a = 1.5 m/s^2$



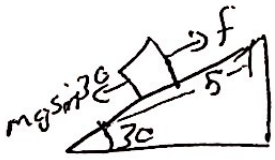
$F - mg\sin 30 = ma$

$F = mg\sin 30 + ma = (80)(0.5) + \left(\frac{80}{10}\right)(1.5)$

$f = 28 N$

$W_f = f \cdot d = (28)(5) = 140 J$

(18)

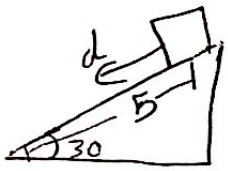


$F - mg\sin 30 = 0$

$F = (80)(0.5) = 40 N$

$W_F = (40)(5) = 200 J$

(19)



$W_{mg} = mg \cdot d$

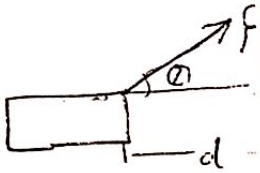
$= (mg)(d)(\cos 90 + \theta)$

$= (mg)(d)(\sin 30)$

$= (80)(5)(0.5)$

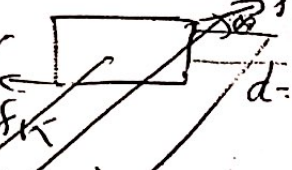
$= 200 J$

(20) $W = fd\cos\theta$



(21)

اقل شغل يلزم لكي يتحرك الجسم
عند اقل قوة تؤثر عليه
وهذا يكون



$f_K = \mu_K N = \mu_K (mg + f\sin\theta)$

اي عندما يكون المقدار

$f\sin\theta = 0$

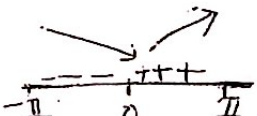
$\sin\theta = 0$

$\theta = 0$

$W_F = Fd\cos\theta$

$dW = Fd\sin\theta = 0$

$\theta = 0$



نشغل مركبة القوة على y-axis وعلى z-axis يساوي صفر لأن الزاوية في تلك الحالة تكون 90 بين F و d
ونتيجة لذلك يكون شغل F

$W_F = F_x \cdot d = (4)(5)(1) = 20\ J$

23) $W_s = \frac{1}{2}K(x_i^2 - x_f^2)$

يكون W_s موجب اذا كان

$x_i^2 > x_f^2$

24) $F = -K\Delta x$

في الحالة الاولى

$00 = -K(40 - x_0)$ — (1)

الحالة الثانية

$200 = -K(60 - x_0)$ — (2)

بحل (1) و (2) من خلال طرح

~~$100 = 4K$~~

~~$00 = 40K - Kx_0 + 6K - Kx_0$~~

$-100 = K(60 - x_0) - K(40 - x_0)$

$100 = 60K - Kx_0 - 40K + Kx_0$

$100 = 20K$

$K = 5$

بتعويض في (1)

$100 = 5(40 - x_0)$

$x_0 = 20$

في الحالة الثالثة

$W_{ext} = K(30 - x_0)$

$= 5(30 - 20)$

$= 50$

$F = K\Delta x$

$-mg = -Kx$

في الحالة الأولى

$(4)(10) = K(3\ cm)$

$K = \frac{40}{3}\ N/cm$

في الحالة الثانية

$60 = \left(\frac{40}{3}\right)(\Delta x)$

$\Delta x = 4.5\ cm$

وبما انه يوجد زنبرك y وزنبرك z فان كل منهما يتمدد بمقدار 4.5cm

$\Delta x = 4.5 + 4.5 = 9\ cm$

26) $W = \int f\,dx = \int_0^L Ax\,dx$

$W = \frac{Ax^2}{2}\Big|_0^L = \frac{AL^2}{2} - 0 = \frac{AL^2}{2}$

27) $W = \int f\,dx = \int_0^L ax + bx^2$

$= \frac{ax^2}{2} + \frac{bx^3}{3}\Big|_0^L = \frac{aL^2}{2} + \frac{bL^3}{3}$

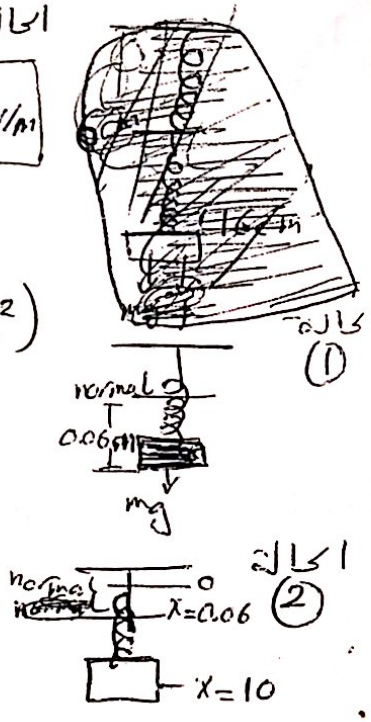
28) $mg = K\Delta x$

$20 = K(0.06) \Rightarrow K = \frac{20}{0.06}\ N/m$

$W = \frac{1}{2}K(x_i^2 - x_f^2)$

$= \frac{1}{2}\left(\frac{20}{0.06}\right)\left((0.06)^2 - (0.16)^2\right)$

$= -3.66$

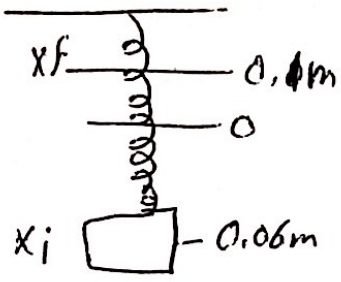


(29) $K = \frac{20}{0.06}$

$W = \frac{1}{2} K (x_i^2 - x_f^2)$

$= \frac{1}{2} \left(\frac{20}{0.06}\right) \left((0.06)^2 - (0.1)^2\right)$

$= -1.06$ J



(30) الجسم الأول : $K_1 = \frac{1}{2} m V^2 = \frac{1}{2} (3m)(V)^2 = \frac{3}{2} MV^2$

الجسم الثاني : $K_2 = \frac{1}{2} (3M)(2V)^2 = \frac{1}{2} (3M)(4V^2) = 6MV^2$

الجسم الثالث : $K_3 = \frac{1}{2} (2M)(3V)^2 = 9MV^2$

الجسم الرابع : $K_4 = \frac{1}{2} (M)(4V)^2 = 8MV^2$

~~الجسم الخامس : $K_5 = \frac{1}{2} \cdot 10$~~

الجسم الثالث له اكبر طاقة حركية

$K_3 > K_4 > K_2 > K_1$

(31) $V_x = \frac{1}{2} m V_x^2 = \frac{1}{2} (500) V^2 = 250V^2$

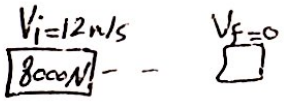
$V_y = \frac{1}{2} m V_y^2 = \frac{1}{2} (2000) V^2 = 1000V^2$

$V_x = \frac{1}{4} V_y$

$V_y : V_x$

$4 : 1$

(32)



$\Delta K = K_f - K_i$

$= \frac{1}{2} m V_f^2 - \frac{1}{2} m V_i^2$

$= 0 - \frac{1}{2} \left(\frac{8000}{9.8}\right) (12)^2$

$= -587755$

$= -5.9 \times 10^4$ J

(33) $W = \Delta K.E$

$W = \frac{1}{2} m (V_f^2 - V_i^2)$

يكون الشغل موجب عندما تكون

$V_f^2 > V_i^2$

(34) $T = \frac{mV^2}{R}$

الحبل ينقطع اذا زادت (T) عن (16N)

اكبر طاقة حركية يمكن الحصول عليها تكون عند اكبر سرعة واكبر سرعة يمكن الحصول عليها بحيث لا ينقطع الحبل عندما تكون

$T = 16$

$T = 16 = \frac{mV^2}{0.5}$

$V^2 = \frac{8}{m}$ ①

$K_{max} = \frac{1}{2} m V^2 = \frac{1}{2} m \left(\frac{8}{m}\right) = \frac{8}{2} = 4$ J

(35) بما ان الطاقة الحركية لا تعتمد على اتجاه السرعة بالتالي تكون متساوية لجسمين لهما نفس الكتلة ويتحركان بنفس السرعة حتى كوكبين مختلفين

$K_{moon} = \frac{1}{2} m V^2$

$K_{Earth} = \frac{1}{2} m V^2$

$K_{moon} : K_{Earth}$

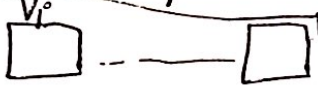
$1 : 1$

ملاحظة : الكتلة تختلف كوكب لآخر والاختلاف في الوزن لا يختلف من كوكب لآخر

(36) الجواب C

$K = \frac{1}{2} m V^2 = \frac{kg\, m^2}{s^2} = \frac{ML^2}{T^2}$ ← الكتلة ← مسافة ← زمن

(37)



$W = \Delta K.E$

$W = K_f - K_i = 0 - K_i$

$W = -\frac{1}{2} m V^2 =$ Kinetic energy of the objec

38) $W_{net} = \Delta K.E = K_f - K_i$

$= \frac{1}{2} m (V_f^2 - V_i^2)$

$= \frac{1}{2}(5)\left((10)^2 - (6)^2\right)$

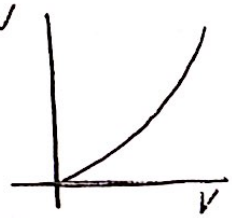
$= 160\ J$

39) $W = \Delta K.E = K_f - K_i = K_f - 0$

$W = \frac{1}{2} m V^2$

$W \propto V^2$

الشغل يتناسب طرديا مع V^2



40) $W = F_r \cdot d$

نحتاج لمعرفة d كما ان F_r تكون متغيرة حتى نصبح $V = V_T$ ومن ثم تثبت وتصبح بساوي mg بيانيا نجد المساحة تحت المنحنى

F_r Vs t

41) $W = \Delta K = \frac{1}{2} m (V_f^2 - V_i^2)$

$= \frac{1}{2}(4)(0 - (3)^2)$

$= -18\ J$

42) $W = F \cdot d = \Delta K.E = K_f - K_i$

للجسم الاول $(F_1)(d_1)(1) = 0 - K_{i_1}$

للجسم الثاني $F_2 (d_2)(1) = 0 - K_{i_2}$

بما ان

$F_1 = F_2$

$K_{i_1} = K_{i_2}$ ②

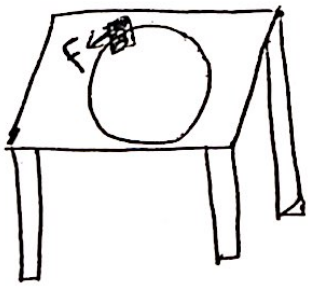
$d_1 = d_2$ بيانيا

43) $W = F \cdot d = \Delta K = K_f - K_i$

$(F)(d)(-1) = 0 - \frac{1}{2} m V^2$

$Fd = \frac{mV^2}{2} \Rightarrow F = \frac{mV^2}{2d}$

44)



$W = F \cdot d = \Delta K.E = K_f - K_i$

$(3)(2\pi R) = \frac{1}{2} m V^2 - 0$

$V = \sqrt{\frac{(3)(2\pi R)(2)}{m}}$

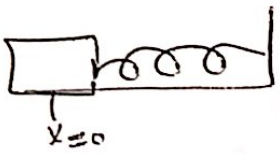
$= \sqrt{\frac{6(2\pi(2.5))}{0.5}}$

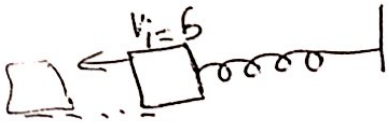
$V = \sqrt{188.5} = 13.7\ m/s \simeq 14$

