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" ≈ 0.5 من الصح

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 $V_{sphere} = \frac{4}{3}\pi r^3$
$= \left(\frac{4}{3}\right)(3.14)(1.7 * 10^{-2})^3$
$= 20.569 \approx 2.1 * 10^{-5}$ 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

21) Ans: D

$V_{cylinder}$ = (Area of base)(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" Area base + $2\pi rh$

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

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

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

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

$A = B^n C^m$

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

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

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

$2n + m = 1$ [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 $\Delta X = -8 - 4 = -4$

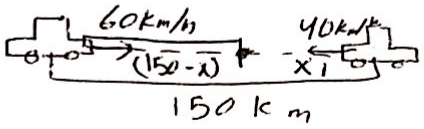
It is the only negative result.

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

So B ~~the absolute~~

كل السائقين التي مشيتها في تلك الفترة على السرعة.

4.



~~So Avg velocity~~ $a = 0$

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

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

$X_1 = v_{0_1} t + \frac{1}{2} a t^2$ (a = 0)

$X_1 = 16.7t$

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

$X_2 = 150 \times 10^3 - v_{0_2} t - \frac{1}{2} a t^2$

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

$X_2 = 150000 - X_1$

$150000 - 16.7t = 11.1t$

$150000 = 27.8t$

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

$= 1.5\ h$

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

عالشنا كان الوقت صيرو 1 وصلنا 1.5 صار الوقت 80 km

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

D

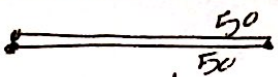
6.

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

وبما انه راح يرجع 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. $V = bt^2$

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

$\int_0^x dx = \int_0^t V\,dt$

$X = \int_0^t bt^2\,dt$

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

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. [crossed out]

particle 1,2 ✗

ما نقولوا تشتغل هام مرتين

يعني في t بتغيرات constant

(3) ⇒ 3.5 + 2.7t²

v = 5.4t

a = 5.4 m/s

(4) ⇒ 3.5 - 3.4t - 2.7t²

v = -3.4 - 5.4t

a = -5.4 m/s

so only 3 and 4 ✓

(D)

15. particle 1 = x(t) = 3.5 - 2.7t³

v(t) = -8.1t² / a(t) = -16.2t

← a v

(4) الجسم يتحرك بالاتجاه السالب والسرعه سالبه و التسارع بنفس الاتجاه اذن عم تزداد سرعته

particle 2 ⇒ x(t) = 3.5 + 2.7t³

v = 8.1t² / a(t) = 16.2t

بنفس الاتجاه بالاتجاه الموجب

particle 3 = 3.5 + 2.7t²

v = 5.4t   a = 5.4

فيه تسارع بالاتجاه ولو كان ثابت

particle 4 = 3.5 - 3.4t - 2.7t²   (4) A   كلهم

16 $v_0 = 0$ a = 4 m/s²

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

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

2 = 2t²

t = 1 s

8 = 2t²

t² = 4

t = 2

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

$= \frac{8 - 2}{2 - 1} = 6$ m/s

17 (E)

مستحيل يكون جسم تسارعه ثابت بس السرعه ثابته كانت

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

18 C.

$S\uparrow$ increase

(ن) $a \neq 0$ and a & v in the same direction

لانو تتزداد لازم يكونوا بنفس الاتجاه

والكبوا الوحيد اليزي الاشي.

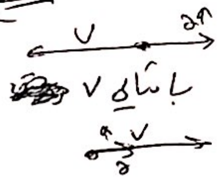
(C) negative & negative

ولانو speed ما بتعتمد على الاتجا

فما بتبين الاشاره.

19

E لانو يمكن



مش شرط عشان هيك

E

20 $y = at - 6t^2$

y postion L

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

C

21 $x = 6t^2$

E لانو ولا وحده

صح

$a = 6t$ ⊖

⊖ تابعل الاحداثي سالب

مش عشان t^2 كارج يكون سالب

⊖ ومعادله t خارج

يكون سالب عشان هيك يشمل

خارج يكون

⊖ ومعد $a \neq 9.8$

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

$v(0) = c$

$c = 16$

$v = -0.25t^2 + 16$

$-0.25t^2 + 16 = 0$

$0.25t^2 = 16$

$t^2 = 64$

$\boxed{t = 8}$

$\boxed{D}$

25) نفس السؤال

24

$v = -0.25t^2 + 16$

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

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

$\Delta x = 58.7 = 59\ m$

$\boxed{E}$

26) نفس السؤال السابق

24, 52

It stopped at $t = 8$

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

$\boxed{D}$

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

$98 - 2t^2 = 0$

$2t^2 = 98$

$t^2 = 49$

$\boxed{t = 7}$

$a(t) = -4t$

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

$\boxed{D}$

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

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

$75 - 3t^2 = 0$

$3t^2 = 75$

$t^2 = 25$

$\boxed{t = 5}$

$a(t) = -6t$

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

$\boxed{C}$

29) 20 m in 4s

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

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

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

$\boxed{C}$

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

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

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

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

$\Delta t = 2s$

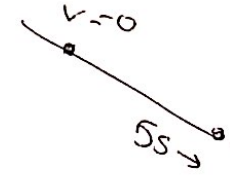
ي كمل

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

$a = 2\ m/s^2$

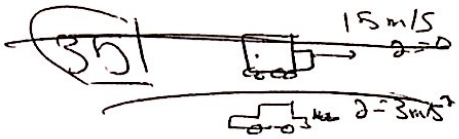
$\Delta x = V_0 t + \frac{1}{2}at^2$

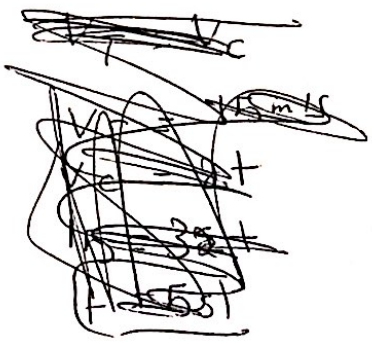
$\Delta x = 2(6) + \frac{1}{2}(2)(6)^2$

$= 12 + 36 = 48\ m$

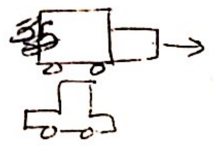
E

35)





35



$X_T = X_c$

$V_T t + \frac{1}{2} a_T t^2 = V_c t + \frac{1}{2} a_c t^2$

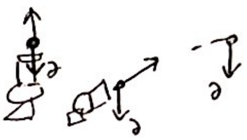
$V_T t = \frac{1}{2} a_c t^2$

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

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

B

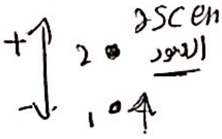
36



downward

دائمًا بكون تسارع الجاذبية
لتحت كان في الصعود ولا
في النزول. (A)

37



$\Delta X = X_f - X_i$
$= X_2 - X_1$
$= +$

($X_2 > X_1$)

disascent $\Delta X = X_f - X_i$
$= X_1 - X_2$
$= -$

موجب بالصعود وسالب بالهبوط

38

$V = 0$, $a = g$

g دائمًا in free fall

39

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

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

$\Delta x = 4.9 t^2$

$\Delta X(1) = 4.9$

$V_{avg} = \frac{4.9 - 0}{1} = 4.9$ 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 4.9m
مش 9.8m كل ثانية

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

(9)

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 ✓

وعادةً شغوف ↓ اذن

رح يكون اتجاه السرعه للاسفل عشان

فصل درح تتزايد مش تتناقص

زي جواب E

41 ↑ v ↓ a

B

↑ v ↓ a ← دائما بتكون للاسفل

42 ↑ 50 m/s

46 (level ground)

$\Delta X = X_0 + V_0 t - \frac{1}{2} g t^2$

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

$= 45\ m$

B

نفس السؤال 42

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

$= 300 - 180$

$= 120\ m$

E

والله اعلم

44 ↓ 1 m/s

$\Delta X = V_0 t + \frac{1}{2} g t^2$

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

$= 5 + 122.5$

$= 127.5\ m$

لانو ال V_0 و a بنفس الاتجاه

بتكون الاشارة (+)

B

45 ↑ 35 m/s

$v = v_0 + at$

$V = 35 - 10(5)$

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

15 down

B

46 C لانو التسارع

دائما نفس ثابت بالسقوط الحر

47 ~~$\Delta X = V_0 t + \frac{1}{2} g t^2$~~

[illegible]

~~$\Delta X = \frac{4.9}{2}(2)^2$~~

~~$t = 19.6\ s$~~

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 $\frac{3g}{2} \times (1) = \frac{3g}{2} = \frac{3 \times 10}{2} = 15\,m$

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

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

(C)

48 $v_0 = 0$

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

$v(3) = 3g$

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

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

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

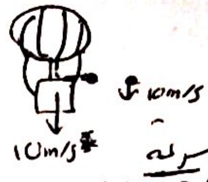
$= \frac{7}{2}g \times (4-3) = 34.3\,m$

(D)

49

عالية الصاروخ
تزداد هذه القذيفة 9.8
بالتالي لايوجد
شارع منا الى شارع الجاذبية
الارض الذي يكون اعا من الاتجاه

50



عاالبه المطلقنا
من البالون فهو سرعته
يكون بنفس

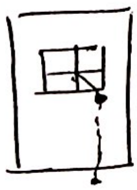
$v_0 = 10\,m/s$

$v = v_0 + gt$

$= 10 + 9.8(20)$

$= 206\ m/s$

51



12 s

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

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

$= 705.6\ m$

(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 $= 0$

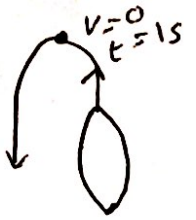
$v = v_0 + gt$

$v_0 = gt$

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

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

54



2s

~~$v = gt$~~

$\cancel{v}^{0} = v_0 - gt$

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

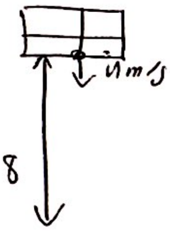
$\Delta X = v_0 t - \frac{1}{2} g t^2$

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

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

(A)

55



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

$8 = 4t + 4.9t^2$

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

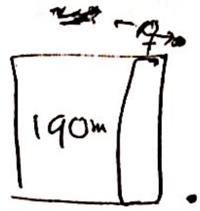
$t = \frac{-4 \mp \sqrt{16 + 156.8}}{9.8}$

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

$t = 0.93$ $t = -X$ لانو سالب

B

56



~~$v = v_0 + gt$~~

~~$v = gt$~~

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

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

$v = 61\,m/s$

B

57

$a_n = 19.6 = 2g$

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

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

~~$\cancel{v_f}^{0} = v_0 - at$~~

~~$v_0 = 2gt$~~

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

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

~~$6\,vt$~~

~~$v_0 = gt$~~

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

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

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

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

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

متشابهة

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

الشرنة

في الارض ح يرتفع اعلى مرتين من الكوكب الثاني
بالتالي بالكوكب 2 يرتفع نصف الارتفاع 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

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

0

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

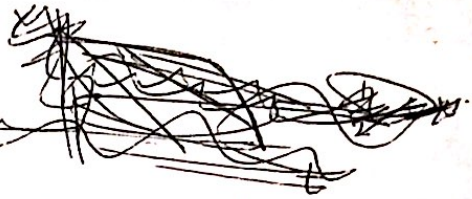
$x_1 = \frac{10000}{2g}$

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

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

B

60.



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

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

$x = \int v\,dt$

displacement

61. D

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

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

$dv = a\,dt$

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

$v = 3t$

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

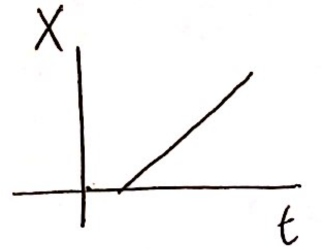
$x = \int_0^t v\,dt$

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

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

So It is increase with time

63



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

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

و عبارة a stright line
ازن رح يكون V
ثابت لانو مشتقة
معادلة اولية تعني رقم.

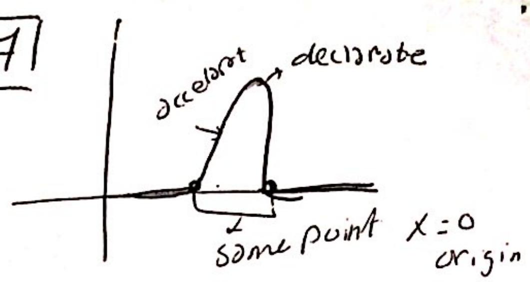
64 B نفس الفكرة

constant
ازن رح ندور على الخطأ
non zero ممنوع يكون
افقي او عمودي
ماضل غير B

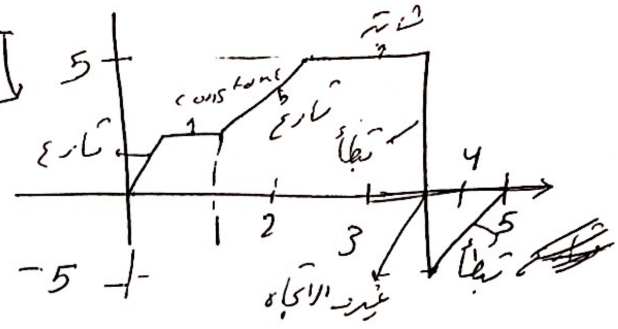
65 constant velocity means $a = 0$ so E

66 speed increasing
(1) ازن مش خط مستقيم.
(2) ميله موجب
A

67

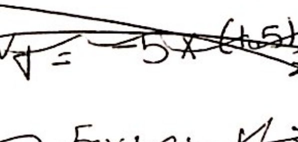


68



ازا كانت $V = 0$ لازم يكون
مافي ياعرة تسارع ولا أي حركة بكون
في هنا سرعة.
E

69



هوا الزئبق بس يتحرك رح يكونا
بجاه س
نفس سرعة المصعد بالتالي
رح يرتفع لفوق ويرجع
ينزل $\Delta x = V_0 t - \frac{1}{2} g t^2$
(معادلة السقوط)

نفس فكرة سؤال 74
75

هيكون الجواب

كمان

C

$V \propto t$

بتزايد مع الزمن

77

$V = V_i - gt$

When $t = 0$

$V = V_i$

والسرعة الوحيدة

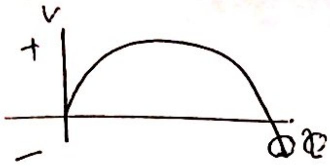
اي مش بتلاشه

من نقطة الاصل هي

C

وهي هي

70 E

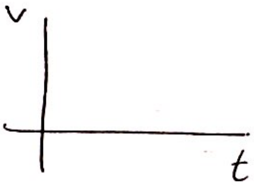


يكون الإشارة بالسالب
عشان هيكون يتحرك بسرعة ولكن
بالاتجاه العكسي

71 C بالتسارع

لأنه الميل موجب

72



Δx ??