45) المطلوب حساب قوة الشد

$T = \frac{mV^2}{R} = \frac{(0.5)(13.7)^2}{2.5} = 37.7\ J$

46)





$\Delta E_m = \Delta K + \Delta U = 0$

$K_f - K_i + U_f - U_i = 0$

$0 - \frac{1}{2} m V_i^2 + \frac{1}{2} k x_f^2 - 0 = 0$

$\frac{1}{2} m V_i^2 = \frac{1}{2} k x_f^2$

$x_f = \sqrt{\frac{m V_i^2}{k}}$

$= \sqrt{\frac{(2)(25)}{200}} = \sqrt{0.25} = 0.5\ m$

(47) بما ان الطاقة الحركية تزداد بشكل منتظم بمرور الوقت بتالي

$K.E(t) = Ct$

$\frac{1}{2}mv^2 = ct \Rightarrow v = \sqrt{\frac{2ct}{m}} = \sqrt{\frac{2c}{m}}\sqrt{t}$ ← ثابت

$a = \frac{dv}{dt} = \sqrt{\frac{2c}{m}} \frac{1}{2\sqrt{t}}$

$F = ma = \left(\frac{m}{2}\sqrt{\frac{2c}{m}}\right)\frac{1}{\sqrt{t}}$ ← ثابت

$F \propto \frac{1}{\sqrt{t}}$

(48) $V_i = \sqrt{(4)^2 + (3)^2} = 5$

$V_f^2 = (2)^2 + (3)^2 = 13$

$W = \Delta K = \frac{1}{2}mV_f^2 - \frac{1}{2}mV_i^2$

$= \frac{1}{2}(2)(13) - \frac{1}{2}(2)(25)$

$= 13 - 25 = -12\,J$

(49) $F = Ct$

$ma = ct$

$a = \frac{c}{m}t$

$V = \int_0^t a\,dt = \int_0^t \frac{c}{m}t$

$V = \frac{c}{2m}t^2$

$K.E = \frac{1}{2}mv^2 = \frac{1}{2}m\left(\frac{c}{2m}t^2\right)^2$

$K.E = \left[\frac{c^2}{4m}\right]t^4$ ← ثابت

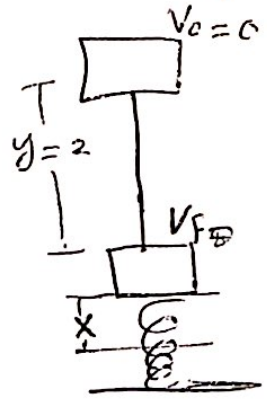
$K.E \propto t^4$

(50) reading of scale $= t = kx$

$V_f^2 = V_i^2 + 2gy$

$V_f^2 = 0 + (2)(10)(2)$

$V_f^2 = 40$



من قانون حفظ الطاقة الميكانيكية

$\Delta K = \Delta U$

$\frac{1}{2}mV_f^2 = \frac{1}{2}kx^2$

$x = \sqrt{\frac{40}{105}} = 0.02$

$F = kx = (1.5 \times 10^5)(0.02) = 3 \times 10^3\,N$

(51) $W = F.d = \frac{1}{2}mv^2$

$F = \frac{mv^2}{2d} = \frac{m\,L^2}{L\,t^2} = \frac{mL}{t^2}$

وبما ان $F = F_o e^{-kx}$ بتالي

$F_o = \frac{mL}{t^2}$

$k = \frac{1}{x}$

$k = \frac{1}{x} = \frac{1}{L}$

$K.E = \frac{mL^2}{t^2}$

بتجريب الاجوبة:

(a) $\frac{F_o}{k} = \frac{\frac{mL}{t^2}}{\frac{1}{L}} = \frac{mL^2}{t^2} = K.E$ ✓

(b) $\frac{F_o}{e^k}$ ✗ لا يجوز ان تكون $\left(e^{\frac{1}{L}}\right)$

(c) $kF_o = \left(\frac{1}{L}\right)\left(\frac{mL}{t^2}\right) = \frac{m}{t^2} \neq K.E$ ✗

(d) $\frac{1}{2(kF_o)^2} = \frac{1}{\left(\frac{m}{t^2}\right)^2} = \frac{t^4}{m^2} \neq K.E$ ✗

(E) $ke^k F_o$ ✗ لا يجوز ان تكون $\frac{1}{e^{\frac{1}{L}}}$

= الشبه بين القوة التي بذل بها الاثر والقوة التي تؤثر بها

3) بما ان الارتفاع الذي رفع الجسم اليه مساوي في الحالتين بالتالي فان رفع الجسم بشكل عمودي يحتاج الى قوة اكبر من القوة اللازمة لرفع في نفس

4) Watt
وحدة قياس Power
$= F \cdot V = (ma) \cdot V$
$= (Kg)\left(\frac{m}{s^2}\right)\left(\frac{m}{s}\right)$
$= Kg \cdot m^2/s^3$

5) من السؤال السابق
$= Kg \cdot m^2/s^3$
$= mL^2/T^3$

6) Watt → وحدة قياس القدرة
اما باقي الوحدات لطاقة

7) $ma = F$ = Newton

8) Watt · second $= (P)(t) = \left(\frac{W}{t}\right)(t) = W$
= Energy

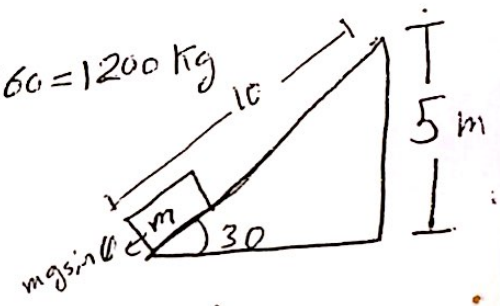
9) Kilowatt - hour
وحدة قياس الطاقة الكهربائية
وتساوي Work

61) $W = mg\,h$
$h = 2R = 40\ m$
$m = 0.01\ kg$
$W = (0.01)(10)(40) = 4\ J$

ملاحظة: الشغل لا يعتمد على الوقت وبالتالي (0.75 min) لا طاقة منها
اما Power فانه يعتمد على الوقت
$P = \frac{W}{\Delta t}$

62) الشغل لا يعتمد على الوقت والما يعتمد على مقدار القوة ويعتمد ايضا على نقطة البداية ونقطة النهاية (الازاحة)

63) $m = 20 \times 60 = 1200\ kg$



$P = F \cdot V = (mg\sin\theta)\left(\frac{10m}{60s}\right)$
$= (6000)\left(\frac{10}{60}\right) = 1000\ watt$

64) $P = \frac{W}{\Delta t} = \vec{F} \cdot \vec{V}$
$P = \frac{(80)(2)}{30} = 5.3\ watt$

65) $V_o = 0$, 2kg $\Rightarrow f = 50\ N$
$F = ma$
$50 = 2a \Rightarrow a = 25\ m/s^2$
$V_f = V_o + at$
$d = V_o t - \frac{1}{2} a t^2$
$= 0 - \frac{1}{2}(25)(2)^2 = 50\ m$
$V_f = 10(2) = 20$
$Work = f \cdot d = 50 \times 50 = 2500\ J$
rate of work $= \frac{\Delta W}{\Delta t} = \frac{2500}{2} = 1250\ watt$

(66) $F = ma \Rightarrow a = \frac{F}{m}$

$a = \frac{50}{2} = 25\ m/s$ $\quad P = (V)(F)$

$d = v_0 t + \frac{1}{2} a t^2$ $\quad V^2 = 0 + \frac{1}{2} a$

$2 = 0 + \frac{1}{2}(25) t^2$ $\quad V = \sqrt{\frac{1}{2}(25)(2)}$

$t = \sqrt{0.16} = 0.4\ s$

$W = F \cdot d = 50 \times 2 = 100$

the rate $\frac{W}{\Delta t} = \frac{100}{0.4} = 250$ watt

(66) $F = ma$

$a = \frac{F}{m} = \frac{50}{2} = 25\ m/s^2$

$V^2 = V_0^2 + 2aX$

$V^2 = 0 + 2(25)(2) = 100$

$V = 10$

$P = \frac{dW}{dt} = F \cdot V = (50)(10)(1)$

$= 500$ watt

(67) $\frac{W}{t} = ct$

$W = ct^2$

$\frac{1}{2} m v^2 = ct^2$

$v^2 = \frac{2c}{m} t^2$

$v = \sqrt{\frac{2c}{m}}\, t$

$V \propto t$

$W = P t$

$W = \frac{1}{2} m v^2$

(67)

Chapter 8

إعداد: محمد المرسي

اذا اثرت قوة محفوظة على جسم فان مجموع الشغل لمسار مغلق يساوي صفر

اذا كانت القوة محفوظة فان شغلها يعتمد على المسافة بين نقطة البداية و النهاية و لا يعتمد على المسار

$W_1 = W_2 = W_3$

(5) بما ان كلا الجسمين عادا إلى نفس النقطة التي انطلقا منها فان طاقة الوضع تكون نفسها (لانهما عادا إلى نفس الارتفاع)

$U = -W_f = -f \cdot d$

(3) التغير في طاقة الوضع يساوي صفر (بسبب العودة الى نقطة البداية)

$E_m = K + U$

ثابت

وبما ان سرعة كل من الجسمين قلت بتالي الطاقة الحركية قلت وبما ان $\Delta E_m \neq 0$ بتالي يوجد تحول لطاقة اي اثرت قوة غير محفوظة

$E_m = K + U$ ثابت

$E_m = K + U$ ثابت

تقل لان السرعة تقل

بتالي E_m تقل

(4) السرعة كبيرة جدا وبها ان

$K.E = \frac{1}{2} m v^2$

بتالي تكون الطاقة الحركية كبيرة جدا

(8) في حالة الجسم الساكن تكون $v = 0$ وبها ان

$K.E = \frac{1}{2} m v^2$

بتالي $K.E = 0$

لا يوجد طاقة حركية

(9) البايض الملقوف في الساعة يمتلك طاقة وضع و لا يمتلك طاقة حركية

(10) الجسم الساكن في نظام بامكانه ان يبذل شغل اذا كان بامكانه الحركة بحيث تقل طاقة الوضع الخاصة به اي تزداد الطاقة الحركية له حسب ان

$W = \Delta K.E$

(12) $U = -W_f = F d \cos\theta =$

$d = vt$

$U = FVt$

$U = FVT$

(13) $U = -W_f = -\int F dx = -(\text{مساحة})$

① مساحة $= \frac{1}{2} x_1 f_1 \Rightarrow U_1 = -\frac{1}{2} x_1 f_1$

② مساحة $= x_1 f_1 \Rightarrow U_2 = -x_1 f_2$

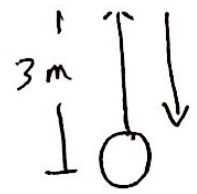
③ مساحة $= \frac{1}{2} x_1 f_1 \Rightarrow U_3 = \frac{1}{2} x_1 f_1$

$U_3 > U_1 > U_2$

الترتيب من الاكثر سالبية

2 > 1 > 3

(14)



اكبر طاقة وضع تكون عند اعلى ارتفاع حيث تكون الطاقة الحركية لساعي صفر ($V=0$) وذلك لان

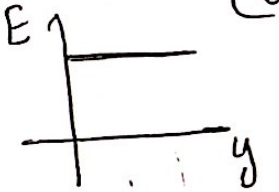
$U = mgh$

h: اعلى ارتفاع ثابت

(15) بما ان مقاومة الهواء يمكن تجاهلها يتالي

$\Delta E_m = 0$

اي ان الطاقة الميكانيكية محفوظة (تبقى ثابتة)



(16)

$V_{60m}^2 = V_0^2 + 2gh$

$V^2 = 0 + (2)(10)(60) = 1200$

$V^2 = 1200$

$K.E = \frac{1}{2} m V^2 = \frac{1}{2}(6)(1200) = 3600$

او بطريقة اخرى

at height 80 m

$E_m = U + K = U + 0 = mgh = (6)(10)(80) = 4800$

at height 60

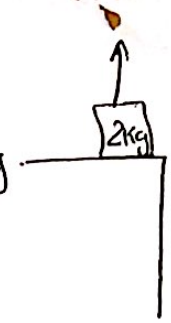
$\Delta E_m = 0$

$E_m = E_m$

$4800 = U + K = mgh_{20} + K = (6)(10)(20) + K$

$K = 4800 - 1200 = 3600$

(17) المطلوب: متى تكون $\Delta U = 500\ J$



~~$U_0 = mgh = (2)(9.8)(20) = 392\ J$~~

$\Delta U = U_f - U_i = 500$

$mg(h_f - h_0) = 500$

$h_f - h_0 = \frac{500}{mg} = \frac{500}{19.6} = 25.5$

$h_f = h_0 + 25.5$

$= 20 + 25.5 = 45.5$

(18) بما ان الصعد يرتفع بسرعة ثابتة فان تسارعة سيارة صفر

$a = \frac{V}{t} = 0$

الطاقة الحركية له ثابتة

$\Delta K = mg(V_f - V_i) = mg(0) = 0$

وبما ان يحرك بسرعة ثابتة فان القوة المؤثرة عليه تكون ثابتة

(19) (20) K.E (vertical component) =

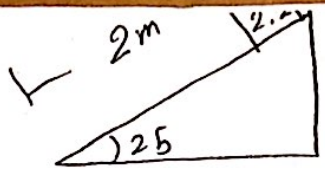
$= \frac{1}{2} m (V \sin 60) = \frac{1}{2}(\frac{1}{2})(8.6)$

$= \frac{75}{4} = 18.75$

(20) لكي يصل الى ارتفاع (h) يجب ان يمتلك على الاقل طاقة حركية لساعي طاقة الموضع عند ارتفاع h

$K = U = mgh$

1) $\mu_K = .25$



$\Delta E_m + \Delta E_{th} = 0$

$E_m = -\Delta E_{th} = W_{f_K} = (\mu_K N)\, d \cos 180$

$= -\mu_K (mg \cos 25)(2)$

$= -(0.25)(2.2)(9.8)(\cos 25)(2)$

$= -9.8$

2) $U = K$

$mgh = \frac{1}{2} m v^2$

$v^2 = 2gh$

$v = \sqrt{2gh}$

$= \sqrt{(2)(9.8)(1.85)}$

$= 6.02 \text{ m/s}$

23) $\Delta E_m = 0$

$E_{m_f} = E_{m_i}$

$K_f + U_f = K_i + U_i$

$\frac{1}{2} m v_f^2 + 0 = \frac{1}{2} m v_i^2 + mgh$

$v_f^2 = \left(\frac{1}{2}\right)(3)^2 + (9.8)(0.5)$

$v_f^2 = 4.5 + 4.9 = 9.4$

$v = \sqrt{(2)(9.4)} = 4.3 \text{ m/s}$

24) $f = -\frac{dU}{dx} \Rightarrow dU = -f\,dx$

$\int dU = -\int f\,dx$

$U - U_0 = -\int 8x^3 dx = -2x^4$

$U - 0 = -2x^4$

$U = -2x^4$

25) at $x = 1 \Rightarrow U(1) = 80$

$K(1) = \frac{1}{2} m v^2 = \frac{1}{2}(0.2)(5)^2 = 2.5$

at $x = 1$ $E_{m_1} = U(1) + K(1) = 82.5$

$\Delta E_m = 0$

$E_{m_0} = E_{m_1}$

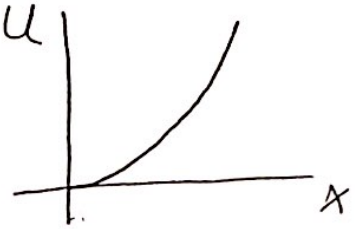
$K_0 + U_0 = 82.5$

$\frac{1}{2} m v^2 + 0 = 82.5$

$v = \sqrt{125} = 11.1 \text{ m/s}$

26) $U = \frac{1}{2} k x^2$

اقتران تربيعي



27) $U = \frac{1}{2} k x^2$

$f = \frac{-dU}{dx} = -kx$

$10 = -20x \Rightarrow x = -\frac{1}{2}$

$U = \frac{1}{2}(20)\left(-\frac{1}{2}\right)^2 = \frac{20}{8} = 2.5$

28) طاقة الوضع تتحول الى طاقة حركة

$x_0 = 0.07 \text{ m}$

$U = K$

$\frac{1}{2} k x^2 = \frac{1}{2} m v^2$

$\left(\frac{1}{2}\right)(20)(0.07)^2 = \frac{1}{2}(0.015) v^2$

$v = \sqrt{6.533} = 2.556$

$K.E = \frac{1}{2} m v^2 = \frac{1}{2}(0.015)(2.556)^2$

$= 0.049$

(29) $E_m = U + K = U + 0$

$0.12 = \frac{1}{2} K x^2$

$x = \sqrt{\frac{(2)(0.12)}{80}} = 0.054$

(30) $E_m = U + K = 0 + K$

$0.12 = \frac{1}{2} m v^2$

$v = \sqrt{\frac{(2)(0.12)}{0.5}} = 0.692 \text{ m/s}$

(31) when the spring is 4cm

$E_m = U + K = \frac{1}{2} K x^2 + \frac{1}{2} m v^2$

$E_m = (\frac{1}{2})(80)(0.04)^2 + \frac{1}{2}(0.5)(0.5)^2$

$E_m = 0.064 + 0.0625 = 0.1265 \text{ J}$

$\Delta E_m = 0$

$E_{m_0} = E_m$

$0.1265 = K + U = K + 0$

$0.1265 = \frac{1}{2} m v_{max}^2$

$v_{max} = \sqrt{\frac{(2)(0.1265)}{(0.5)}} = 0.71 \text{ m/s}$

(32) [illegible]

$\frac{1}{2} m v^2 = \frac{1}{2} K x^2$

$(\frac{1}{2})(\frac{1}{2})(2)^2 = \frac{1}{2}(800) x^2$

$x = \sqrt{\frac{1}{400}} = 0.05 \text{ m} = 5 \text{ cm}$

(33) $K.E = U$

$\frac{1}{2} m v^2 = \frac{1}{2} K x^2$

$x^2 = \frac{m v^2}{K} \Rightarrow \boxed{x = v\sqrt{\frac{m}{K}}}$

~~$\frac{1}{2} K x^2 = \frac{1}{2} \left(\frac{m v^2}{K} \right)$~~

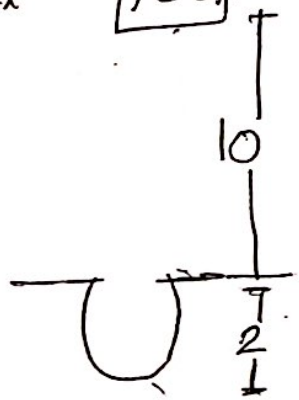
(34)

$mgh = \frac{1}{2} K x^2$

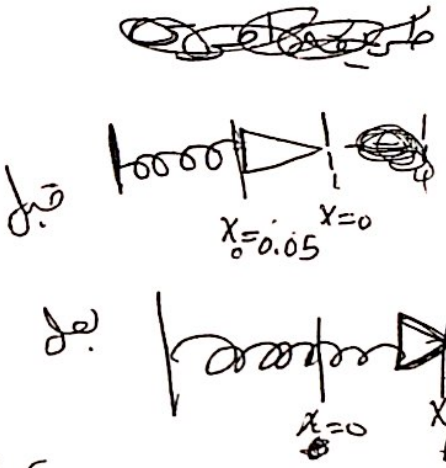
$(700)(12) = \frac{1}{2} K x^2$

$\frac{1}{2} K x^2 = 8400$

700N



(35)



$\Delta E_m = 0$

$E_{m_0} = E_{m_f}$

$U_0 + K_0 = U + K$

$\frac{1}{2} K x_0^2 + 0 = \frac{1}{2} K x_f^2 + \frac{1}{2} m v^2$

$v^2 = \frac{K x_0^2 - K x_f^2}{m}$

$v^2 = \frac{(10)(0.05)^2 - (10)(0.01)^2}{(0.005)}$

$v^2 = 4$

$\boxed{v = 2}$

(36) $mgr = \frac{1}{2}mv$

$v^2 = 2gr$

$\Sigma f = ma = \frac{mv^2}{r} = \frac{m(2gr)}{r} = 2mg$

$\Sigma f = T - mg = 2mg$

$\boxed{T = 3mg}$

(37) $mgh = \frac{1}{2}mv^2$

$h = r$

$v^2 = 2gr = 2(9.8)(0.5)$

$v = \sqrt{9.8} = 3.13\ m/s$

(38) $\Delta Em = 0 \quad Em_1 = Em_2$

$mgh_1 = mgh_2 + \frac{1}{2}mv^2$

$= 2g(h_1 - h_2)$

$= \sqrt{2g(h_1 - h_2)}$

(39) $mg(2r+h) = mg2r + \frac{1}{2}mv^2$

بما ان الطاقة الميكانيكية محفوظة الجسم سيفقد اقل

$mg(2r+y) = mg2r + \frac{1}{2}mv^2$

$2mgr + mgy = 2mgr + \frac{1}{2}mv^2$

$\boxed{gy = \frac{v^2}{2}}$ — (1)

(40) $f = ma = \frac{mv^2}{r}$

$mg = \frac{mv^2}{r}$

$v = \sqrt{gr} = \sqrt{\frac{3}{2}(9.8)} = 3.8\ m/s$

(41) عند اعلى ارتفاع (Point 3) يكون الجسم يمتلك اقل طاقة حركية واكبر طاقة وضع وهما ان

$\Delta Em = 0$

$Em_1 = Em_2$

$\Delta K + \Delta U = \Delta K + \Delta U$

$K_1 + U_1 = K_2 + U_2 = Em$

$Em_1 = K_2 + U_2$

$Em_1 = Em_2 = U + K$

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

عند اعلى ارتفاع يكون هذا المقدار اكبر ما يمكن وبالتالي تكون الطاقة الحركية اقل ما يمكن وهما ان

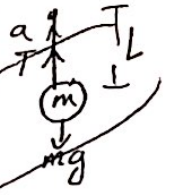
$K.E = \frac{1}{2}mv^2$

بالتالي تكون السرعة اقل ما يمكن

(42) at the bottom of circle

$\Sigma f = ma = \frac{mv^2}{L}$

$T - mg =$



(42)