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

= Area under the curve

$= 3 \times 12 = 36$ m

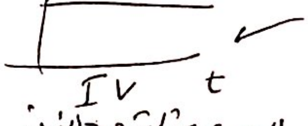
D

73 A خطأ لأنه متسارع

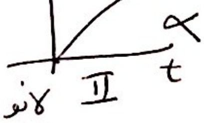
لأنه بمشي بسرعة ثابتة وبعدين بيتسارع

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

74 (ث) I and IV — E

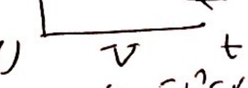


السرعة ثابتة مع الزمن ✓



لأنه السرعة تتزايد مع الزمن ✗

لأنه هو يتسارع و[illegible] السرعة تزداد ✗



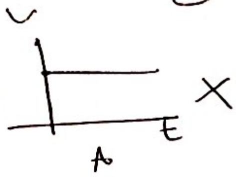
(A) تسارع ثابت بغض [illegible] سرعة تزايد [illegible] ✗

75 $v_i = 0$

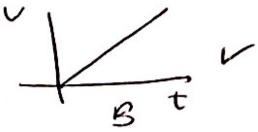
(أ) $v = gt$

(ب) $y = \frac{1}{2}gt^2$

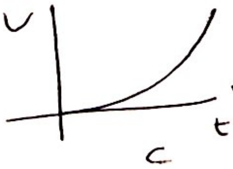
(ت) $v^2 = 2gx$



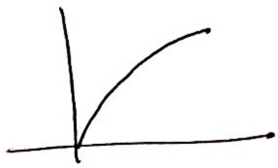
✗ لأنه $v \propto t$ تتزايد مع الزمن



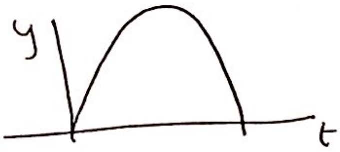
✓



$v \propto t$ (~~$v \propto t^2$~~)



✗ ($v \propto t$)



$y = \frac{1}{2}gt^2$
وعبارة [illegible] الاشتقاق
السلم موجود [illegible]
يكون القطع المكافئ [illegible]
و [illegible] 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 $|A| = \sqrt{(10)^2+(10)^2+(5)^2} = 15$

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

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

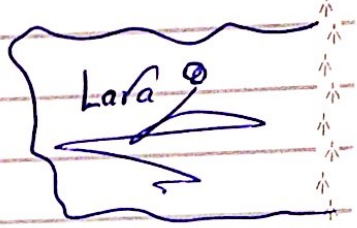
19 $\theta = \tan^{-1}\frac{45}{25} = 61°$ Ans: B

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 $\quad \tan\theta = \frac{10}{4} \quad \theta = 68°$ } 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 component $= A\sin\theta_2 = 10.6 \sin 41.6 \approx 7.2$

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 $\vec{A}.\vec{B} = (2)(4) + (6)(2) + (-3)(1) = 17\ m^2$

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 بصور من 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

منصة

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 مكاوي

1. $v = \frac{dx}{dt} = \frac{\Delta x}{\Delta t}$

معدل التغير في الازاحة بالنسبة للزمن

(A)

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

معدل التغير في السرعة بالنسبة للزمن

(C)

3. speed (non-polar quantity) كمية قياسية

4. (E) وحدة

5. (E) المسافة الأفقية

المتغيرات دائما بتكون

لنفس السرعة والزمن ثابتة

اذن (D) السارع

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

to

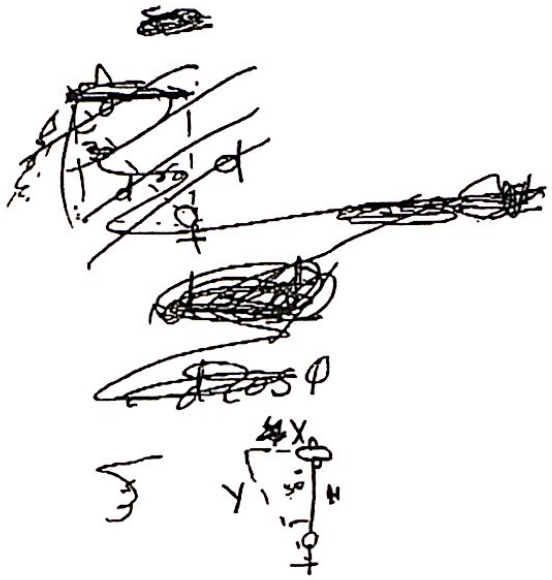
$r = 3\hat{i} - 1\hat{j} + 4\hat{k}$

$\Delta r = r_2 - r_1$

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

(B)

7.



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

Y it is the distance that sound waves have traveled

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

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

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

but

X is the distance that plane have traveled

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

$X = \tan 30\, H$

و عالنه

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

وقطع الصوت والطيارة هذه المسافة
بنفس الزمن اذن

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

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

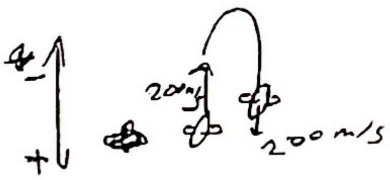
$$\frac{X}{Y} = 2$$

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

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

B half the speed of sound.

8.



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

موجه south

9

عادنه الشارع الى افقيا اذا
كان افقي اذن ما بأثر على
ضربه بالارض فرح يضربا مع
التاني

(A)

10

~~[illegible]~~

~~$V_x^2 = V_0 \cos\theta$~~

~~$V_y = V_0 \sin\theta - gt$~~

~~[illegible]~~

~~[illegible]~~

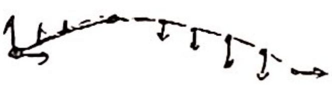
~~[illegible]~~

~~[illegible]~~

~~$V = V_0$~~

~~[illegible]~~

~~[illegible]~~



(D) constantly increasing downward velocity (gt)

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

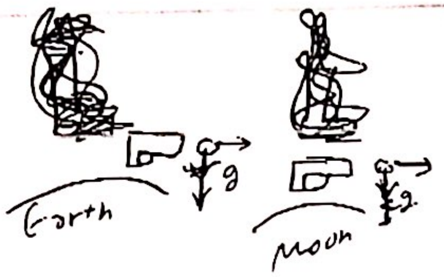
~~[illegible]~~

بشكل عام

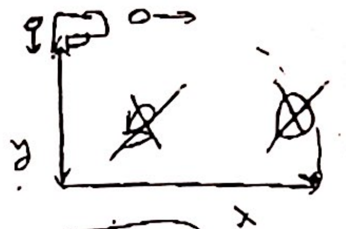
11

عمودي

12

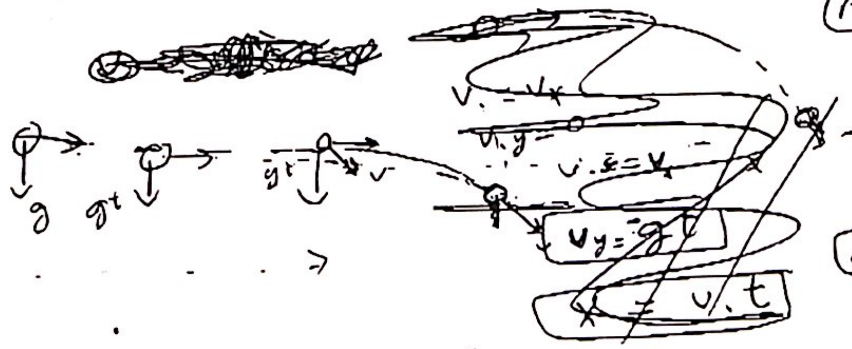


14



projectile

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



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

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

عبارة الرصاصات رح يتأثروا بجاذبية بتكون الجاذبية بالقمر اقل من الارض اذن المسافة اليارح يقطعها الرصاصة بالقمر رح تكون اكبر من المسافة في الارض والزمن اكبر

كمان I and II

(i) $X = V_0 t$

$X_E = V_0 \sqrt{\frac{2y}{g}}$

$X_m = V_0 \sqrt{\frac{2y}{g}}$

بتكون اصغر

$X_m > X_E$

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

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

اصغر

$t_m > t_E$

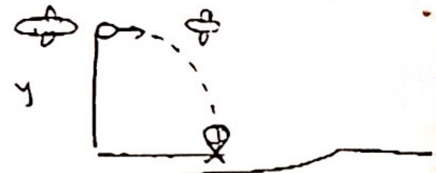
I and II

15 C

CA

B ✓ E ✓

D ✓



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

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

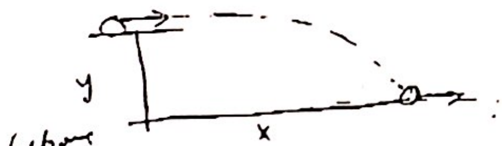
$V = V_0$

$X = V_0 t - \frac{1}{2} g t^2$

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

A ✓

اذن الجواب C



$V_0 = V_x$

$V_{y0} = 0$

$V_x = V_0$

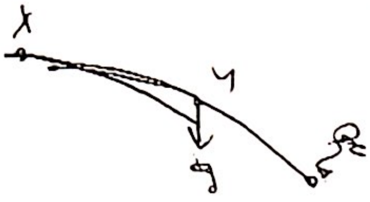
$V_y = -gt$

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

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

وعبارة y متساوية في الحالتين

13



م

(21)

16

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

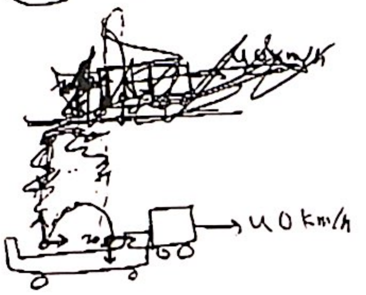
$X = \frac{1500}{36} \sqrt{\frac{2000}{10}}$

$X = 41.7 \times 10$

$X = 417\ m$

(C) ≈ 420m

17



(C) On the flatcar

because the object has both horizantal and vertical components

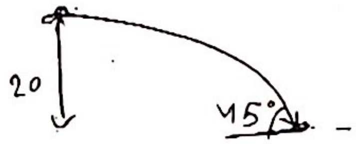
اعركبه الافقيه لسرعه subject

$Platform\ c\ as\ 5 = $

اذن احنا اعطينا بارتفاع وبعدها

اشرنا عليه

18



$v_x = v_y$

$v \sin\theta = v \cos 45$

$v_x = v$ ✓

I need to find (v_y)

$v_{oy} = 0$

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

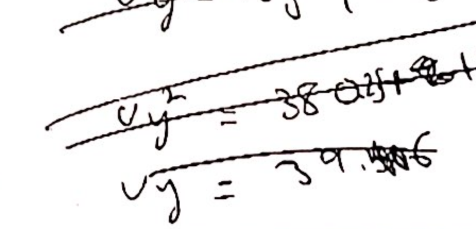
$v_y^2 = 0 - 2g\,20$

$v_y = \sqrt{400}$

$= 20\ m/s$

$v_x = v_0 = 20\ m/s$

19



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

~~$v_y^2 = 38\ldots$~~

~~$v_y = 39.\ldots$~~

~~$v_y = v_0 - gt$~~

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

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

$t = 2\,s$

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

$v_x = 480 \times \cos 30$

$= 848.7 \text{ m/s}$

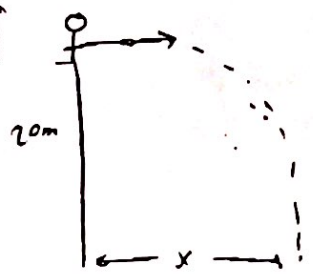
$R = v_x t$

$6t$

$0 = v \sin\theta - gt$

$t = \frac{480 \sin 30}{g} \Rightarrow t = 2 \times 50 = 100$

21



$y = 20$

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

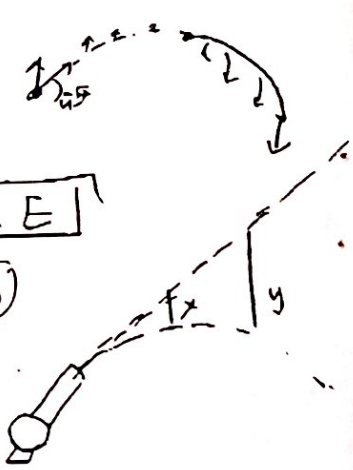
$-20 = -\frac{1}{2} g t^2$

$t = 2 \text{ s}$

$x = v_0 t$

$= 20 \times 2 = 40 \text{m}$

22



تجاه الأفقي:

$v_x = v_0 \cos\theta$

$v_y = v_0 \sin\theta$

بعد الزمن:

$v_y = v \sin\theta - gt$

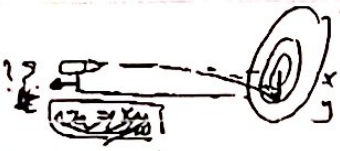
بوجود الزمن $y = v_{0y} t - \frac{1}{2} g t^2$

تجاه الزمن $y = v_{0y} t$

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

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

24)



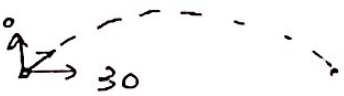
$t = ?$ s

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

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

$y = 0.05\ m$

25)



$v_y = v_{oy} - gt$

$0 = 20 - 10t$

$t = 2$ s

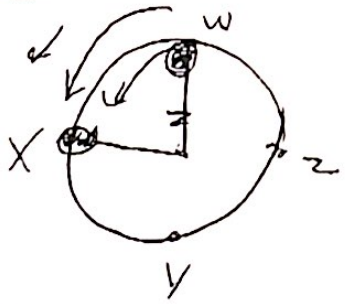
$t_{\text{كلي}} = 2 \times$ زمن الصعود

$= 2 \times 2 = 4$ s

$X = v_x t$

$= 30 \times 4 = 120$ m

26)

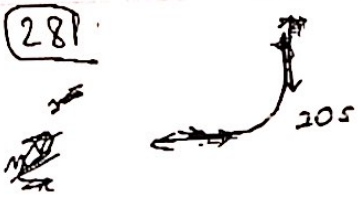


27) ب

$x = 0 \quad y = 3$ m

$v = 6\hat{i}$

28)



$v = 200$ m/s.

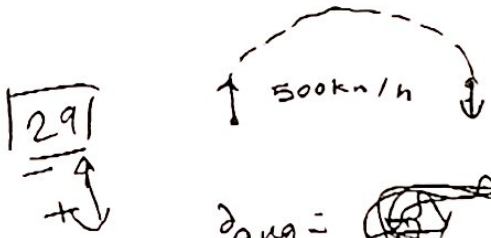
$a_{avg} = \frac{v_2 - v_1}{\Delta t}$

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

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

$= 14\ m/s^2$

29)

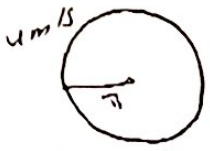


$a_{avg} = \frac{500 + 500}{40}$

$= \frac{1000}{40}$

$= 25\ km/h^2$

30)



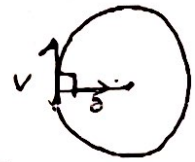
$V = \frac{\Delta x}{\Delta t}$

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

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

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

~~19~~

31 

C

32 

$v_2 = 2v_1$

Same

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

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

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

$4a_1 = a_2$

C ✓

33 @ have same a

(A) $v_A = 2v_B$

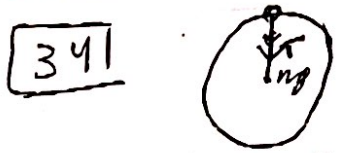
$a_A = \frac{2v_B}{}$

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

$= v$

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

$4R_B = R_A$

34 

$v = 4$ m/s

~~$T + mg = ma$~~

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

$= 3.2$ m/s² down

35 $a = \frac{v^2}{R} = \frac{16}{25} = 32$ up m/s²

36 $a = \frac{v^2}{R} = \frac{100}{20} = 5$ m/s²

37 

$a = 25g$

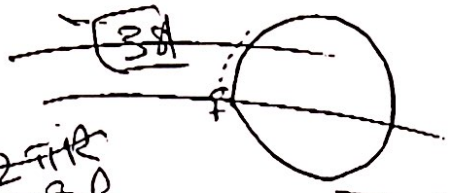
$a = \frac{v^2}{R}$

$v^2 = aR$

$v = \sqrt{25g}$

$= 16$ m/s.

~~$T = 2\pi r$~~

38 

~~$a = 2\pi R$~~

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

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

$= \frac{400}{15.9} = 25.15$ m/s²

$T = 2\pi R$

$\frac{1}{2} \cdot 2\pi = \frac{\pi}{2}$ 25m

$s = r\theta$

$25 = r\left(\frac{\pi}{2}\right)$

$r = \frac{50}{\pi}$

$r = 15.9$

50 100

38

$S = r\theta$

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

$R = 25$

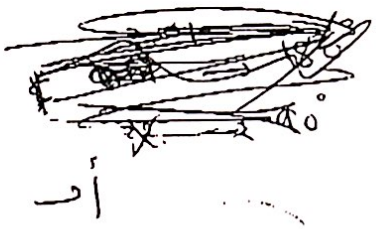
1.57

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

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

$\omega = \frac{\pi}{\frac{2}{T}} = \frac{\pi}{2T} = 0.314$ 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

$V = 2 \times 3.14 \times 1.5$
$= 9.42$

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

$4\pi \rightarrow 1s$
$2\pi \rightarrow ?$
$? = 5s$

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

$V = \frac{2\pi R}{T}$
$= \frac{2 \times 3.14 \times 1.5}{5}$
$= 18.84$ m/s

$a = \frac{v^2}{R} = 237$
$= 240$ m/s

40 $R = 8$

$T = 10s$

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

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

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

$= 5\ m/s$

16m

$R = vt$

$6vt$

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

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

$t = 1.8\ s$

$R = 5 \times 1.8$

$= 9.1m$

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 $V_{bR} = 14 km/h$

$V_{Rb} = 6 km/h$

$V_{mb} = 6 km/h$

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

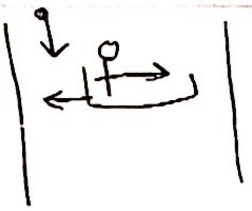
$= 6 + 14$

$= 20 km/h$

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

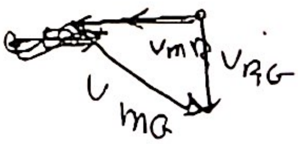
$= 20 + 6 = 26 km/h$

42



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

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

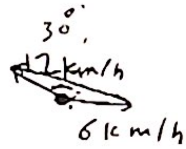


$V_{mG} = V_{RG} + V_{mR}$

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

$= 10$ km/h .

43

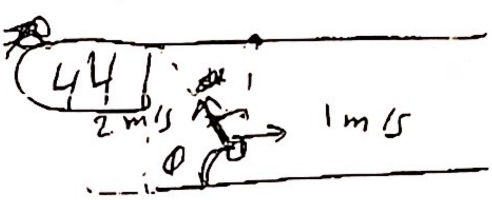


~~$V_{BG} = V_{BR} + V_{RG}$~~

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

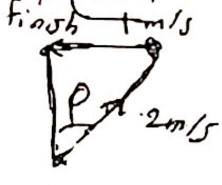
اذا كان القارب ع بيجر 30° من الشمال نحو الغرب اذن هم عم يقصد منطقة فوق الشمال وهم لبرو صيرة كان التيار .

44



لأنه 90°
طالب أقل وقت ممكن
فش بفرده الوصل
اسرع شي عنو
ومش طالب طول الخانة
لازم يكون 90°

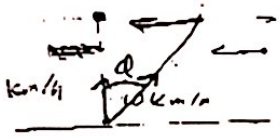
45



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

$\varphi = 30°$

46



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

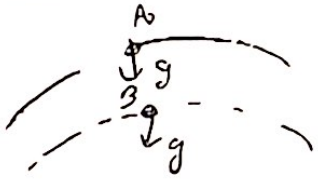
$$\theta = 30^\circ$$

W of N

E of N

(B)

47



$$a_{AB} = a_{AO} - a_{BO}$$
$$= g - g = 0$$

تم بحمد الله

وأخيراً تحيات

إعداد: وئام معاوية

Chapter 5

1. B
لأنه اذا لا يوجد قوة تأثر على الجسم
$F = \Sigma ma$
اذن $a = 0$
وعليه اما يكون ساكن ويظل ساكن او يتحرك بسرعه ثابته ويظل نفس الاشي وهذا اتعلق نظرية القصور الذاتي

2. لنفس الكره
اذن 2
D
$F_{net} = 0$

3. $F = ma$
so D

4. A mass

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

6. و نفس الكره 7

8. $F = ma$
$F = 5.6 \times 1$
$= 5.6 \; m/s^2$

9. D net force
$F_{net} = ma$
ثابته وموجه
اذن F و a
same direction

10. B الاشياء
لا تتغير بسبب ما اسمه القصور الذاتي Inertia لأنها عبارة تتغير حركة الجسم خاصة اثرنا على جسم بقوه
$F = ma$
كل ما زادت m لازم نزيد القوه عشان نحركها ونغير من اتجاهه.

11. C يعني
اي يكون ساكن او متحرك وبالعكس

12. C لأنها
في الطاقة
قصور يسمى كتلتها بحيث أنه لو اهملت القوه رح يتأثر بس الخيط التحتاني بدون ما يتأثر العلوي

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

14. B
$W = mg$
$F = ma$ يعني

15.
الاشياء نفسها وبيتم بالرغم
وهي اسمه C
في freefall

16.
$W = 9.8 \; m$
$\frac{W}{m} = 9.8$
وهذا يعني
E
الحجم لأن اشي حركي يوحد جسم خفيف رح يتحرك اسرع

17. 12 kg
12 kg
scale $W = 120$ N
$m = \frac{W}{g} = \frac{120}{10}$
$m = 12$ kg
$W = mg$
$= 12 \times \frac{1}{6}$
$= 2$

(18) $m_1 < 3m_2$

$V = gt + V_0$ ~~V_0~~ → 0

يعني مايعتمد على الكتلة

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

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

(B) the same

(20) $a = 0$

$F \neq ma$ → 0

$F = 0$

$5 - 3 - f = 0$

$f = 5 - 3$

$f = 2N$

left word

(B)

(21) (A)

$5 - 3 = 2$

(22) 1- $N = mg$

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

3- $N + 10 = mg$

$3 < 2 < 1$

(23) $N_i = mg$

$N_{ii} = mg\cos\theta$

(C) (less)

(24) $m_B = 3m_A$

$F_B = F_A$

$m_B a_B = m_A a_A$

$3 m_A a_B = m_A a_A$

$3 a_B = a_A$

(A)

(25) zero

$a = 0$

$F_{net} \to a$

نفس الاتجاه

(26) $F = 8N$

4s

16 kg

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

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

$\Delta V = 2$ m/s

(B)

$\Delta V = 0.5$

in this case

(27) ↑12N

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

$= 2$ m/s²

North

(28) $W = 9000N$

$F = 500N$

$F = ma$

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

$= \frac{500}{9000}$

$= .55$ (B)

(29) always

(F) = ma

$f_{app} - 0 = ma$

(30) 25 kg

$f = 20N$ 20°

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

$= .75$ m/s

(31) $W = 1.5N$

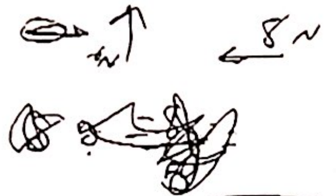
30°

$V_0 = 12$ m/s

$F = mg = 1.5N$

down

(32) 5 kg



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

$= 10N$

ما اخذ من محور الاتجاه

ازاي ما منها الزاوية

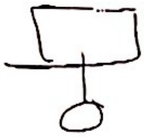
نسبا هي

33

$T = 400\ N$

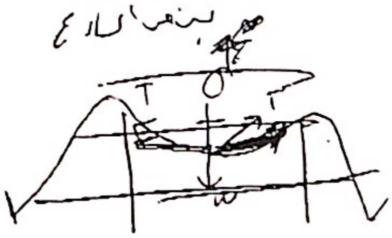
$T = mg = W = 400$

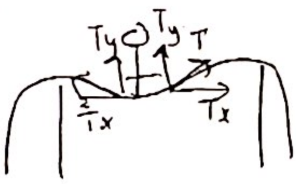
34 $A = zero$



لانو
التنين عم بيندول
بنفس التسارع

35





حسابة لانو T ال2
component y و x
كبشة الف 1
$T_y = mg$
وبما انه الا كمان x
component نحنا هيدي
بتكون اكبر من w