$\Delta E_m = 0$

$E_{m_{Top}} = \sum m_{bottom}$

$K + U = K + U$

$\frac{1}{2}mV_{Top}^2 + mg(2L) = \frac{1}{2}mV_{bottom}^2 + 0$

$\frac{V_{Top}^2}{2} + 2gL = \frac{V_{bottom}^2}{2}$ → (1)

at the top

$\sum F = ma = m\frac{V^2}{r}$

$mg = \frac{mV^2}{L}$

$V^2 = gL$

من المعادلة (1)

$\frac{gL}{2} + 2gL = \frac{V^2}{2}$

$V^2_{bottom} = 5gL$

$V = \sqrt{5gL}$

ملاحظة: عند اقصى ارتفاع الشد لسلك يصبح صفر

(44) the limits of motion are when $U = E_m$ when K.E = zero

$8x^2 + 2x^4 = 9$ J

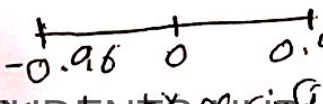
بالتجريب

$8(.96)^2 + 2(.96)^4 \doteq 9$

$9 = 9$

بالتالي الجواب

$-0.96 \le x \le 0.96$ m



اكبر او تساوي -0.96 واصغر او تساوي 0.96

(45) $K(1) = \frac{1}{2}mV^2 = \frac{1}{2}(0.2)(5^2) = 2.5$

$U(1) = 8 + 2 = 10$

$\sum E_{m_1} = 10 + 2.5 = 12.5$

~~when it stop~~

$\Delta E_m = 0$

$\sum E_m = \sum E_m$

$K(1) + U(1) = K + U$

when it stop

$K(1) + U(1) = 0 + U$

$E_{m_1} = U$

$8x^2 + 2x^4 = 12.5$

بالتجريب

$8(1.1)^2 + 2(1.1)^2 \doteq 12.5$

$12.5 = 12.5$

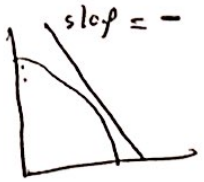
وبما انه كان يتحرك على محور السينات الموجب (معطيات) بالتالي فالحل يكون عندما

$x = +1.1$

(46) $F = -\frac{dU}{dt}$

(F) is positive when $\frac{dU}{dt}$ is negative $F = (-)(-) =$

that when U is decreasing functi



(47) $F = -\frac{dU}{dt}$

$|F| = \left|\frac{dU}{dt}\right|$

$C = 0$: ميل

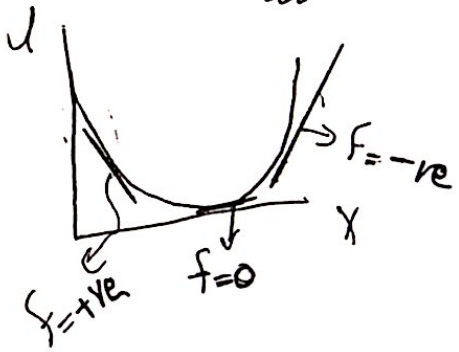
: ميل

$AB < CD$ (اقل انحدار)

بالتالي: بما ان (F) تعتمد على القيمة المطلقة للميل

$CD > AB > BC$

(48) $F = -\frac{dU}{dt}$



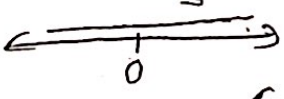
بما ان اقتران $(U-X)$ يشبه اقتران التربيعي

$U = (X-C)^2$

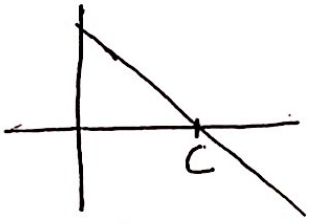
$F = -\frac{dU}{dx} = -2(X-C) \Rightarrow X = C$

(اشارة F: +ve | -ve عند C)

$\frac{dF}{dx} = -2$



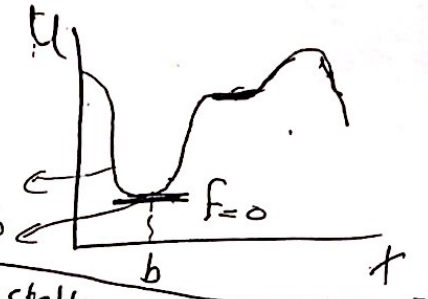
F decreasing (من اليسار لليمين)



(49) The Point of stable equilibrium

نقطة تكون عندها $f=0$ والاقتران على شكل $(U-X)$ مقعر للاعلى

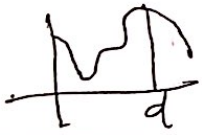
only b



(50) The Point of unstable equilibrium

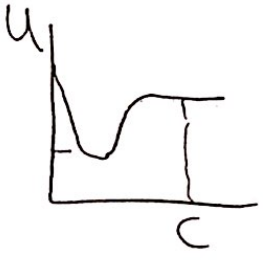
نقطة تكون عندها $f=0$ والاقتران $(U-X)$ مقعر للاسفل

only d



(51) The Point of neutral equilibrium

نقطة تكون عندها مقدار U ثابت مع تغير X



only C

(52) $U = -mgx + \frac{1}{2}kx^2$

$f = -\frac{dU}{dx} = -(-mg + kx) \Rightarrow$

$f = mg - kx$

(53) $F = ma_1 = -\frac{du_1}{dx}$

$\left.\frac{du}{dx}\right|_{x=1} = 8x + 8x^3 = 16 + 8 = 25$

$F = -25 = ma$

$a = \frac{-25}{m} = \frac{-25}{0.2} =$

(53) لو جد خطأ في السؤال التصحيح :

$U(x) = 8x^2 - 2x^4$

$F = -\frac{du}{dx} = ma$

$\left.\frac{du}{dx}\right|_{x=1} = 16x - 8x^3 = 16 - 8 = 8$

$F = -8 = ma$

$a = -\frac{8}{m} = \frac{-8}{0.2} = -40\ m/s$

(54) $U = Ax^{-12} - Bx^{-6}$

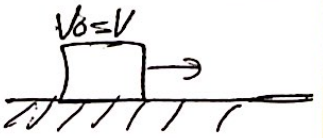
$F = -\frac{du}{dx} = -\left(\frac{-12A}{x^{+13}} + \frac{6B}{x^7}\right)$

$= 12A/x^{13} - 6B/x^7$

(56)

(57)

(58)



$\Delta E_m + \Delta E_{int} = 0$

$\Delta K + \Delta U + \Delta E_{th} = 0$

$\Delta K + 0 + \Delta E_{th} = 0$

$\Delta K + \Delta E_{th} = 0$

الشغل الذي يبذل لاحتكاك يغير الطاقة الحركية والطاقة الداخلية فقط

(59)

$\Delta E_m + \Delta E_{int} = 0$

$\Delta K + \Delta U + 15 = 0$

$K_f - 0 + 0 - U_i + 15 = 0$

$\frac{1}{2}mv^2 - mgh + 15 = 0$

$\frac{1}{2}mv^2 = mgh - 15 = 19.6 - 15 = 4.6$

$V^2 = \frac{(2)(4.6)}{0.025} = 368 \Rightarrow V = 19.1\ m/s$

(60) $\Delta E_m + \Delta E_{th} = 0 \Rightarrow \Delta E_{th} = -\Delta E_m$

$\Delta E_{int} = \Delta E_m = -\Delta K + -\Delta U = -\Delta K +$

$\Delta E_{int} = -\Delta K = \frac{1}{2}m(V_i^2 - V_f^2) = \frac{1}{2}(5)((200)^2 - (15$

$\Delta E_{int} = 44000\ J$

(61) $\Delta E_m + \Delta E_{int} = 0 \Rightarrow \Delta E_{int} = -\Delta K + \Delta U$

$\Delta E_{int} = K_i - K_f + U_i - U_f = \left(\frac{1}{2}mv^2 - 0 + 0 - \frac{1}{2}kx^2\right)$

$= \left(\frac{1}{2}(0.75)(3.5)^2 - \frac{1}{2}(1200)(0.057)^2\right)$

$\Delta E_{int} = -(4.5 - 1.9) = -2.6$

إعداد: عمر المحتسب

CHAPTER 9

1) Ans: E "None of these"

2) Ans: C $6kg(1,3)m$ / $4kg(0,0)m$ / $5kg(3,2)m$

$$X_{com} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{\sum M}$$

$$= \frac{4(0) + 6(1) + 5(3)}{15} = 1.4$$

Y_{com} the same $= 1.9$

$Y_{com} = 2$ m

Com (1.4, 1.9)

3) Ans: E the center of the circle

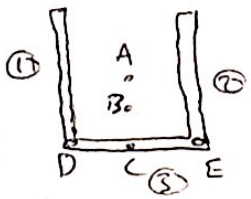
4) Ans: B Closer to the sun than the Earth or Mars bcz the mass of the sun is very large

$M_{sun} \gg (M_{earth} + M_{mars})$

5) Ans: D "near the center of Earth"

6) Ans: B

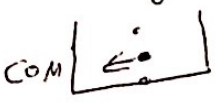
The center of 1 2 3 is in the midway between the ends across the thickness



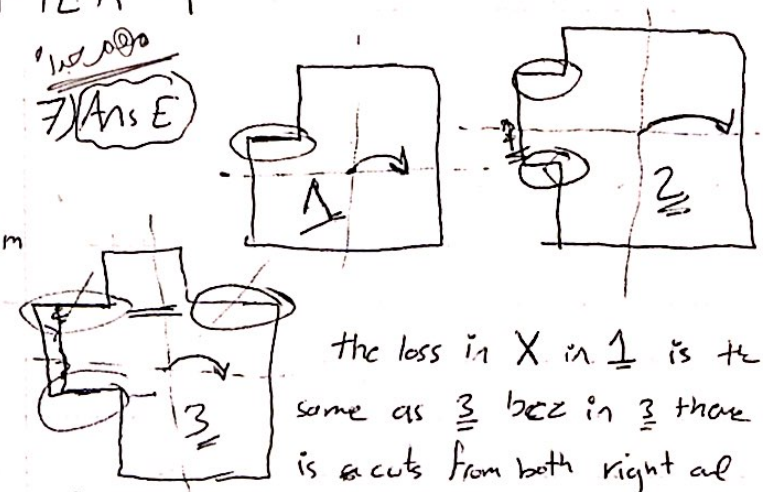
the center between 1, 2 in the middle between

the center "1,2" as "3" them is in the midway between them

COM

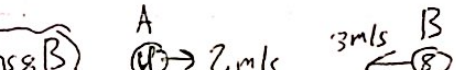


7) Ans: E



the loss in X in 1 is the same as 3 bcz in 3 there is 2 cuts from both right and left side's. But in 2 the loss is greater bcz there is 2 two cuts from the left side only.

8) Ans: B



$$V_{com} = \frac{V_1m_1 + V_2m_2}{M}$$

$$= \frac{(4)(2) + (8)(3)}{12} = 7.3 \text{ m/s}$$

9) Ans: D we find the height of the two balls after 2 s by $y = v_0t + \frac{1}{2}at^2$

$H_1 = 25 - y_1 \Rightarrow H_1 = 25 - 19.6 = 5.4$ m

$H_2 = y_2 = 10.4$ m

$$H_{com} = \frac{m_1h_1 + m_2h_2}{M} = \frac{(5.4)(0.5) + (10.4)(0.25)}{0.75}$$

$\cong$ 7.1 m

10) Ans: C we first find V after 2 sec. by $V_2 = V_0 + at \Rightarrow V_1 = -19.6 / V_2 = 4.6$

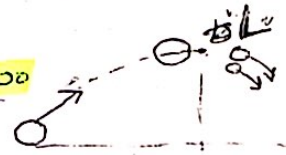
$$V_{com} = \frac{V_1m_1 + m_2V_2}{M} = \frac{(-19.6)(0.5) + (0.25)(4}{0.75}$$

$= -15.026 \approx 15$ m/s

11) Ans: D) $a=g$ the acceleration never changes when the particles moves still within the range of the Earth

12) Ans: E) None of these

13) Ans: B) since the two objects are the same with the same initial conditions the center of mass of displacement is the displacement of one of them.