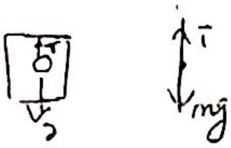
36 1000 kg

$a = 3 m/s^2$

$f_{net} = ma$

$= ma$

37



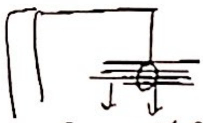
$T = ma + mg$

$T = m(a+g)$

$= m(-3+9.8)$

$= 34\ N$

38



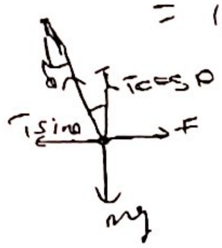
$T - mg = -ma$

$T = mg - ma$

$T = 16000(9.8-3)$

$= 11000 N$

39



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

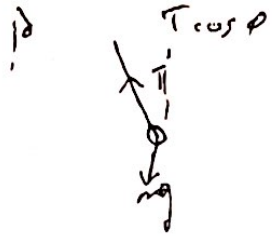
① $T^2 \cos\theta^2 = 1$

$+$

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

①+② $T^2 = 5$

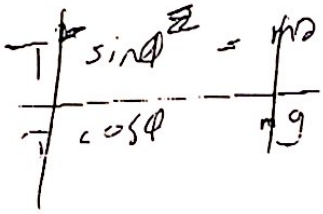
40



$F_{net} = ma$

$T\sin\theta = ma$

$T\cos\theta = mg$

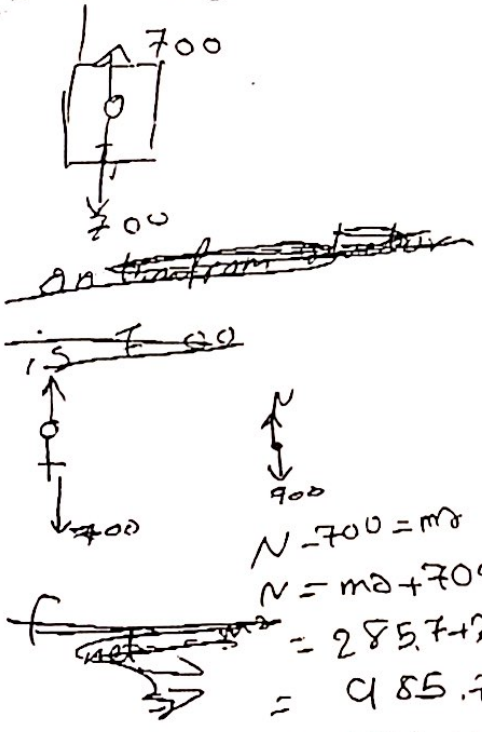


$\tan\theta = 0.306$

$\theta = 17°$

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) $N = m(g-a)$

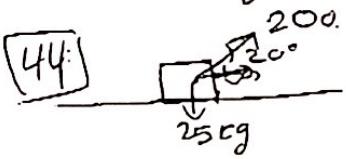
(B) $N = m(g+a)$

(C) $N = mg$

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

(E) $N = mg$

44



$N = mg + 200\sin 20$

$= 245 + 68.4$

$= 313$

$\sim$ 310N

45

$kmg\sin\theta = km a$

$a = 4.9\ m/s^2$

$490\ cm/s^2$

46

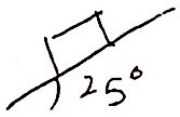
$N = mg\cos\varphi$

$= 25\cos 25$

$= 22.6$

$= 23N$

47



$F - mg\sin\theta = 0$

$F = mg\sin\theta$

$= 25\sin 25$

$= 10.5\ N$

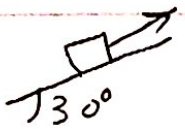
$\approx 11\ N$

48

$N = mg\cos$

$= 23N$

49



$F - mg\sin\theta = ma$

$32 - 4.9m = 0$

$4.9m = 32$

$= 6.5\,kg$

50

$mg\sin\theta - f = ma$

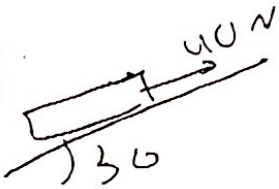
$4.9m - 40 = 2m$

$2.9m = 40$

$m = 13.79$

E

51



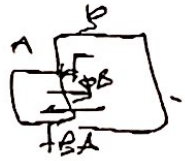
$F - mg\sin\theta = ma$

$40 - 4.9m = 2m$

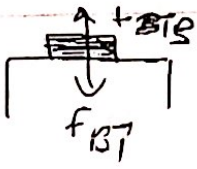
$40 = 6.9m$

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

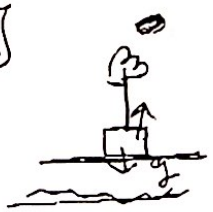
52 B



53



54



The block on Earth

55

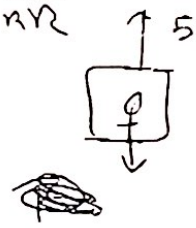
$F - mg = ma$

$f = mg - ma$

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

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

56



$F = mg$

$= 90 \times 9.8$

$= 880\,N$

57

$F - mg = ma$

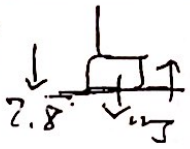
$F = m(g + a)$

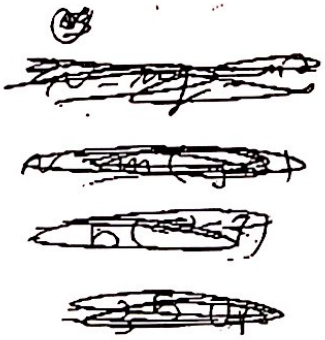
$F = 90(10 + 1.4)$

$= 774$

$\approx 760\,N$

58



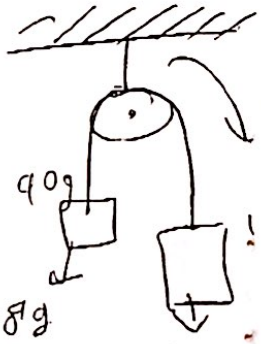


$F_{BG} = mg$

$= 49\,N$

$f_{GB} = 49\,N$

59



$W = 882$, $110g$

$W = 1,07$

$1,07 - T = 110$

$+$

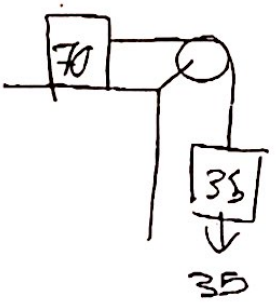
$T - 882 = 98$

$1,07 - 882 = 188$

$a = 1.03$

$\approx 0.98\,m$

(60)



$35 - T = 3.8a$

$T = 7.14a$

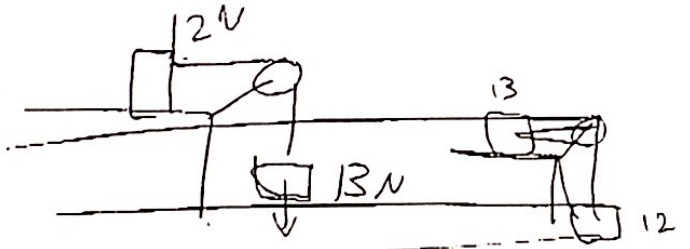
$35 - 7.14a = 3.6a$

$35 = 10.7a$

$a = 3.25\ m/s^2$

$= 3.3$

(61)



$13 - T = 1.3a$

$T = 1.2a$

$12 - 1.3a = 1.2a$

$13 - 1.2a = 1.3a$

$12 = 2.5a$

$a = 4.8$

$a = 5.2$

(62)

$5g - T = 5a$

$T - 4g = 4a$

$1g = 9a$

$a = \frac{g}{9}$

(63)

$350 - T = 35a$

$T - 250 = 25a$

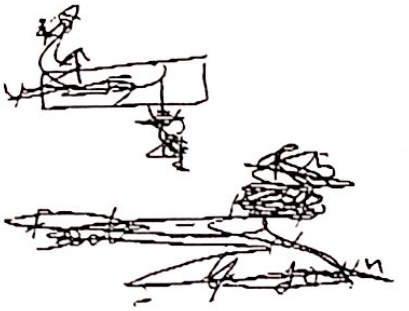
$100 = 60a$

$a = 1.66\ m/s^2$

$T = 41.7 + 250$

$= 290\ N$

(64)



zero

لا تولوكان

الكرة

يكون التسارع

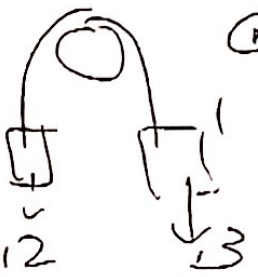
وكان ع تحرك

ليس هو ثابتة

(A) 6 ub for free falling body

$2 \quad 2g$

$= 9.8$



$13 - T = 1.3a$

$T - 12 = 1.2a$

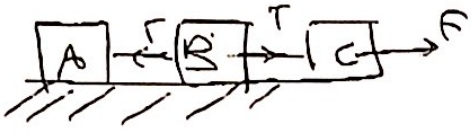
$\frac{a}{g} = \frac{1}{25}$

$a = \frac{1}{25}g$

(65)

لا توجد $9 = X \cdot Y$

(66)



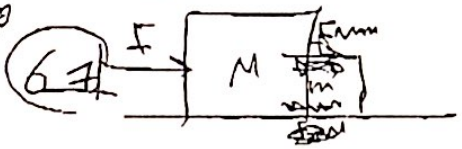
$F - T_1 = Ma$

$T_1 - T_2 = Ma$

$T_2 = Ma$

$F = 3Ma$

(67)



$F_{net_B} = Ma$

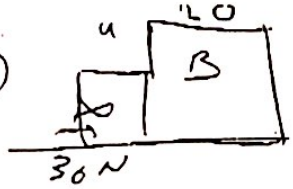
$F - f_{sm} = Ma$

$f_{sm} = ma$

$F = (M+m)a$

$f_{sm} = mF/(m+M)$

(68)



$F - f_{AB} = ma$

$F_{AB} = Ma$

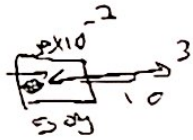
$F = (m+M)a$

$36 = 24a$

$a = 1.5\ m/s^2$

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

(69)



$F = M_T a$

$3 \times 10^{-2} = 50a$

$a = 6$

$F - F_{ST} = ma$

$F_{ST} = F - ma$

$= 3 \times 10^{-2} - m_S a$

$= M_T a - ma$

$= (50a - 10$

$,03 - 0,00$

$= 0.24$

$= 2.4 \times 10^{-2}$

$= 1.5 \times 10^{-2}$

Chapter 6

إعداد: محمد الهدلق

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

بتاثير زيادة الكتلة يؤدي الى زيادة f_s

(2) M_K :

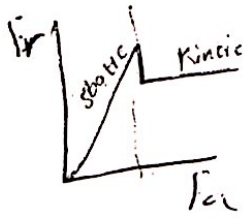
① ليس له وحدة

② ليس له اتجاه

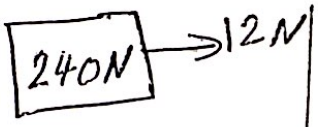
(3)

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

وذلك قبل بدء الانزلاق



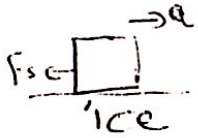
(4)



$f = M_K N$

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

(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:

$f_s = (10N)\cos 0$

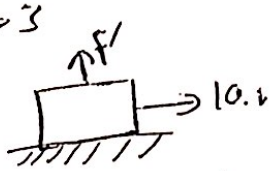
في الحالة الثانية:

$f_s = 2e.6$

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)

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

$F > f_{s\,max}$

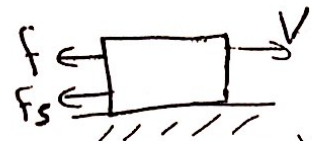
$f_s = \mu_K N = (0.4)(40) = 16\,N$

(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) $v_f = v_i + at$

$0 = 15 + a(4)$

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

$F_K = \mu_K N = \mu_K mg$

لحظة 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 التسارع ليساوي 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

$\boxed{P > F}$

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

$N = F_g - P\sin\theta$

$N < F_g$

بما ان الجسم يتحرك بسرعة ثابتة

(16) $f\cos\theta - f_K = ma = 0$

$f\cos\theta = F_K$

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

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

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

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

$(1.04)f = 160$

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

(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 الجسم باتجاه عمودي على سطح الجسم)

(19) اقل قوة تلزم لتحريك الجسم عندما

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

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

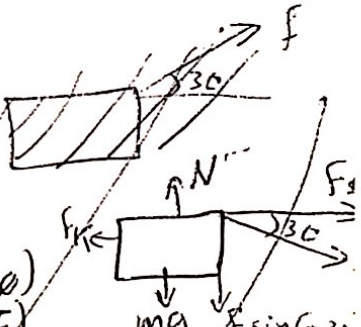
$F\cos(30) = (0.4)((12)(9.8) + (0.5)F)$

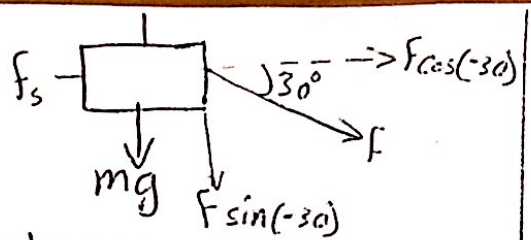
$F = \frac{47.04}{\cos 30} = 54.317\ N = 54$

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

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

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





اقل قوة تلزم لتحريك الجسم عندما تكون

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

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

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

$F = \frac{47.04}{\cos 30 - \sin 30} = \frac{47.04}{0.366}$

$F\cos 30 - 0.2F = 47.04$

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

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

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

$= 22^\circ$

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

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

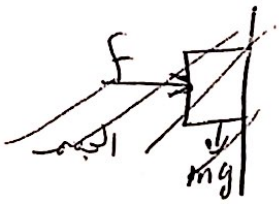
$\theta = 26.6 \approx 27^\circ$

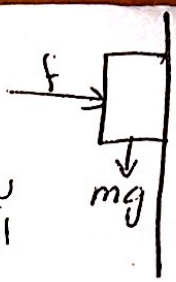
عند هذه الزاوية تكون القوة و بتالي اكبر تتساوى

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

$f_s = \mu_s N$

(23)





ليتحرك الجسم للاسفل

اذا كانت

$mg > f_{smax}$

$f_{smax} = \mu_s N = \mu_s F$

$= (0.6)(12)$

$= 7.2$

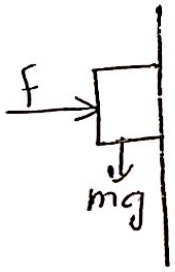
$F_{smax} > mg$

بتالي:

$f_s = mg$

$= (0.5)(9.8) = 4.9$

(24)



نبحث اذا كان الجسم تحرك للاسفل ام لا

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

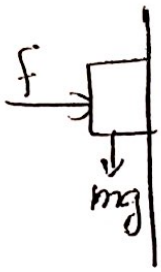
$f_{smax} = \mu_s F = (0.6)(5) = 3N$

$mg > f_{smax}$

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 التسارع يساوي صفر

(26)

$mg = 4.9$

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

$mg > f_{smax}$

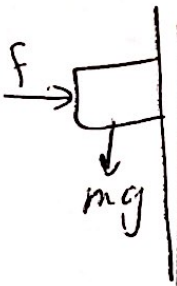
بتالي الجسم تحرك للاسفل

$mg - f_K = ma$

$mg - \mu_K f = ma$

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

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



(27) في الحالة الاولى

$F_1 = f_{s_1} + ma$

في الحالة الثانية

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

بما ان:

$F_1 = F_2$

$f_{s1} + ma = f_{s2} + mg\sin\theta + ma$

$f_{s1} = f_{s2} + mg\sin\theta$

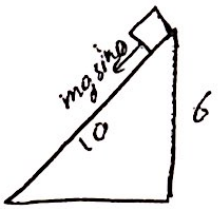
بما ان

$mg\sin\theta > 0$

بتالي

$f_{s1} > f_{s2}$

(28)



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

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

$\mu_s = \tan\theta$

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

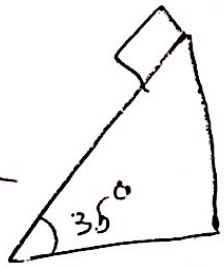
(30)

$mg\sin\theta - f_K = 0$

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

$\mu_K = \tan\theta = 0.577$

(31)



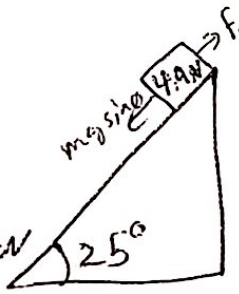
$mg\sin\theta - f_K = ma$

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

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

$a = 2.409$

(32)



نبحث اذا تحرك الجسم للاسفل ام لا

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

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

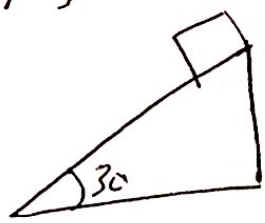
$f_{smax} = 22.2$

$f_{smax} > mg\sin\theta$

بتالي الجسم لم يتحرك

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

(33)



نبحث اذا تحرك الجسم للاسفل ام لا

$mg\sin\theta = 24.5N$

$f_{smax} = (0.5)(49)(\cos 30) = 21.2$

$mg\sin\theta > f_{smax}$

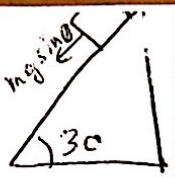
بتالي الجسم تحرك للاسفل

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

$= 17N$

$mg\sin\theta = 24.5\ N$

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



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

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

$f_{s\max} = 21.2$

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

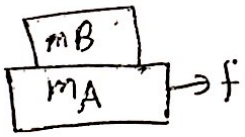
$F = mg\sin\theta + f_{s\max}$

$= 24.5 + 21.2$

$= 46\ N$

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

(36)



ملاحظة: اذا كانت

$F \leq f_{s\max}$ بين A و B

ينفصل الجسمان

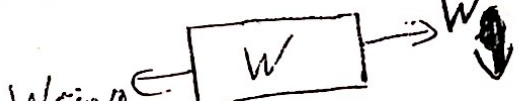
اما اذا كانت

$F > f_{s\max}$

ينفصل الجسمان

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

(37)



بما ان الغلاح ساكن

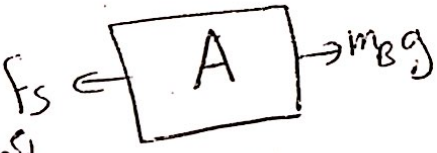
$W\sin\theta + f_s - W = 0$

$f_s = W - W\sin 37$

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

$f_s = 8\ N$

(38)



لكون الجسم على وشك ان
يتحرك فان

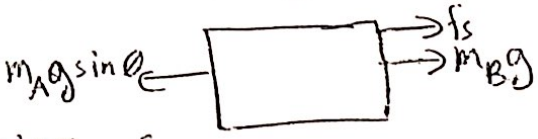
$m_B g = f_{s\max}$

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

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

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

(39)



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

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

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

$m_B = 5.735 - 3.276$

$m_B = 2.458 \rightarrow 2.5$

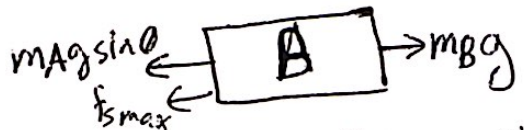
(40)

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

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

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

(41)



$m_A g \sin\theta = 49\ N$ ← لكان $m_A g \sin\theta$ اكبر من $m_B g$ بالتالي تكون الحركة باتجاه $m_A g \sin\theta$ والاحتكاك باتجاه $m_B g$ عكسي

$m_B g = 78.4$

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

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

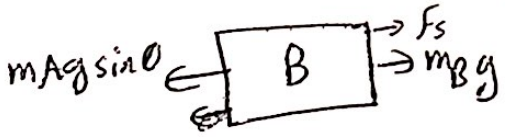
$m_B g - m_A g \sin\theta - f_K = m_{(A+B)} a$

$12.7 = (18)a$

$a = 0.69$ باتجاه $m_B g$

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

$m_B g = 29.4$



$m_A g \sin\theta - m_B g - f_K = m_{all} a$

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

$a = 2.0$

$m_A g \sin\theta$ باتجاه

up

(43) $\sum f = ma$

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

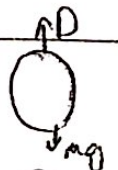
(44)

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

$a > g$

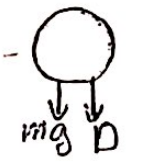
(46) (حالة التوازن) $V < V_T$ (اعلى ارتفاع)



$mg = D \Leftarrow V = V_T$

$mg > D$

$V > V_T$



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

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

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

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

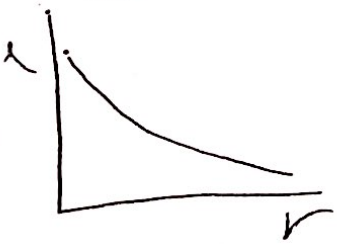
$V = 150\ rev/minute = \frac{150(2\pi r)}{60}$ m/s

$V = 9.42$

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

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

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



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

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

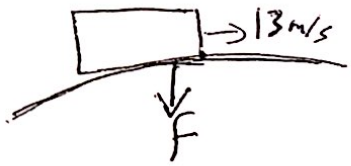
$T_2 = \frac{1}{2}T_1$

(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 دائماً باتجاه المركز

(57)



لكي يفتح باب السيارة يجب ان تكون $F = 800N$

وعندما كان السيارة تتحرك بسرعة 13m/s

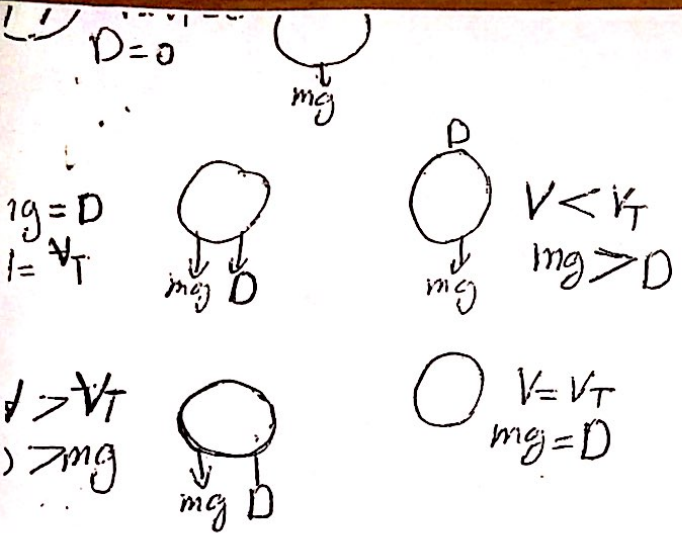
$F = \frac{mV^2}{R}$

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

لكي يفتح الباب يجب ان تكون F تساوي 800N

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

(1)



(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) $f_s = \frac{mv_{max}^2}{R}$

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

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

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

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

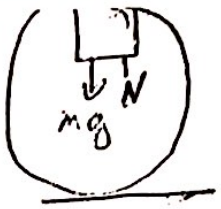
$a = \frac{(18)^2}{75} = 4.32$ m/s²

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

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

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

(62)



$\Sigma f = mg + N$

وعندما ان

$0 = mg$

$\Sigma f = 2mg$

(63) من السؤال السابق

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

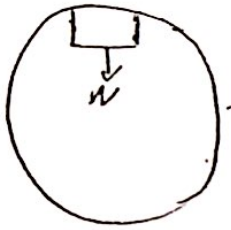
$a = (2)(9.8) = 19.6$ m/s²

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

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

$v = 19.8 \approx 20$

(64)



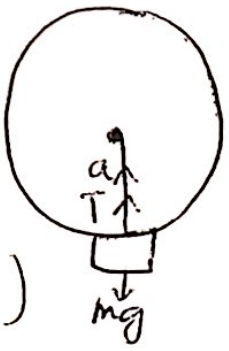
دوران

$f_g = N = mg$

$f_b = 0$ ← تبقى محفوظة طالما الدولاب يدور

$f_s = 0$

(65)



$T - mg = ma$

$T = mg + ma$

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

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

$= 19.6 + 32$

$= 51.6 \simeq 52$ N

(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)

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

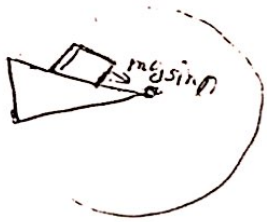
$R = \frac{v^2}{a}$

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

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

بثابتية R تزداد اربع اضعاف

(71)



$mg\sin\theta = ma$

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

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

$\theta = 17^\circ$

Chapter 7

Erg: وحدة قياس الطاقة ✓

$W = \Delta K.E$ وحدتان

Ft lb وحدة القياس ✓

Natt وحدة قياس القوة ✗

$1.m \Rightarrow W = F.d = N.m$

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

1) Scalar quantity:
Power / speed
energy / ~~mass~~ / distance
time

Vector quantity:
velocity / ~~force~~ / displacement
acceleration / force / ~~mass~~
~~mass~~ weight

3) $W = \vec{F} \cdot \vec{d}$

بما ان الازاحة تساوي صفر
بناي الشغل يساوي صفر

i) 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) نفس فكرة سؤال 5

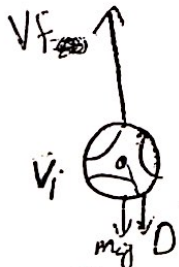
6) $W = 0$

7) $W_{mg} = \Delta K$

V_f دائماً موجبة وان
V_i اكبر من

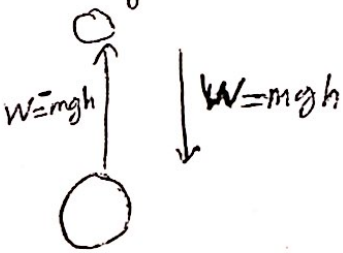
2) ~~$W_{mg} = \Delta K$~~ $W = mgh$

V_f اكبر من V_i بما ان
تكون ΔK سالبة

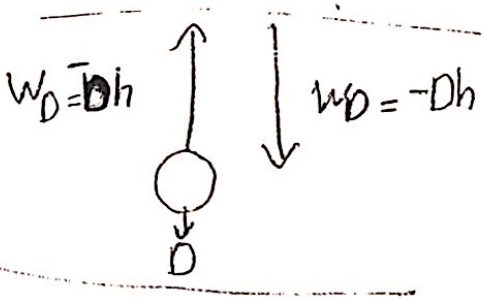


اعداد
محمد
الهدلق

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

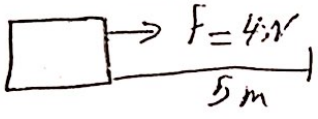


$W_D = -Dh - Dh = -2Dh$



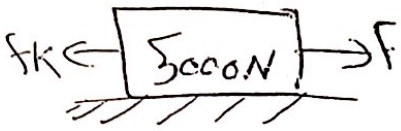
10)

$W_f = F \cdot d = (4)(5) = 20J$



11)

بما ان السرعة ثابتة بناي
التسارع يساوي صفر

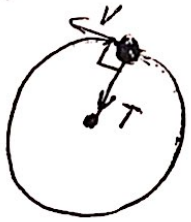


$F - fK = ma = 0$

$F = fK = MK\,N = (0.05)(5000) = 250N$

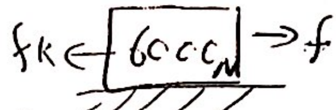
$W_f = F \cdot d = (250)(1000) = 2.5 \times 10^5 J$

7)



لان الزاوية بين (V) و (T) تساوي 90 وبناي
$\cos 90 = 0$
$W = 0$

(12)

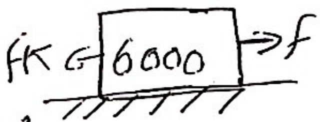


بما ان التسارع يساوي صفر

$F = F_K = \mu_K N = (0.05)(6000) = 300$

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

(13)



$a = 0.2\ m/s^2$

$F - f_K = ma$

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

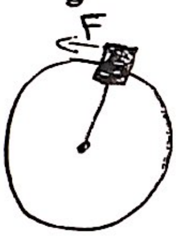
$F = 420\ N$

$W_F = F \cdot d = (420)(1000) = 4.2 \times 10^5$

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

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

(15)



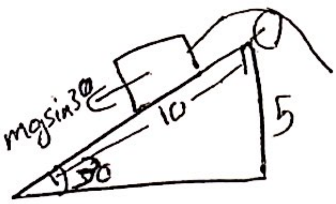
d = one revolution

$= 2r\pi = 15.7\ m$

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

$= (3)(15.7) = 47.1$

(16)



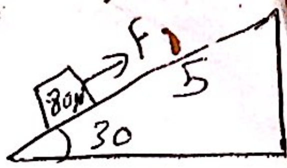
بما ان السرعة ثابت
بالتالي التسارع
يساوي صفر

$F_m - mg\sin 30 = 0$

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

$W_m = F_m \cdot d = (50)(10) = 500\ J$

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



$F - mg\sin 30 = ma$

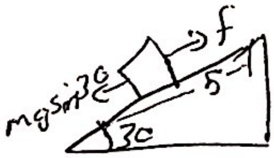
$F = mg\sin 30 + ma = (80)(0.5) + \left(\frac{80}{10}\right)(1.5)$

$F = 28\ N$

$W_F = F \cdot d = (28)(5)$

$= 140\ J$

(18)

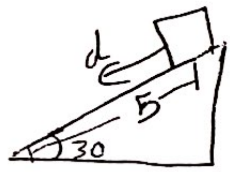


$F - mg\sin 30 = 0$

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

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

(19) $W_{mg} = mg \cdot d$



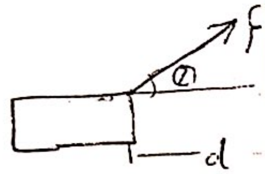
$= (mg)(d)(\cos(90+\theta))$

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

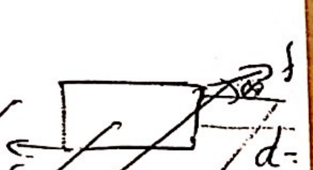
$= (80)(5)(0.5)$

$= 200\ J$

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



(21)