In this question we are considered in vertical $\rightarrow$ D, as the V_y at "L" is zero, the question is free fall: $y = V_0 t + \frac{1}{2} a (t)^2 \Rightarrow = 0 + (\frac{1}{2})(10)(4)$
$= 20$

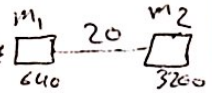
14) Ans: B) $\Sigma F_{ext} = 0$

15) Ans: A) $V_0 = 0$ if $\Sigma F_{ext} = 0$

16) Ans: E) is rearward of its original place of not moving.

17) Ans: B) since the bear will move $\frac{1}{6} * 20 = 3.3$ m

640 : 3200
1 : 5



$\frac{m_1}{m_2} = \frac{d_1}{d_2}$

18) Ans: A) the same as 17

10 : 60
1 : 6

the 60 kg boy will move $\frac{10}{2.5} = 4$ m

19) Ans: C) $\vec{F} = \Sigma F_{ext}$ / $m = m_{system}$

20) Ans: B) the same as 17 & 18 so $V_1 = 2V_2$ for the 1kg amp. $V_2 = \frac{6}{2} = 3$ m/s

m_1	m_2
5	10
1	2

21) Ans: D) the motion was started with at least one of masses moving

22) Ans: B) $E_b = E_a \Rightarrow \frac{1}{2} k x^2 =$
$= (\frac{1}{2})(100)(0.1)^2 = 0.5$
$E_{mg} = \frac{1}{2} m V_1^2 + \frac{1}{2} m V_2^2 = (\frac{1}{2})(2)(0.6)^2 + \frac{1}{2}(4)(0.15)^2 =$
$0.129 \quad 0.1944$
$\Delta E_m = 0.5 - 0.3056$

23) Ans: C) $\Delta p = J \Rightarrow J = F \cdot t$ N.s

24) Ans: E) acceleration

25) Ans: D) $p = \sqrt{2 k m}$ $m_a = 4 m_b$

$\frac{P_A}{P_B} = \frac{\sqrt{2 k_1 m_a}}{\sqrt{2 k_b m_b}} \Rightarrow \frac{P_a}{P_b} = \frac{\sqrt{4 m_b}}{\sqrt{m_b}}$

$\frac{P_a}{P_b} = \frac{3}{1}$

An 26) Ans: B) "is moving faster"

27) Ans: B) F is the slope in "P vs t" graph

28) Ans: D) $\Delta p = m \Delta v = 1(1.5 - -2) = 3.5$ already

29) Ans: D) $\Sigma F_{ext} \neq$ zero

30) Ans: B) "the force of friction of the vel. 0.

31) Ans: A $V = V_0 + at \Rightarrow V = 39.2$

$P = mV = (64.2)(2.5) = 98$

32) Ans: B $m_1V_{1b} + m_2V_{2b} = m_1V_{1a} + m_2V_{2a}$

$0 = (64)(0.0017) + 0.1\,V_{2a}$

$V_{2a} = -1.1$

33) Ans: C the same as 32 $V = 8.3 * 10^{-2}$

34) Ans: B the same as 32, 33 $V = 0.38$ m/s

35) Ans: A P is conserved in explosion

36) Ans: C $P_b^{\circ} = P_a \Rightarrow 0 = MV_1 + m_2V_2$

$V = \frac{-m_2V_2}{M}$

37) Ans: C $P_b^{\circ} = P_a \Rightarrow 0 = MV + m_bV$

$\frac{P_{G_1}}{P_{G_2}} = \frac{m_{bullet1}V}{m_{bullet2}V} = \frac{2m_2}{m_2} = \frac{2}{1}(2:1)$

38) Ans: A Area under $(F_{vs}\,t)$ graph $= J$

$\Rightarrow J = \Delta P \Rightarrow (\frac{1}{2})(4)(2) = m\Delta V$

$\frac{4}{5} = V = 0.8$

39) Ans: D $F = \frac{\Delta P}{\Delta t}$

40) Ans: B $V_{Comb} = V_{Comafter}$

$V_{con} = \frac{m_1V_1 + m_2V_2}{M} = \frac{+0.2*3 + 4*2}{0.6}$

$= 0.33$

Ans: C

41) Ans: D $P_b = P_a \Rightarrow m_1V_1 = (m_1+m_2)V$

$2000*3 = (2000+500)V \Rightarrow V = 2.4$ m/s

42) Ans: E "Zero"

43) Ans: B "the force of the existing fuel gases"

44) Ans: C Thrust $= V_{rel}\frac{dM}{dt} = (1500)(100)$

$= 1.5*10^5$

45) Ans: B $V_f - V_i = V_{rel}\ln(\frac{M_i}{M_f})$

$\Rightarrow V_f = 1500\ln(\frac{1}{0.2}) = 2414 \cong 2400$ m/s

46) Ans: B $V_f - V_i^{\circ} = V_{rel}\ln(\frac{M_i}{M_f})$

$\frac{20}{1500} = \ln(\frac{M_i}{M_f}) \Rightarrow 1.004 = \ln(\frac{M_i}{M_f})$

$M_f = \frac{1000}{1.004} = 996 \Rightarrow 1000 - 996 = 4$ kg

47) Ans: D $J = \Delta P$

48) Ans: D $J_{ext} = 0 \Rightarrow F_{ext} = 0$

49) Ans: E $J_{xy} = -J_{yx}$

50) Ans: E "the same reaction for the other"

51) Ans: A $J = \Delta P = m\Delta V$

$= 0.2(20 - -30) = +10$ upward

52) Ans: C $Ft = \Delta P \Rightarrow 1*1 = P_f - P_0$

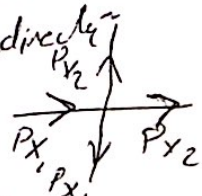
$P_f = +1$ kg·m/s

53) Ans: C "mae in stright line"

54) Ans: C $J = \Delta p = +50$

55) Ans: D the airbags make t larger so J will be smaller "exerts a much smaller force"

56) Ans: C $\Delta P_x = P_{x_1} - P_{x_2} = 0$ same direction
$\Delta P_y = P_{y_1} - -P_{y_2} = 2P_y > 0$



57) Ans: B $J = F \cdot t \Rightarrow F = \frac{J}{t}$
$F = \frac{mv}{t}$

58) Ans: E "Impossible to determine from given data"

59) Ans: E "None of the choices"

60) Ans: D "a frame for which the total momentum of the two objects is zero"

61) Ans: D P is conserved & K is Not

62) Ans: A $P_{before} = P_{after}$
$m_1 v_1 = (m_1 + m_2) V$
$V = \frac{1.2}{1.2} = 1$ m/s

63) Ans: B the same as 62
$V = \frac{m_1 v_1}{(m_1 + m_2)} = 6.399 = 0.4$

64) Ans: B $P_b = P_{after} \Rightarrow m_1 v_1 = (m_1 + m_2) V$
$V = 1$ $J = \Delta P$
$\Delta P_2 = (1)(4) = 4$ N.s

65) Ans: B $m_1 v_1 = (m_1 + m_2) V \rightarrow \sqrt{2gy}$
$V = 0.245$ $v_1 = \frac{2.450}{0.003} = 816 \simeq 8 \times 10^2$

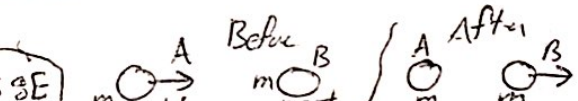
66) Ans: C $K = \frac{1}{2} m v^2$
$40 = \left(\frac{1}{2}\right)(5) v^2$
$V = 4$ m/s

67) Ans: C $m_1 v_1 + m_2 v_2 = (m_1 + m_2) V_f$
$V_f = 0 \Rightarrow \Delta K = K_f - K_i$
$\Delta K = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v^2 = 3750$ J

68) Ans: C $\frac{1}{2} M_{total} V_{com}$

69) Ans: D $(m_1 + m_2) V_f = m_2 v_2$
$V_f = \frac{(105)(2)}{30} = 7$ $\Delta V = 7 - 2 = 5$ m/s

70) Ans: C P & K are conserved

71) Ans: E 

the whole speed of elastic
A goes to B for ellastic → proved by $(P_b = P_a)$ & $\left(\frac{v_2' - v_1'}{v_1 - v_2} = 1\right) \Longrightarrow$ for B to have the greatest K $\cdot m_B = m_A$

72) Ans: C " 

" it likes when a ball strikes a wall in an ellastic collision so the ball will rebound with same speed & the opposit direction $V_{A_{after}} = -5$ m/s

$$V_{1a} = \frac{m_1 - m_2}{m_1 + m_2}(V_{1b}) + \frac{2m_2}{m_1 + m_2}(V_{2b})$$

73) Ans: D $\quad = 0 + \frac{2m_2}{m_2} 10 = 20 \text{ m/s}$

74) Ans: B

$P_{before} = P_{after}$

$$m_A V = m_A V_A + m_B V_B \Rightarrow mV = mV_A + 2mV_B$$

$$V = V_A + 2V_B \quad (1)$$

$$\Rightarrow \frac{V - 0}{V_B - V_a} = 1 \Rightarrow V = V_B - V_a \quad (2)$$

$$V_B - V_a = V_a + 2V_B \Rightarrow -V_B = 2V_a \quad \text{so } V_a : V_b = 1 : 1$$

$$\Rightarrow V_a = \frac{-V}{3} \;/\; V_B = \frac{2V}{3}$$

75) Ans: A By using $\Delta P = 0$ $\quad V_{2a} - V_{1a} = V_{1b} - V_{2b}$

76)

76) Ans: E "the incident and target particle have the same mass" the same as 71

77) Ans: D $\quad X = \frac{2}{5}Y \Rightarrow K = \frac{1}{2}mv^2 \Longrightarrow K(x) = 50$ so $K(y) = 50 \times \frac{5}{2} =$ 125 J

78) Ans: E "the kinetic energy of the system is at a minimum"

79) Ans: B "if some other form of energy were changed to kinetic during the collision the report could be true" Because the K_{after} is larger than K_{before} and that impossible is if there is no another source of energy

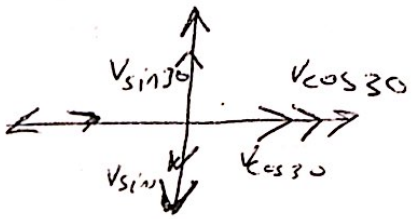
80) Ans: A $p_b = p_a \Rightarrow \boxed{mV_0 = mV_1 + mV_2}$ ... ① $\boxed{V_0 = V_1 + V_2}$

$2K_b = K_a \Rightarrow 2\left(\frac{1}{2}mV_0^2\right) = \frac{1}{2}mV_1^2 + \frac{1}{2}mV_2^2 \Rightarrow 2V_0^2 = V_1^2 + V_2^2$ ②

$\Rightarrow (5 = V_1 + V_2)$ ① $(50 = V_1^2 + V_2^2)$ ② By solving these simultaneously

$\Rightarrow V_1 = 1.83$ m/s

81) Ans: B



the same as [56] $\Rightarrow \Delta p_x = 0$ $\Delta p_y = 2p_y$

$= 2mV\sin 30$

إعداد : لارا الساعي محمد رشيد

Chapter 10: Rotation

Test bank Answers

1) $\pi \longrightarrow 180^\circ$
$1 \longrightarrow ??X$
$X = \frac{180^\circ}{3.14} = 57.3^\circ$ ans: D

2) ans: E

3) $\frac{1\ rev}{min} = \frac{2\pi\ rad}{1 \times 60\ s} = 0.105\ rad/s$ ans: B

4) ans: C

5) $T = \frac{2\pi}{\omega} = \frac{2\pi}{3} \approx 2.09 \approx 2.1\ s$ ans: E

6) $\omega = \frac{100 \times 2\pi}{10} \approx 63\ rad/s$ ans: E

7) The second hand complete 1 rev/min
So $\omega = \frac{2\pi}{60}\ rad/s = \pi/30\ m/s$
ans: C

8) $\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2 \Rightarrow \alpha = \frac{2(\Delta\theta - \omega_0 t)}{t^2} = \frac{2(450 - 20 \times 9)}{81} \approx 6.7\ rad/s$
ans: D

9) The min hand complete one rev / hour so $\omega = \frac{2\pi}{60 \times 60} = \left(\frac{\pi}{1800}\right) m/s$
ans: D

10) $\alpha_{Avg} = \frac{\Delta\omega}{\Delta t} = \frac{300(2\pi)}{60 \times 10} = 3.14\ rad/s$ ans: A

11) $\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta \Rightarrow \omega_i = \sqrt{4\pi^2 - 2\pi^2} = \sqrt{2}\pi\ rad/s$
ans: D

12) $\alpha_{Avg} = \frac{\Delta\omega}{\Delta t} = \frac{0 - 24\pi}{6} = 4\pi\ rad/s^2$ ans: D

13 $\alpha_{avg} = \frac{\Delta w}{\Delta t} = \frac{0 - 0.75 \times 2\pi}{30} = \frac{-1.5\pi}{30} = \frac{-\pi}{20}$ ans: D

14 Given that the time taken is t = 1min = 60s { $w_i = 0$ $w_f = 4\pi$ rad/s

$\alpha_{Avg} = \frac{\Delta w}{\Delta t} = \frac{4\pi}{60} = \frac{\pi}{15}$ rad/s² ans: D

15 The time taken for angular velocity 18 rad/s to zero is $w_f = w_i + \alpha t$

$t = \frac{0-18}{-2} = 9s$ and The time for angular velocity zero to 18 is also 9s

Total time is $t = 9 + 9 = 18s$ Hence we get by it ans: D

16 $\alpha = \frac{w_f - w_i}{t} = \frac{+24 - 36}{6} = -2$ rad/s² Ans: B

17 $\alpha = \frac{w_f - w_i}{t} = \frac{-24 + 36}{6} = 2$ rad/s² Ans: A

18 $w_f^2 = w_i^2 + 2\alpha \Delta\theta \Rightarrow 0 = (18)^2 + 2(-2)\Delta\theta \Rightarrow \Delta\theta = 81$ Ans = A

19 $w_f^2 = 0 + 2(4)(20\pi) \Rightarrow w_f = 22$ rad/s ans: B

20 $\Delta\theta = w_0 t + \frac{1}{2}\alpha t^2 \Rightarrow t^2 = \frac{2(20\pi - 0)}{4} = 10\pi$ $t = \sqrt{10\pi} = 5.6\,s$ Ans: E

21 $\alpha(t) = (6t^2)$ $\frac{dw}{dt} = 6t^2 \Rightarrow w = \int 6t^2 dt = \frac{6t^3}{3} = 2t^3 + c$ (c = zero)

$\Rightarrow \frac{d\theta}{dt} = 2t^3 \Rightarrow \theta = \int 2t^3 dt = \frac{2t^4}{4} = ((1/2)t^4)$ rad ans: C

22 from Q 21 we found that $\theta = \frac{1}{2}t^4 \Rightarrow 10 \times 2\pi = \frac{1}{2}t^4$

$t = \sqrt[4]{125.6} = 3.3$ ملاحظة: استخدمنا العلاقة من الدائرة السابقة

فقط لأنه اقتران التسارع المعطى هو نفسه أي أن هذه العلاقة ليست علاقة عامة

لإيجاد الزمن.

ans: B

23 Using Q 21 and Q 22 $w = 2t^3 \Rightarrow$ when $\theta = 10$ rev $t = 3.3$

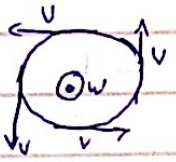
so $w = 2(3.3)^3 \approx 75$ rad/s ans: B

24 $\int dw = \int -3t^2 \Rightarrow w = -t^3 + c$ but $w(0) = 27 \Rightarrow 27 = 0 + c \Rightarrow c = 27$

$w = -t^3 + 27$ when $w = 0$ $t = 3$ second Ans: C

الثلاثة فروع تعتمد على بعضها البعض

25 ans: B



26 Ans A (دائرة جيدة)

27 $\theta = \frac{s}{r} = \frac{3000}{20} = 150$ rad ans: C

28 $v = wr = 0.7(10) = 7$ Ans A 29 Ans: D

30 $\Delta\theta = wit + \frac{1}{2}\alpha t^2$ But $\Delta\theta = \frac{s}{r} = \frac{4}{0.015} = 266$

$266 = 0 + \frac{1}{2}(2)t^2$ $r = \frac{0.03}{2} = 0.015$

$t = \sqrt{266} \approx 16$ s ans: D

31 Because w is constant the particle has ar and doesn't have at

so $a = a_r = w^2 r = (5(2\pi))^2 (0.1) = 10\pi^2$ m/s² ans: E

32 ans: A دائرة

33 to find how many revelouli/s the tube made $r = 0.05$ m

so the tube complete one revolution when

and the tube circumference $= 2\pi r = 2\pi(0.05) = 0.1\pi$

الأنبوب يقطع 10 سم كل ثانية ولذلك نجد كم تمثل الـ 10 سم من المحيط

ويكون ذلك عدد الدورات في الثانية

$\frac{10 \times 10^{-2}}{0.1\pi} = 0.318\,47$ revlution the tube made every second

so $w = 0.318$ rev/s $= 0.318(2\pi)$ rad/s $= 2$ rad/s Ans: A

34 from Question 33 we notice that $w = 2$ rad/s

here $a = a_r = w^2 r = (2)^2 (0.05) = 0.2$ m/s²

35 $a_t = \alpha r = 5 \times 0.6 = 3$ ans B

36 $v_1 = wr_1 = wr$ $v_2 = w\frac{r}{2}$ $\Rightarrow \frac{v_1}{v_2} = \frac{wr}{w\frac{r}{2}} = 2$ ans: B

point 1 r, point 2 $\frac{r}{2}$

37 نفس 36 ⇒ $a_{t_1} = \alpha r$ $a_{t_2} = \alpha \frac{r}{2}$ $\frac{a_{t_1}}{a_{t_2}} = 2$

ans : B

38 نفس 37, 36 $a_{r_1} = \omega^2 r$ $a_{r_2} = \omega^2 \frac{r}{2}$ $\frac{a_{r_1}}{a_{r_2}} = 2$

Ans B

39 $\omega_B = 2\omega_A$ $a_{r_A} = \omega_A^2 r$ $a_{r_B} = 4\omega_A^2 r$ $\frac{a_{r_B}}{a_{r_A}} = 4$

Ans D

40 Ans: D $\omega_f = \omega_i + \alpha t$ ⇒ $\omega_f = \alpha t$ (constant, increasing) ⇒ ω_f increase

$a_t = \alpha r$ (constant, constant) $a_r = \omega^2 r$ (increases, constant)

Vector $|a| = \sqrt{(a_r)^2 + (a_t)^2}$ (increasing, constant)

So $\vec{a}$ increases in magnitude and becomes more radial

41 $|\vec{a}| = \sqrt{(a_t)^2 + (a_r)^2}$ $|\vec{a}_i| = \sqrt{(a_t)^2 + (a_r)^2}$

$a_{t_{final}} = 4 a_{t_i}$

$\alpha_f r = 4 \alpha_i r$

$\alpha_f = 4\alpha_i$

$|\vec{a}_F| = 4\sqrt{(a_t)_i^2 + (a_r)_i^2}$

$= \sqrt{16 (a_{t_i})^2 + 16 (a_{r_i})^2}$

$= \sqrt{(4 a_{t_i})^2 + (4 a_{r_i})^2}$

$= \sqrt{(4\alpha r)^2 + (4\omega^2 r)^2}$

$a_{r_{final}} = 4 a_{r_i}$

$\omega_f^2 = 4\omega_i^2$

$\omega_f = 2\omega_i$

answer is E

42 $I_1 = m(1)^2 = m$

$I_2 = m(2)^2 = 4m$

$I_3 = m(3)^2 = 9m$

$I_1 < I_2 < I_3$

Ans : A

43 $I_{yy} = 2(0)^2 + 2(0)^2 + 2(1)^2 + 2(+1)^2 = 12\ kg.m^2$

المسافة r هي الاساسي
السيخ

44 $I = 3_M(0)^2 + 2_m(\frac{L}{2})^2 + M(L)^2$

$= \frac{\frac{1}{2}ML^2}{2} + \frac{2ML^2}{2} = \frac{3ML^2}{2}$ Answer is C

شفت عارفة ليش بال TestBank معطوطة E انا متأكدة من الحل

45 Ans: D thin اسمه حاطط
Hoop يعني نفس طريقة المعاملة ال

46 Ans: D

47 $I_1 = \frac{2}{5}MR^2$ $I_2 = \frac{2}{3}MR^2$ $I_3 = \frac{MR^2}{2}$ $I_4 = MR^2$

suppose that $X = MR^2$
the $I_4 > I_2 > I_3 > I_1$ ⇒ 1,3,2,4 Ans: C

بصراحة سؤال مستفز ! لازم نحفظ القوانين

48 $I = \frac{1}{2}MR^2$

$Mass = \rho V$ $V_A = \pi r^2 L$ $V_B = \pi(2r)^2 2L = 8V_A$

$I_A = \frac{1}{2}\rho\pi r^2 L R^3$ ---①

$I_B = (\frac{1}{2}\rho\pi r^2 L\ 4r^3) = 32\ I_A$ $\frac{I_B}{I_A} = 32$

Answer: E

Lava😊

49 ans A

← مش سهلة

50 $V = \frac{m}{\rho}$ ← constant

الحجم يزداد عندما تقل الكثافة ويقل عندما تزيد

(بتقليل الكثافة) عندما يزداد الحجم تزداد ابعاد الشكل بالتالي تزداد I

(بزيادة الكثافة) عندما يقل الحجم تقل ابعاد الشكل بالتالي تقل I

50

على نفس مبدأ سؤال 49

لما انه كثافة الـ lead > من كثافة الـ Wood

∴ الـ $I_{wood} > I_{lead}$

طبعاً بثبوت الكتلة

مهم

51 ans B 😜 "عنده رجعاً" تركه عجباً

52 $I_{new} = I_{disk} + mr^2$

$= 0.7 + 0.32 = 1.02$ ans : E

53 $I = I_{com} + Mh^2 = \frac{1}{12} ML^2 + M(\frac{1}{2}L)^2 = \frac{1}{3} ML^2$ ans: C