~~اول شغل يكون اكبر يكون عند اقل قوة احتكاك ومن ثم~~

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

~~اي عندما يكون الصفر~~

~~$F\sin\theta = 0$~~

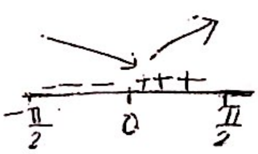
~~$\sin\theta = 0$~~

~~$\theta = zero$~~

$W_F = Fd\cos\theta$

$dW = Fd\sin\theta = 0$

$\theta = 0$



تشغل مركبة القوة على y-axis وعلى z-axis بشكل صفر لأن الزاوية في تلك الحالة تكون 90 بين F و d

وبنتيجة 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 (2) - (1)

~~$100 = 4K - Kx_0 + 6K - Kx_0$~~

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

$200 - 100 = K(60 - x_0) - K(40 - x_0)$

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

$100 = 20K$

$K = 5$

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

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

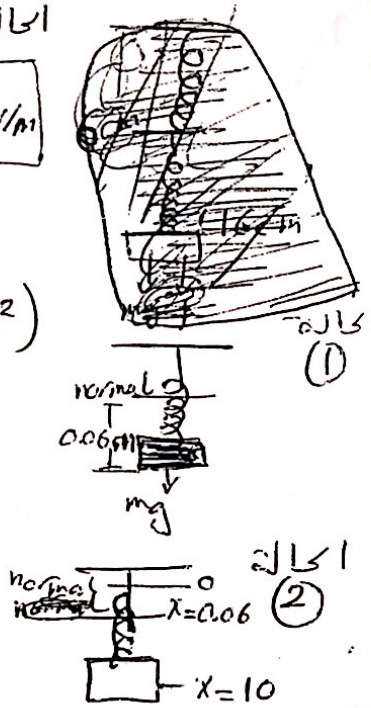
28) $mg = K\Delta x$

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

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

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

$= -3.66$

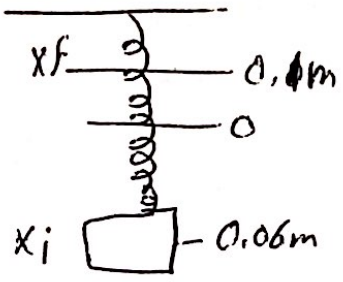


(29) $K = \frac{20}{0.06}$

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

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

$= -1.06$ 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) $V_x = \frac{1}{2} m V_x^2 = \frac{1}{2} (500) V^2 = 250 V^2$

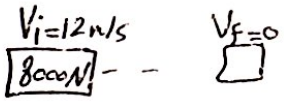
$V_y = \frac{1}{2} m V_y^2 = \frac{1}{2} (2000) V^2 = 1000 V^2$

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

$V_y : V_x$

$4 : 1$

(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 التسارع بالتالي تكون مساوية لجسمين لهما نفس الكتلة ويتحركان بنفس السرعة هي كوكبين مختلفين

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

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

$K_{moon} : K_{Earth}$

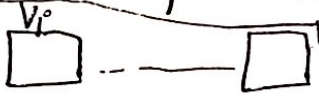
$1 : 1$

ملاحظة : الكتلة تختلف كوكب لآخر لاختلاف g اما 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) $W_{net} = \Delta K.E = K_f - K_i$

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

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

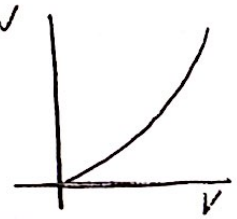
$= 160\ J$

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 تصبح $V = V_T$ ومن ثم تثبت وتصبح بمقدار mg بيانيا نحتاج إلى منحنى

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 الأول $(F_1)(d_1)(1) = 0 - K_{i_1}$

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

بما ان

$F_1 = F_2$

$K_{i_1} = K_{i_2}$ ③ بيانيا

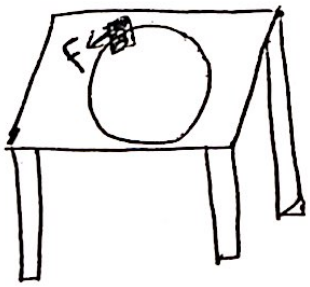
$d_1 = d_2$

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)



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

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

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

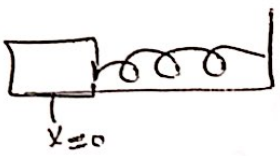
$= \sqrt{\frac{6(2\pi(2.5))}{0.5}}$

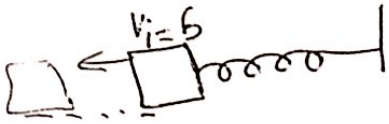
$V = \sqrt{188.5} = 13.7\ m/s \simeq 14$

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

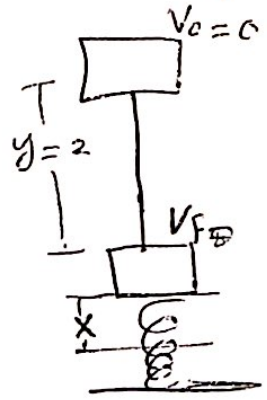
$K.E \propto t^4$

(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

$\Delta K = \Delta U$

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

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

$F = kx = (1.5\times10^5)(0.02) = 3\times10^3\,N$

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

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

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 $\frac{1}{e^{\frac{1}{L}}}$

2) الشبه بين القوة التي بذل بها الاثر والقوة التي تؤثر بها

3) بما ان الارتفاع الذي رفع الجسم اليه متساوي 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

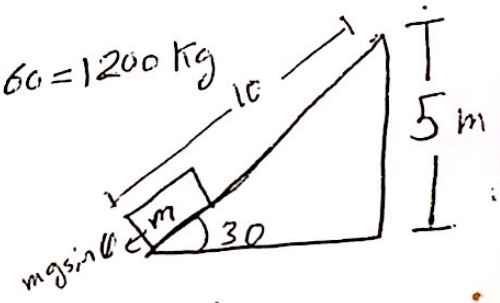
9) Kilowatt - hous
وحدة قياس الطاقة الكهربائية
وتساوي Work

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

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) $F = ma$
$50 = 2a \Rightarrow a = 25\ m/s^2$
$d = V_0 t - \frac{1}{2} a t^2$
$= 0 - \frac{1}{2}(25)(2)^2 = 50\ m$
$Work = F \cdot d = 50 \times 50 = 2500\ J$
rate of work $= \frac{\Delta W}{\Delta t} = \frac{2500}{2} = 1250\ watt$

$V_0 = 0$, 2kg $\Rightarrow f = 50\ N$
$V_f = V_0 + at$
$V_f = 10(2) = 20$

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

$a = \frac{50}{2} = 25\ m/s$ $\quad P = Fv$

$d = v_0 t + \frac{1}{2} a t^2$ $\quad v^2 = v_0^2 + 2ad$

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

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

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

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

$W = ct^2$

$W = P t$

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

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

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

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

$v \propto t$

(67)

Chapter 8

إعداد: محمد المرسلي

إذا أثرت قوة محفوظة على جسم فإن مجموع الشغل لمسار مغلق ليس صفر

إذا كانت القوة محفوظة فإن شغلها يعتمد على المسافة بين نقطة البداية و النهاية و لا يعتمد على المسار

$W_1 = W_2 = W_3$

(5) بما أن كلا الجسمين عادا إلى نفس النقطة التي انطلقا منها فإن طاقة الوضع تكون نفسها (لأنهما عادا إلى نفس الارتفاع)

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

(7) التغير في طاقة الوضع يساوي صفر (بسبب العودة إلى نقطة البداية)

$E_m = K + U$ ثابت

وبما أن سرعة كل من الجسمين قلت بتالي الطاقة الحركية قلت وبما أن $\Delta E_m \neq 0$ بتالي يوجد تحول لطاقة أي أثرت قوة غير محفوظة

$E_m = K + U$ ثابت

$E_m = K + U$ ثابت

تقل لأن السرعة تقل

بتالي E_m تقل

(4) السرعة كبيرة جداً وبما أن $KE = \frac{1}{2}mv^2$

بتالي تكون الطاقة الحركية كبيرة جداً

(8) في حالة الجسم الساكن تكون $v = 0$ وبما أن $K.E = \frac{1}{2}mv^2$

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 بإمكانه أن يبذل شغل إذا كان بإمكانه الحركة بحيث تقل طاقة الوضع الخاصة به أي تزداد الطاقة الحركية له حسب أن

$W = \Delta K.E$

(12) $U = -W_f = Fd\cos\theta =$

$d = vt$

$U = FVt$

$U = FVT$

(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 $= x_1 f_1 \Rightarrow U_2 = -x_1 f_2$

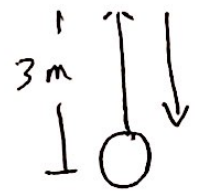
③ مساحة $= \frac{1}{2}x_1 f_1 \Rightarrow U_3 = \frac{1}{2}x_1 f_1$

$U_3 > U_1 > U_2$

الترتيب من الأكثر سالبية

2 > 1 > 3

(14)



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

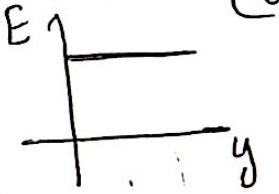
$U = mgh$

h ← اعلى ارتفاع ثابت

(15) بما ان مقاومة الهواء يمكن تجاهلها بتالي

$\Delta E_m = 0$

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

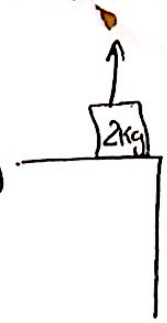
$\Delta E_m = 0$

$E_m = E_m$

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

$K = 4800 - 1200 = 3600$

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



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

$\Delta U = U_f - U_i = 500$

$mg(h_f - h_0) = 500$

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

$h_f = h_0 + 25.5$

$= 20 + 25.5 = 45.5$

(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 (~~horizontal~~ vertical component) =

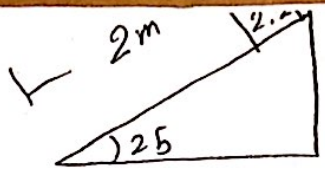
$= \frac{1}{2} m (V \sin 60) = \frac{1}{2}(\frac{1}{2})(8.6)$

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

(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) $U = K$

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

$v^2 = 2gh$

$v = \sqrt{2gh}$

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

$= 6.02 \text{ m/s}$

3) $\Delta E_m = 0$

$E_{m_f} = E_{m_i}$

$K_f + U_f = K_i + U_i$

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

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

$v_f^2 = 4.5 + 4.9 = 9.4$

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

4) $f = -\frac{du}{dx} \Rightarrow du = -f dx$

$\int du = -\int f dx$

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

$U - 0 = -2x^4$

$U = -2x^4$

25) at $x = 1 \Rightarrow U(1) = 10$

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

E_m at $x = 1$: $E_{m_1} = U(1) + K(1) = 12.5$

$\Delta E_m = 0$

$E_{m_0} = E_{m_1}$

$K_0 + U_0 = 12.5$

$\frac{1}{2} m v^2 + 0 = 12.5$

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

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

$x_0 = 0.07 \text{ m}$

$U = K$

$\frac{1}{2} k x^2 = \frac{1}{2} m v^2$

$\left(\frac{1}{2}\right)(20)(0.07)^2 = \frac{1}{2}(0.015) v^2$

$v = \sqrt{6.533} = 2.556$

$K.E = \frac{1}{2} m v^2 = \frac{1}{2}(0.015)(2.558)^2$

$= 0.049$

(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) $K.E = U$

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

$x^2 = \frac{m v^2}{K} \Rightarrow \boxed{x = v\sqrt{\frac{m}{K}}}$

~~$\frac{1}{2} K x^2 = \frac{1}{2} (\frac{m v^2}{K})$~~

(34)

$mgh = \frac{1}{2} K x^2$

$(700)(12) = \frac{1}{2} K x^2$

$\frac{1}{2} K x^2 = 8400$

700N

10

2

(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) $\Delta E_m = 0 \quad E_{m1} = E_{m2}$

$mgh_1 = mgh_2 + \frac{1}{2}mv^2$

$= 2g(h_1 - h_2)$

$= \sqrt{2g(h_1 - h_2)}$

(1) ~~$mg(2r+h) = mg2r + \frac{1}{2}mv^2$~~

ما دام الطاقة الميكانيكية محفوظة السيارة تفقد اة

$mg(2r+y) = mg2r + \frac{1}{2}mv^2$

$2mgr + mgy = 2mgr + \frac{1}{2}mv^2$

$\boxed{gy = \frac{v^2}{2}}$ — (1)

(39)

$\Sigma f = ma$

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

$v^2 = gr$

(1) في المعادلة

$gy = \frac{gr}{2}$

$\boxed{y = \frac{r}{2}}$

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

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

$v = \sqrt{gr} = \sqrt{\left(\frac{3}{2}\right)(9.8)} = 3.8\ m/s$

(41) عند اعلى ارتفاع (Point 3) يكون

الجسم يمتلك اقل طاقة حركية

واكبر طاقة وضع وهما ان

$\Delta E_m = 0$

$E_{m1} = E_{m2}$

$\Delta K + \Delta U = \Delta K + \Delta U$

$K_1 + U_1 = K_2 + U_2 = E_m$

$E_{m1} = K_2 + U_2$

$E_{m1} = E_{m2} = U + K$

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

عند اعلى ارتفاع يكون هذا المقدار اكبر ما يمكن وبالتالي تكون الطاقة الحركية اقل ما يمكن وهما ان

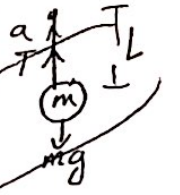
$K.E = \frac{1}{2}mv^2$

بالتالي تكون السرعة اقل ما يمكن

(42) at the bottom of circle

$\Sigma f = ma = \frac{mv^2}{L}$

$T - mg =$



(42)