54 $I = \frac{2}{5} MR^2 + MR^2 = 7/5\ MR^2$ answer : E

حيدة

55 $I = I_{com} + Mh^2 = \frac{2}{5} MR^2 + M(4R)^2$

$= \frac{2}{5} MR^2 + 16MR^2 = \frac{2}{5} MR^2 + \frac{16 \times 5}{5} MR^2$

$= \frac{82}{5} MR^2$

where $h = 4R$
is the distance between the center
of the sphere and the point of suspention

حيدة

56 ans: D

57 Ans: E

Torque = $FR\sin\theta$

$\tau \vec{F_2} = \tau \vec{F_5} = 0$ ($r = 0$, $\theta = 180$)

$\vec{F_4}$ $\sin\theta$ ↓ أصغر من $\sin 90$

$\tau \vec{F_1} = \tau \vec{F_3}$

58: $\tau_1 = F_1 \times r_1 = F_1 r_1 \sin\theta_1 = 5(4)(\sin 150) = 10\ N.m$

$\tau_2 = F_2 \times r_2 = F_2 r_2 \sin\theta_2 = 5(2)(\sin 150) = 5\ N.m$

$\tau_{net} = \tau_1 + \tau_2 = 10 + 5 = 15$ Ans: D

59 ans: D 60 ans: A

61 $\tau = r \times F = I\alpha$ $\alpha = \frac{rF\sin\theta}{I}$

$I_{Disk} = \frac{1}{2}Mr^2$, $I_{Hoop} = Mr^2$, $I_{sphere} = \frac{2}{5}Mr^2$

$\alpha_{Hoop} < \alpha_{Disk} < \alpha_{\frac{2}{5}Mr^2}$ Ans: D

62 Ans: B 63 $\alpha = \frac{(0.1)(1)}{0.020} = 5$ Ans: B

64 $\alpha = \frac{(5)(0.4)}{2} = 1$ ans: C

65 ans: A Because the force is applied along the rotation axis $\tau = 0$ so $\alpha = 0$

66 $\tau = F \times r = I\alpha$

$Fr\sin\theta = I\alpha$ $\Rightarrow \alpha = 0.4\ rad/s^2$

$\frac{(8)(0.25)(1)}{5} = \alpha$

then:

$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$

$\omega_f^2 = 0 + 2(0.4)\pi$

$\omega_f = \sqrt{0.8\pi} \approx 1.6$

$\Delta\theta$ = half revolution $= \frac{1}{2} \cdot 2\pi = \pi$

Ans: D

67 $I_{Hoop} = Mr^2 = 1(2)^2 = 4\ kg.m^2$

$\tau = \alpha I = (7)(4) = 28\ N.m$ Ans: C

68 $\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$ ⟸ torque constant and I constant so α is constant

$(6)^2 = (5)^2 + 2\alpha(10\pi)$

$\alpha = 0.175 \Rightarrow \tau = I\alpha = 12(0.175) = 2.1$

Ans: D

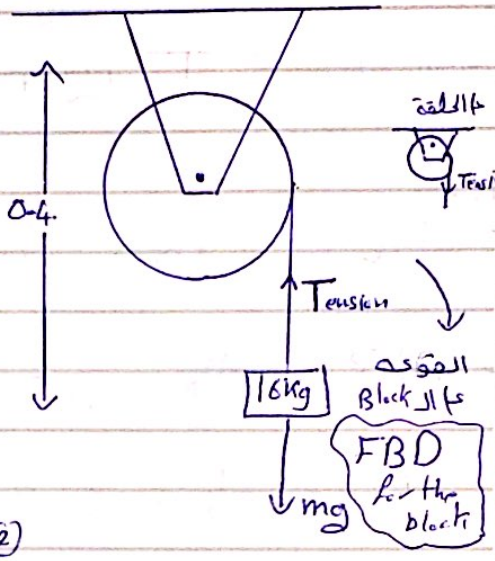
69

$I = 0.5\ kg.m^2$

We know that $\tau = I\alpha = F \times r$

$\tau = I\alpha = \text{Tension} \times r$ (1)

so Tension = $\frac{I\alpha}{r}$



And $F_{net} = W - T$

$ma = mg - \left(\frac{I\alpha}{r}\right)$ ---①

But we know that $a = \alpha r$ $\Rightarrow \alpha = \frac{a}{r}$ ---②

By substituting ② in ①

$ma = mg - \frac{Ia}{r^2}$ ⇒ now we must solve for a so

$ma + \frac{Ia}{r^2} = mg$

$a = \frac{(mg)}{\left(m + \frac{I}{r^2}\right)} \Rightarrow a = \frac{16\,g}{16 + \frac{0.5}{(0.2)^2}} = 0.56g$

Ans is B

---

70 $R = 8.0\ cm = 8 \times 10^{-2}\ m$ { $I = 0.12\ kg.m^2$ { $m = 10\ kg$ { $\tau = 9\ N.m$

~~$\tau = I\alpha$ = Tension (1)~~

~~$T =$~~

$\alpha = \frac{a}{R}$ ---①

$F - mg = ma \Rightarrow F = m(a+g)$

$\tau_{net} = I\alpha$

$\tau_1 - FR\sin\theta = I\alpha$

$\tau_1 - m(a+g)R = I\left(\frac{a}{R}\right)$

$a = \frac{(\tau_1 - mRg)}{\left(mR + \frac{I}{R}\right)} = \frac{9 - 10(8\times10^{-2})(9.8)}{10(8\times10^{-2}) + \frac{0.12}{(8\times10^{-2})}} = 0.5\ m/s^2$

ans: A

71 The Ans is B. 9.8 N

The suspension holding the cylinder pulls up on the cylinder with a force of $T = mg + M_{block}(g - a_{block})$ where a_{block} - the acceleration of 2 kg mass. At the same that is the tangential acceleration of the disk. Let's find it.

$$\tau = I\alpha = F \times R = M_{block}(g - a_{block})R$$

$$\left(\frac{a}{R}\right)\frac{m_{disk}R^2}{2} = M_{block}(g - a_{block})R$$

$$\frac{m_{disk}a_t}{2} = M_{block}(g - a_t) \Rightarrow 2M_{block}(g - a_t) = m_{disk}a_t$$

$$2M_{block}g - 2M_{block}a_t = m_{disk}a_t \Rightarrow 2M_{block}g = a_t(m_{disk} + 2M_{block})$$

$$a_t = \frac{2M_{block}g}{m_{disk} + 2M_{block}} = 8.34\ m/s^2 \Rightarrow T = m_{disk}g + M_{block}(g - a_t)$$

$$= (0.7)(9.8) + 2(9.8 - 8.34)$$

$$\approx 9.8\ N$$

ans : B

$\tau_{net} = F_1R_1 - TR_2 = I\alpha$

$T \Rightarrow T = FR_1 - I\alpha$

R_2

Then we use $F = ma$:

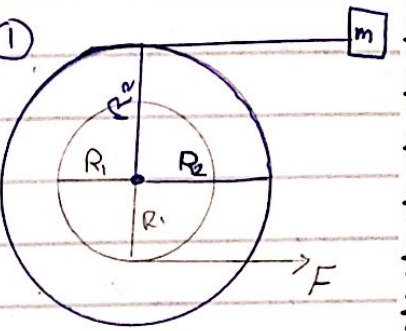
To find a : a_t

Continued

Lara

72 $\tau_{net} = \tau_{1 by \vec{F}} - \tau_{2 by T} = I\alpha$ --- ①

$\tau_{net} = R_1 F_1 - T R_2 = I\alpha$



The point here is that $\alpha = \frac{a}{R_2}$

So we can now find T from ①

$$T = -\frac{I a}{R_2^2} + \frac{F R_1 R_2}{R_2^2} = \frac{F R_1 R_2 - I a}{R_2^2}$$

Then we use T to find a : since $T = ma$

$$a = \frac{T}{m} = \frac{F R_1 R_2 - I a}{m R_2^2} \Rightarrow a m R_2^2 = F R_1 R_2 - I a$$

$$a(mR_2^2 + I) = F R_1 R_2$$

$$a = \frac{F R_1 R_2}{m R_2^2 + I}$$

ans : C

---

73 From problem 72 $T = am = mF R_1 R_2 / mR_2^2 + I$

The ~~answer~~ answer is C

---

74 ans : A

---

75 By $V = \omega r \Rightarrow \omega = \frac{V}{r} \Rightarrow \omega = \frac{2}{3 \times 10^{-2}} = 66.7$ rad/s

Thus by KE (rotational) $= \frac{1}{2} I \omega^2$

$= \frac{1}{2} (45 \times 10^{-3}) (66.7)^2 = 10$ J

ans : D

---

76 ans : C

---

77 Work done = $F \times$ distance ~~distance~~ distance $= \pi R = 3.14 (0.25) = 0.7854$ m

Work done $= (2)(0.7854) = 1.6$ J

Ans : A

$W = \tau \theta$

$= FR\pi$

$= 1.6$ J

Constant $\omega \Rightarrow \alpha = 0$

78 Work $= \tau \cdot \theta$ $\theta = \omega t = 20 \times 60 = 1200 \text{ rad}$ (1 min)

$= (0.80)(1200)$

$= 960 \text{ J}$ ans: C

---

79 $\omega_f = \omega_i + \alpha t = 0 + 2(5) = 10 \text{ rad/s}$

Work done by $\tau_{net} = \Delta k = \frac{1}{2} I (\omega_f^2 - \omega_i^2)$

$= \frac{1}{2}(6)(10)^2 = 300 \text{ J}$

ans: D

---

80 $\tau_{net} = I\alpha$ (constant τ_{net}, constant I $\rightarrow$ constant α)

$\omega_f = \omega_i + \alpha t$

$\omega(5) = \alpha 5$ $\omega(10) = 10\alpha$

Work done by $\tau_{net} = \Delta k = \frac{1}{2} I (\omega_f^2 - \omega_i^2)$

Work in first 5s $= \frac{1}{2} I 25\alpha$ ---①

Work in second 5s $= \frac{1}{2} I 100\alpha$ ---②

$\frac{②}{①} = 4$

ans: D

---

81 ans: A

"أخيرا"

لا تنسونـي من صالح دعائكم بظهر الغيب

إعداد: للدراسات محمد زيبت

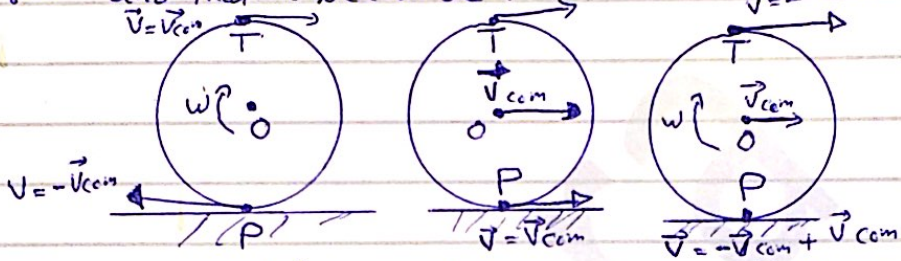
Chapter 11:

Rolling, Torque, and Angular Momentum

Test bank answers

1 ans: E and that is because: $\vec{V}=\vec{V}_{com}$ $\vec{V}=2\vec{V}_{com}$

راجعوا صفحة 276 بالكتاب



(a) pure rotation + (b) pure translation = (c) Rolling motion

---

2 $\Delta\theta = w_i t + \frac{1}{2}\alpha t^2$

$= 0 + \frac{1}{2}(6)(3)^2 = 27 \text{ rad}$ but $s = \theta R = 27(0.5)$

$= 13.5 \text{ m}$

ans: C

---

3 $V = WR$ and If V is the same in the two cases and $R_2 = 2R_1$

then $w_1 = \frac{V}{R_1}$ $w_2 = \frac{V}{R_2} = \frac{V}{2R_1} = \frac{1}{2}w_1$ ans: C

---

4 - 7 غير مطلوبة دوائر الاستكمال غير مطلوبة ست حابوا لنا وحدة بالفايننل

---

8 $K_{rot} = \frac{1}{2} I_{com} w^2$ $K_{translation} = \frac{1}{2} M V_{com}^2$

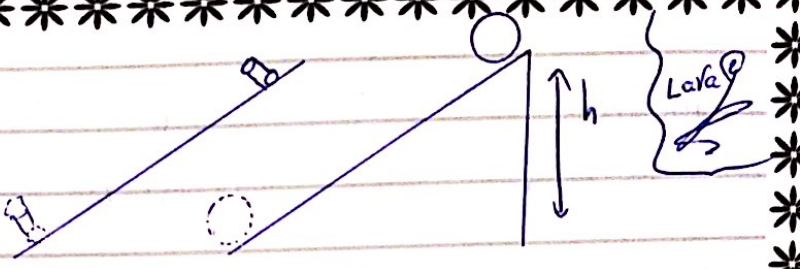
$= \frac{1}{2} M R^2 w^2$

$= \frac{1}{2} M R^2 \frac{(V^2)}{(R^2)} = \frac{1}{2} M V_{com}^2$

so $\frac{K_{rot}}{K_{trans}} = 1$

ans: A

9 ans: E



$I_{sphere} = \frac{2}{5} MR^2$

$I_{cylinder} = \frac{1}{2} MR^2$

* so the first option A is wrong because $I_{cylinder} > I_{sphere}$

* $K_{rotational_{sphere}} = \frac{1}{2} I_{sphere} \omega^2 = \frac{1}{2}\left(\frac{2}{5}\right)\frac{MR^2}{R^2} V^2 = \frac{1}{5} MV^2$ ..(1)

$K_{rotational_{cylinder}} = \frac{1}{2} I_{cylinder} \omega^2 = \frac{1}{2}\left(\frac{1}{2} MR^2\right)\frac{V^2}{R^2} = \frac{1}{4} MV^2$ ..(2)

here we will use the conservation of Energy

First for the sphere: $(K+U)_i = (K+U)_f$

$Mgh = K_{rot} + K_{trans}$

$Mgh = \frac{1}{2} I\omega^2 + \frac{1}{2} MV^2$

$Mgh = \frac{1}{5} MV^2 + \frac{1}{2} MV^2 \Rightarrow Mgh = \frac{7}{10} MV^2_{sphere}$

$V_{sphere} = \sqrt{\frac{10}{7} gh} \Rightarrow$ (it reaches first)

Second for the cylinder $Mgh = \frac{1}{4} MV^2 + \frac{1}{2} MV^2 = \frac{3}{4} MV^2_{cylinder}$

$V_{cylinder} = \sqrt{\frac{4}{3} gh} \Rightarrow V_{sphere} > V_{cylinder}$ (sphere reach first)

$\Rightarrow$ The option B is wrong because the sphere reachs first

The option C is wrong because $K_{rot\,sphere} < K_{rot\,cylinder}$

The option D is wrong because They didn't reach the bottom together

So option E is correct

---

10 $I_{cylinder} = \frac{1}{2} MR^2$

$I_{sphere} = \frac{2}{5} MR^2$

$I_{ring} = MR^2$

for ring:

$\frac{1}{2} MV^2 + \frac{1}{2} MV^2 = Mgh$

$MV^2 = Mgh$

$h = \frac{V^2}{g}$

for cylinder: disk

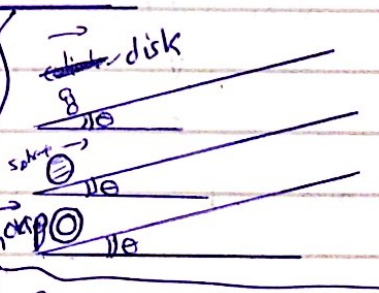
$\frac{3}{4} MV^2 = Mgh$

$h = \frac{\frac{3}{4} V^2}{g}$

for sphere:

$\frac{7}{10} MV^2 = Mgh$

$h = \frac{\frac{7}{10} V^2}{g}$



So answer is $h_{ring} > h_{disk} > h_{sphere}$

ans: A

(11) Ans:B $K_{rot} = \frac{1}{2} I\omega^2 = \frac{1}{2} MR^2 \left(\frac{V^2}{R^2}\right) = \frac{1}{2} MV^2 = K_{trans}$

(12) غير مطلوب؟ 13 D? 14 Ans:D

15 Ans:E السرعة لاتعتمد على الكتلة واغاستخدمت $V = \sqrt{\frac{4}{3}gh}$ بالتالي يصل أسرع

16) Ans:A

As the bodies roll from rest down the inclined plane, the initially gravitational potential energy is converted to translational and rotational kinetic energies. Since the ball is bigger than the ball bearings, its moment of inertia is larger, so that the amount of gravitational potential energy converted to rotational kinetic energy ½ I ω² is also larger, leaving a smaller amount for the translational kinetic energy ½ m v², so that its translational speed at the bottom is smaller.

For the block mounted on roller bearings, the ball bearings are smaller than the ball, so they also have smaller moments of inertia, converting less amount of the initial gravitational potential energy to rotational kinetic energy of the ball bearings, leaving behind a larger amount for the translational kinetic energy of the block, making its translational speed at the bottom higher.

17 غير مطلوبة 18 ans:E 19 Ans:D $kg.m^2/s$ 20 Ans:A

نفس السؤال بصيغ مختلفة

21 Ans:D 22 $\ell = Iw = mR^2 w = 2(0.5)^2(12) = 6\ kg.m^2/s$ Ans:A

23 Ans:C 24 $\ell = r \times p = (12)(6)(4)\sin 30 = 144$ ans:C

25 $\ell_{ball_1} = (1)(6)(2)\sin 90 = 12$ $\ell_{ball_2} = (2)(3)(3)\sin 90 = 18$

$\ell_{total} = 12 + 18 = 30\ kg.m^2/s$ ans:D

26 $v(2) = at = 4(2)i - 3(2)j = 8\hat{i} - 6\hat{j}\ m/s$

$r(2) = v_0 t + \frac{1}{2} a t^2 + r_0 = 0 + \frac{1}{2}(4\hat{i} - 3\hat{j})(2)^2 + 3\hat{i}$

$= 8\hat{i} - 6\hat{j} + 3\hat{i} = 11\hat{i} - 6\hat{j}$

$\ell = r \times p = (11\hat{i} - 6\hat{j}) \times (16\hat{i} - 12\hat{j})$

$= -(36\ kg.m^2/s)\hat{k}$ Ans:B

27 ~~$\ell = rmv = (0.3)\left(\frac{15}{1000}\right)$~~

$\ell = I\omega = mR^2\omega = \left(\frac{15}{1000}\right)(0.3)^2(3.5) = 4.7 \times 10^{-3}$

Ans: B

~~28 $\ell = mR^2\omega = (2)(0.5)^2(12) = 6$ kg.m²/s Ans: A~~

28 + 29 + 30 :

يوجد خطأ في إرقام السؤال يجب انه نحوله 0.75 إلى 0.61

المهم فكرة الحل كالتالي ℓ لها مركبتين :

① The z component ② the xy plane component

29 بداية " دائرة تطلب ال z component والحل كالتالي

$\ell_1 = I\omega = mR^2\omega = 2(0.5)^2(12) = 6$ kg.m²/s Ans: A

30 دائرة تطلب The component in the xy plane

$\ell_2 = I\omega = mR^2\omega = 2(0.61)^2(12) = 9$ ans: C

28 دائرة الحل ℓ هي

$\ell_{net} = \sqrt{(\ell_1)^2 + (\ell_2)^2}$

$= \sqrt{(6)^2 + (9)^2} \approx 11$ kg.m²/s

منه عارفة الأرقام مابتزبط إلا هيك مستحيل تزبط مع وجود 0.75

عمومًا المهم الفكرة

---

31 using parallel axis theorem

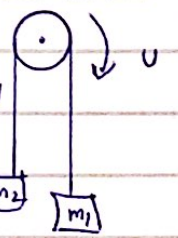
$I = I_{com} + Mh^2$ so $\ell = (I_{com} + Mh^2)\omega$ Ans: B

---

32 $\ell_1 = m_1 vR$

$\ell_2 = m_2 vR \Rightarrow \ell_{net} = (m_1 + m_2)vR + I\omega$

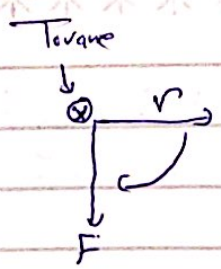
$\ell_{for\ the\ pully} = I\omega = (m_1 + m_2)vR + I\frac{v}{R}$



Ans: B

$\ell_{net} = (m_1 + m_2)vR + Iv/R$

33 ans: B



34 Ans: C

35 Ans: A

36 $F_{centripital} = m\omega^2 R = (2)(12)^2(0.5)$
$= 144$

The distance from the origin = 0.75

$\tau = rF = 0.75\,(144) = 108$

Ans: E

---

37 $\tau = F \times r$

Force prependicular component : since the 2kg mass is located 3m from the origion on the positive x-axis, only the y-component of the force cause torque . To determine the y-component of the force, we use the y-component of the acceleration $a = 4\hat{i} - 3\hat{j}$

$(-3\hat{j})\ m/s^2$ is the y-component

Force = (mass)(acceleration) = $-6N$ $\tau = rxF = rF\sin 90$

$= (3)(-6) = -18\ N.m$

Ans: B

38 ans: A

39 Ans: C

40 ans: A

41 $I_0\omega_0 = I_f\omega_f$ $I_f = \frac{I_0}{4}$ ans: D

42 Ans: E

43 ans: B

44 ans: C Internal forces are unable to change angular Momentum

The Answer is L

45 Ans: B 45 راجعوا سؤاله بالكتاب (ميكانيكس)

Lava ②

46 Ans: C

47 $L_{Before} = L_{After}$

$Iw + 4w = 3I w_f$

$w_f = \frac{5Iw}{3I} = \frac{5}{3} w$ Ans: A

48 $L_{Before} = L_{After} \Rightarrow I w_o = w_f (2I + I)$

$w_f = \frac{w_o I}{3I} = w_o/3$ Ans: C

49 Ans: D

50 from the conservation law,

The total angular Momentum of the child before = L_{After} (child + merry-go-round)

$MRV = MRV' + Iw$

$MRV = MR(wR) + Iw \Rightarrow MRV = w(MR^2 + I)$

So $w = \frac{MRV}{I + MR^2}$ Ans: E

* 51 L_{Before} L_{After}

$600(0.8) = 600 w_f + 20(3)^2 w_f$

$600(0.8) = (600 + 180) w_f$

$w_f \approx 0.62$ Ans: A

52 Ans: A

53 Ans: C

54 Ans: A

The End