$\Delta E_m = 0$

$E_{m_{Top}} = \sum m_{bottom}$

$K + U = K + U$

$\frac{1}{2} m V_{Top}^2 + mg(2L) = \frac{1}{2} m V_{bottom}^2 + 0$

$\frac{V_{Top}^2}{2} + 2gL = \frac{V_{bottom}^2}{2}$ → (1)

at the top

$\Sigma F = ma = \frac{mV^2}{r}$

$mg = \frac{mV^2}{L}$

$V^2 = gL$

من المعادلة (1)

$\frac{gL}{2} + 2gL = \frac{V^2}{2}$

$V^2_{bottom} = 5gL$

$V = \sqrt{5gL}$

ملاحظة: عند اقصى ارتفاع الشكل لسيارة صغير

(44) the limits of motion are when $U = E_m$ when K.E = zero

$8x^2 + 2x^4 = 9$ J

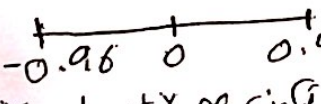
بالتجريب

$8(.96)^2 + 2(.96)^4 \doteq 9$

$9 = 9$

بالتالي الجواب

$-0.96 \le x \le 0.96$ m



اي اما تكون مع +X او -X

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

$U(1) = 8 + 2 = 10$

$\Sigma E_{m_1} = 10 + 2.5 = 12.5$

~~when it stop~~

$\Delta E_m = 0$

$\Sigma E_m = \Sigma E_m$

$K(1) + U(1) = K + U$

when it stop

$K(1) + U(1) = 0 + U$

$E_{m_1} = U$

$8x^2 + 2x^4 = 12.5$

بالتجريب

$8(1.1)^2 + 2(1.1)^2 \doteq 12.5$

$12.5 = 12.5$

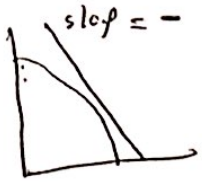
وبما انه كان يتحرك على محور السينات الموجب (معطيات) بالتالي قانه يمكن عندما

$x = +1.1$

(46) $F = -\frac{dU}{dt}$

(F) is positive when $\frac{dU}{dt}$ is negative $F = (-)(-) =$

that when U is decreasing functi



(47) $F = -\frac{du}{dt}$

$|F| = \left|\frac{du}{dt}\right|$

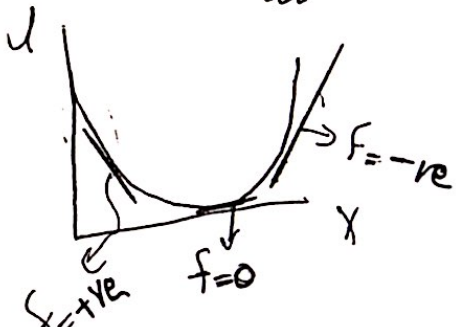
ميل : $C = 0$

ميل : $AB < CD$ (أقل انحدار)

بالتالي: بما ان (F) تعتمد على القيمة المطلقة للميل

$CD > AB > BC$

(48) $F = -\frac{du}{dt}$

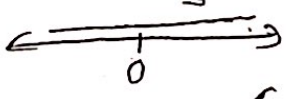


بما ان اقتران (U,X) يشبه اقتران التربيعي

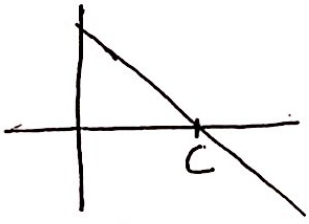
$U = (X-c)^2$

$F = -\frac{du}{db} = -2(X-c) \Rightarrow X = c$

$\frac{dF}{db} = -2$



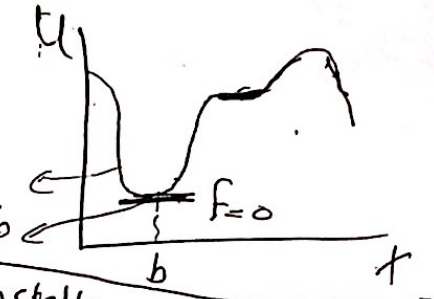
F decreasing (من $-\infty$ إلى ∞)



(49) The Point of stable equilibrium

نقطة تكون عندها $f=0$ والاقتران عند أقصى (U-X)

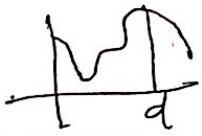
only b



(50) The Point of unstable equilibrium

نقطة تكون عندها $f=0$ والاقتران عند أقصى (U-X)

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) $F = ma_1 = -\frac{du_1}{dx}$

$\left.\frac{du}{dx}\right|_{x=1} = 10x + 8x^3 = 16 + 8 = 25$

$F = -25 = ma$

$a = \frac{-25}{m} = \frac{-25}{0.2} =$

(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) $U = Ax^{-12} - Bx^{-6}$

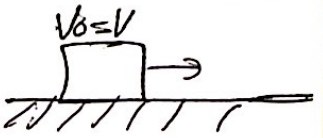
$F = -\frac{du}{dx} = -\left(\frac{-12A}{x^{+13}} + \frac{6B}{x^7}\right)$

$= 12A/x^{13} - 6B/x^7$

(56)

(57)

(58)



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

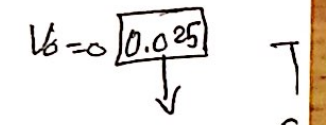
$\Delta K + \Delta U + \Delta E_{th} = 0$

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

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

الشغل الذي يبذل لاحتكاك يغير الطاقة الحركية والطاقة الداخلية فقط

(59)



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

$\Delta K + \Delta U + 15 = 0$

$K_f - 0 + 0 - U_i + 15 = 0$

$\frac{1}{2}mv^2 - mgh + 15 = 0$

$\frac{1}{2}mv^2 = mgh - 15 = 19.6 - 15 = 4.6$

$V_f = ??$

$V^2 = \frac{(2)(4.6)}{0.025} = 368 \Rightarrow \boxed{V = 19.1\ m/s}$

(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 $6kg(1,3)m$ / $4kg(0,0)m$ / $5kg(3,2)m$

$$X_{com} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{\Sigma M}$$

$$= \frac{4(0) + 6(1) + 5(3)}{15} = 1.4$$

Y_{com} the same $= 1.9$

$Y_{com} = 2$ m

Com (1.4, 1.9)

3) Ans: E the center of the circle

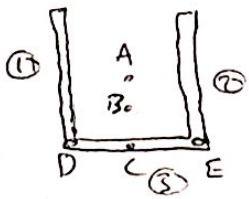
4) Ans: B Closer to the sun than the Earth or Mars bcz the mass of the sun is very large

$M_{sun} \gg (M_{earth} + M_{mars})$

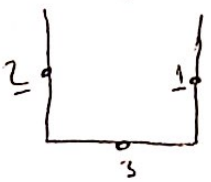
5) Ans: D "near the center of Earth"

6) Ans: B

The center of 1 2 3 is in the midway between A and B



the ends across the thickness

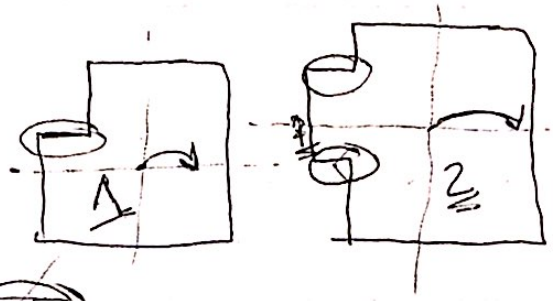


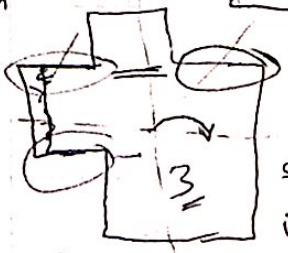
the center between 1, 2 in the midway between

the center "1,2" and "3" them is in the midway between them

COM

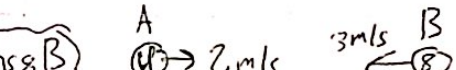
7) Ans: E





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 two cuts from the left side only.

8) Ans: B



$$V_{com} = \frac{V_1m_1 + V_2m_2}{M}$$

$$= \frac{(4)(2) + (8)(3)}{12} = -1.3 \text{ m/s}$$

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

$$H_{com} = \frac{m_1h_1 + m_2h_2}{M} = \frac{(5.4)(0.5) + (10.4)(0.25)}{0.75}$$

$\approx$ 7.1 m

10) Ans: C we first find V after 2 sec. by $V_2 = V_0 + at \Rightarrow V_1 = -19.6 / V_2 = 4.6$

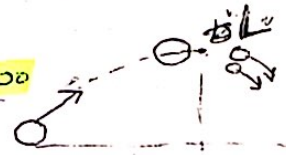
$$V_{com} = \frac{V_1m_1 + m_2V_2}{M} = \frac{(-19.6)(0.5) + (0.25)(4}{0.75}$$

$= -15.026 \approx 15$ 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: $y = V_0 t + \frac{1}{2} a (t)^2 \Rightarrow = 0 + (\frac{1}{2})(10)(4)^2 = 20$

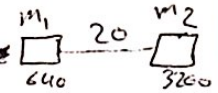
14) Ans: B) $\Sigma F_{ext} = 0$

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

m_1	m_2
5	10
1	2

so $V_1 = 2V_2$ for the 1kg amp. $V_2 = \frac{6}{2} = 3$ m/s

21) Ans: D) the motion was started with at least one of masses moving

22) Ans: B) $E_b \rightarrow E_a \Rightarrow \frac{1}{2} k x^2 = (\frac{1}{2})(100)(0.1)^2 = 0.5$

$E_{mg} = \frac{1}{2} m v_1^2 = (\frac{1}{2})(2)(0.36)^2 = 0.1296$

$\Delta E_m = 0.1296 - 0.5 = -0.3704$

$+\frac{1}{2}(4)(0.15)^2 = -0.3056$

23) Ans: C) $\Delta p = J \Rightarrow J = F \cdot t$ N.s

24) Ans: E) acceleration

25) Ans: D) $p = \sqrt{2km}$ $m_a = 4m_b$

$\frac{P_A}{P_B} = \frac{\sqrt{2 k_1 m_a}}{\sqrt{2 k_b m_b}} \Rightarrow \frac{P_a}{P_b} = \frac{\sqrt{4 m_b}}{\sqrt{m_b}}$

$\frac{P_a}{P_b} = \frac{3}{1}$

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 ver. O.

31) Ans: A $V = V_0 + at \Rightarrow V = 39.2$

$P = mV = (64.2)(2.5) = 98$

32) Ans: B $m_1 V_{1b} + m_2 V_{2b} = m_1 V_{1a} + m_2 V_{2a}$

$0 = (64)(0.0017) + 0.1 V_{2a}$

$V_{2a} = -1.1$

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 $P_b^0 = P_a \Rightarrow 0 = MV_1 + m_2 V_2$

$V = \frac{-m_2 V_2}{M}$

37) Ans: C $P_b^0 = P_a \Rightarrow 0 = MV + m_b V$

$\frac{P_{G_1}}{P_{G_2}} = \frac{m_{bullet1} V}{m_{bullet2} V} = \frac{2m_2}{m_2} = \frac{2}{1} (2:1)$

38) Ans: A Area under (F_y, 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 $V_{Comb} = V_{Comafter}$

$V_{con} = \frac{m_1 V_1 + m_2 V_2}{M} = \frac{0.2 * 3 + 4 * 2}{0.6}$

$= 0.33$

Ans: C

41) Ans: D $P_b = P_a \Rightarrow m_1 V_1 = (m_1 + m_2) V$

$2000 * 3 = (2000 + 500) V \Rightarrow V = 2.4$ 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 $V_f - V_i^0 = V_{rel} \ln(\frac{M_i}{M_f})$

$\frac{20}{1500} = \ln(\frac{M_i}{M_f}) \Rightarrow 1.004 = \ln(\frac{M_i}{M_f})$

$M_f = \frac{1000}{1.004} = 996 \Rightarrow 1000 - 996 = 4$ 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 $F_{net} t = \Delta P \Rightarrow 1 * 1 = P_f - P_0$

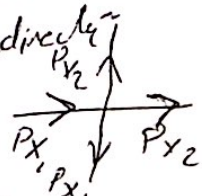
$P_f = +1$ kg·m/s

53) Ans: C "moe 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 $m_1 v_1 = (m_1 + m_2) V \rightarrow \sqrt{2gy}$
$V = 0.245$ $v_1 = \frac{2.450}{0.003} = 816 \simeq 8 \times 10^2$

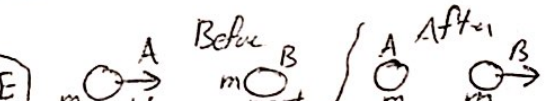
66) Ans: C $K = \frac{1}{2} m v^2$
$40 = \left(\frac{1}{2}\right)(5) v^2$
$V = 4$ m/s

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

$$= 0 + \frac{2m_2}{m_2}\,10 = 20\ m/s$$

74) Ans: B

$P_{before} = P_{after}$

$$m_A V = m_A V_A + m_B V_B \Rightarrow mV = mV_A + 2mV_B$$

$$V = V_A + 2V_B \quad (1)$$

$$\Rightarrow \frac{V - 0}{V_B - V_a} = 1 \Rightarrow V = V_B - V_a \quad (2)$$

$$V_B - V_a = V_a + 2V_B \Rightarrow -V_B = 2V_a$$

so $V_a : V_b = 1 : 1$

$$\Rightarrow V_a = \frac{-V}{3} \;/\; V_B = \frac{2V}{3}$$

75) Ans: A By using $\Delta P = 0$ & $V_{2a} - V_{1a} = V_{1b} - V_{2b}$

76) Ans: E "the incident and target particle have the same mass" the same as 71

77) Ans: D $X = \frac{2}{5}Y \Rightarrow K = \frac{1}{2}mv^2 \Longrightarrow K(x) = 50$ 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

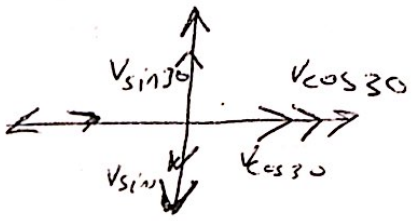
80) Ans: A $p_b = p_a \Rightarrow \boxed{mv_0 = mv_1 + mv_2}$ ... ① $\boxed{v_0 = v_1 + v_2}$

$2K_b = K_a \Rightarrow 2\left(\frac{1}{2}mv_0^2\right) = \frac{1}{2}mv_1^2 + \frac{1}{2}mv_2^2 \Rightarrow 2v_0^2 = v_1^2 + v_2^2$ ②

$\Rightarrow (5 = v_1 + v_2)$ $(50 = v_1^2 + v_2^2)$ 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 $\pi \longrightarrow 180^\circ$

$1 \longrightarrow ??X$ $\quad X = \frac{180^\circ}{3.14} = 57.3^\circ$ 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

9 $\Delta\theta = \omega_i t + \frac{1}{2}\alpha t^2 \Rightarrow \alpha = \frac{2(\Delta\theta - \omega_i t)}{t^2} = \frac{2(450 - 20 \times 9)}{81} = 6.7\ rad/s$

ans: D

8 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

Lara ✪

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 $t = 1\,min = 60\,s$ { $w_i = 0$ $w_f = 4\pi$ 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 $t = 9 + 9 = 18\,s$ 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 $\Delta\theta = w_i t + \frac{1}{2}\alpha t^2 \Rightarrow t^2 = \frac{2(20\pi - 0)}{4} = 10\pi$ $t = \sqrt{10\pi} = 5.6\,s$ Ans: E

21 $\alpha(t) = (6t^2)$ $\frac{dw}{dt} = 6t^2 \Rightarrow w = \int 6t^2 dt = \frac{6t^3}{3} = 2t^3 + c^{\nearrow zero}$

$\Rightarrow \frac{d\theta}{dt} = 2t^3 \Rightarrow \theta = \int 2t^3 dt = \frac{2t^4}{4} = ((1/2)t^4)$ rad ans: C

22 from Q21 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 الخطي هو نفسه أي أن هذه العلاقة ليست علاقة عامة لإيجاد الزمن.

ans: B

23 Using Q21 and Q22 $w = 2t^3 \Rightarrow$ & when $\theta = 10$ rev $t = 3.3$

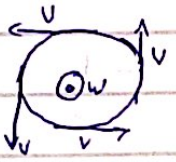
So $w = 2(3.3)^3 \approx 75$ rad/s ans: B

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 $\Delta\theta = \frac{s}{r} = \frac{4}{0.015} = 266$

$r = \frac{0.03}{2} = 0.015$

$266 = 0 + \frac{1}{2}(2)t^2$

$t = \sqrt{266} \approx 16$ 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 revelouls/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

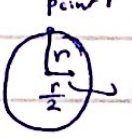
so $w = 0.318$ rev/s $= 0.318(2\pi)$ rad/s $= 2$ rad/s Ans: A

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



(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 $\omega_f = \omega_i + \alpha t \Rightarrow \omega_f = \alpha t$ (ω_i constant, α constant, t increasing) ⇒ ω_f increase

$a_t = \alpha r$ (α constant, r constant) $a_r = \omega^2 r$ (ω increases, r constant)

Vector $|a| = \sqrt{(a_r)^2 + (a_t)^2}$ (a_r increasing, a_t constant)

so $\vec{a}$ increases in magnitude and becomes more radial

41 $|\vec{a}| = \sqrt{(a_t)^2 + (a_r)^2}$ $|\vec{a}_i| = \sqrt{(a_t)^2 + (a_r)^2}$

$a_{t_{final}} = 4 a_{t_i}$

$\alpha_f r = 4 \alpha_i r$

$\alpha_f = 4\alpha_i$

$a_{r_{final}} = 4 a_{r_i}$

$\omega_f^2 r = 4\omega_i^2 r$

$\omega_f = 2\omega_i$

$|\vec{a}_F| = 4\sqrt{(a_t)_i^2 + (a_r)_i^2}$

$= \sqrt{16 (a_t)_i^2 + 16 (a_r)_i^2}$

$= \sqrt{(4 a_{t_i})^2 + (4 a_{r_i})^2}$

$= \sqrt{(4\alpha r)^2 + (4\omega^2 r)^2}$

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 $I_{yy} = 2(0)^2 + 2(2)^2 + 2(1)^2 + 2(+1)^2 = 12\ kg.m^2$

المسافة r هي الاحداثي
السيني

44 $I = 3m(0)^2 + 2m(\frac{L}{2})^2 + M(L)^2$

$= \frac{1M L^2}{2} + \frac{2ML^2}{2} = \frac{3ML^2}{2}$ Answer is C

مش عارفة ليش بال TestBank محطوطة E انا متأكدة من الحل

مهم 45 Ans: D thin انتباه كلمة
يعني نعاملها معاملة ال Hoop

مهم 46 Ans: D

مهم حفظ الحالات عن صفحة 255
47 $I_1 = \frac{2}{5}MR^2 \quad I_2 = \frac{2}{3}MR^2 \quad I_3 = \frac{MR^2}{2} \quad I_4 = MR^2$

suppose that $X = MR^2$
the $I_4 > I_2 > I_3 > I_1 \Rightarrow$ 1,3,2,4 Ans: C

بصراحة سؤاله مستفز ! لازم نحفظ القوانين

جيد ! 48 $I = \frac{1}{2}MR^2$

Mass $= \rho V$ $\quad V_A = \pi r^2 L \quad V_B = \pi (2r)^2\, 2L = 8 V_A$

$I_A = \frac{1}{2}\rho\pi r^2 L\, R^2$ — ①

$I_B = (\frac{1}{2}\rho\, 8\pi r^2 L\, 4r^2) = 32 I_A$ $\quad \frac{I_B}{I_A} = 32$

Answer: E

49 ans A (مشيه بسيطة)

50 $V = \frac{m}{P}$ ← constant

Lava

الحجم يزداد عندما تقل الكثافة ويقل عندما تزيد

(بتقليل الكثافة) عندما يزداد الحجم تزداد أبعاد الشكل بالتالي تزداد I

(بزيادة الكثافة) عندما يقل الحجم تقل أبعاد الشكل بالتالي تقل I

50 نفس مبدأ سؤال 49

لماذا أن كثافة الـ lead أكبر من كثافة الـ Wood

∴ الـ $I_{wood} > I_{lead}$

طبعاً بخبوثة الكتاب

51 ans B (عشان ربنا يزيده علماً)

52 $I_{ans} = I_{disk} + mr^2$

$= 0.7 + 0.32 = 1.02$ 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

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

56 ans: D

57 Ans: E

Torque $= FR\sin\theta$

$\tau_{\vec{F}_2} = \tau_{\vec{F}_5} = 0$ ($r=0$, $\theta = 180$)

$\vec{F}_4 \sin\theta$ (أعظم ما يمكن) $\sin 90$

$\tau_{F_1} = \tau_{F_3}$

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 $w_f^2 = w_i^2 + 2\alpha\Delta\theta$ ⇐ torque constant and I constant so α is constant

$(6)^2 = (5)^2 + 2\alpha(10\pi)$

$\alpha = 0.175 \Rightarrow \tau = I\alpha = 12(0.175) = 2.1$

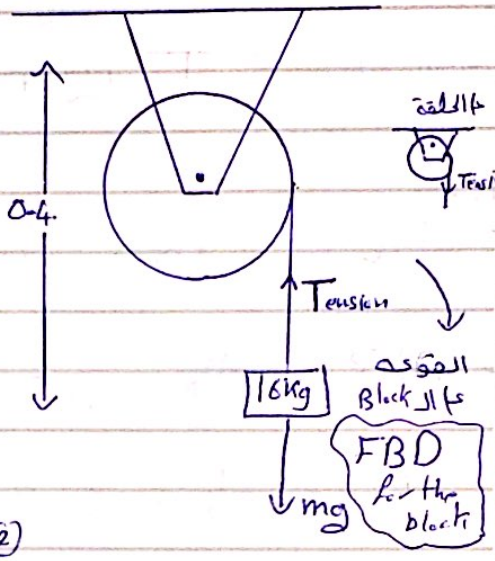
Ans: D

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 $R = 8.0\ cm = 8 \times 10^{-2}\ m$ { $I = 0.12\ kg.m^2$ { $m = 10\ kg$ { $\tau = 9\ N.m$

$\alpha = \frac{a}{R}$ ---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.

$$\tau = I\alpha = F \times R = M_{block}(g - a_{block})R$$

$$\left(\frac{a}{R}\right)\frac{m_{disk}R^2}{2} = M_{block}(g - a_{block})R$$

$$\frac{m_{disk}a_t}{2} = M_{block}(g - a_t) \Rightarrow 2M_{block}(g - a_t) = m_{disk}a_t$$

$$2M_{block}g - 2M_{block}a_t = m_{disk}a_t \Rightarrow 2M_{block}g = a_t(m_{disk} + 2M_{block})$$

$$a_t = \frac{2M_{block}g}{m_{disk} + 2M_{block}} = 8.34\ m/s^2 \longrightarrow T = m_{disk}g + M_{block}(g - a_t)$$

$$= (0.7)(9.8) + 2(9.8 - 8.34)$$

$$\approx 9.8\ N$$

ans : B

$\tau_{net} = F_1R_1 - TR_2 = I\alpha$

$T \Rightarrow T = \frac{F_1R_1 - I\alpha}{R_2}$

Then we use $T = mg$.

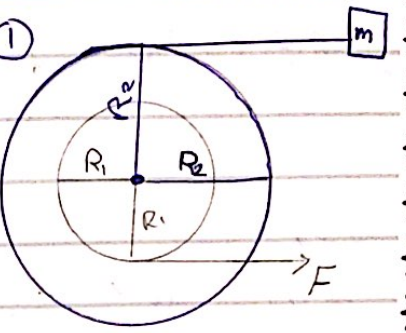
To find a : $a = a_t$

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 x 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 $w \Rightarrow \alpha = 0$

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 = constant × constant)

$\omega_f = \omega_i + \alpha t$

$\omega(5) = \alpha 5$ $\omega(10) = 10\alpha$

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

"أخيرًا"

لا تنسونـي من صالح دعائكم بظهر الغيب

إعداد: للدراسات محمد زيبت

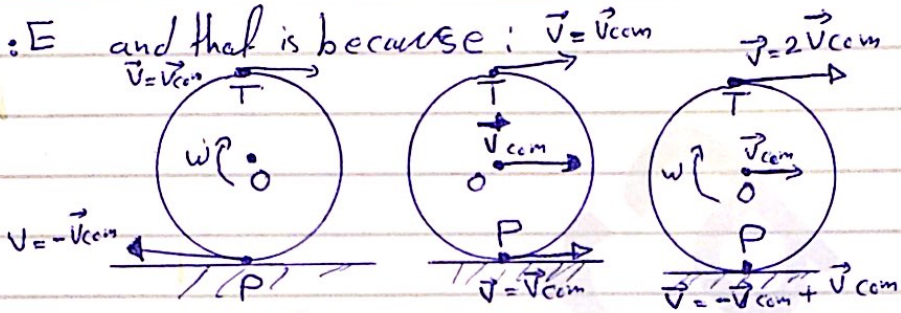
Chapter 11:

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 $\Delta\theta = w_i t + \frac{1}{2}\alpha t^2$

$= 0 + \frac{1}{2}(6)(3)^2 = 27$ rad but $s = \theta R = 27(0.5)$

$= 13.5$ 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 عشوائية دوائر الاستكمال غير مطلوبة ست حابوا لنا وحدة بالفايك

---

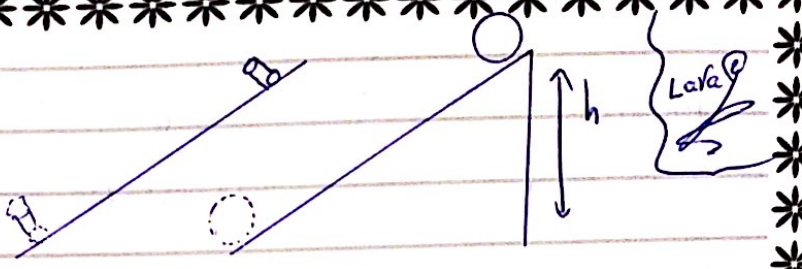
8 $K_{rot} = \frac{1}{2} I_{com} w^2$ $K_{translation} = \frac{1}{2} M V_{com}^2$

$= \frac{1}{2} MR^2 w^2$

$= \frac{1}{2} MR^2 \frac{(V^2)}{(R^2)} = \frac{1}{2} M V_{com}^2$ 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 reaches 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)

$\frac{3}{4} MV^2 = Mgh$

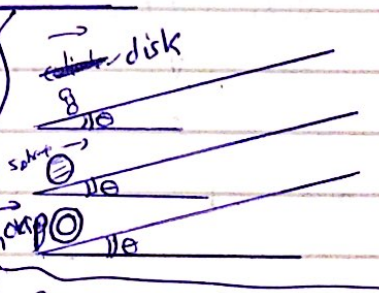
$h = \frac{\frac{3}{4} V^2}{g}$

$h = \frac{3}{4} \frac{V^2}{g}$

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 لاقت بعضها العتلة واستحوذ $V = \sqrt{\frac{4}{3}gh}$ 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 ~~$L = rmv = (0.3)\left(\frac{15}{1000}\right)$~~

$L = I\omega = mR^2\omega = \left(\frac{15}{1000}\right)(0.3)^2(3.5) = 4.7 \times 10^{-3}$

Ans: B

~~28 $L = mR^2\omega = (2)(0.5)^2(12) = 6$ kg.m²/s Ans: A~~

28 + 29 + 30 :

يوجد خطأ في إرقام السؤال يجب أن تكون 0.61 إلى 0.75

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

$L_1 = I\omega = mR^2\omega = 2(0.5)^2(12) = 6$ kg.m²/s Ans: A

30 دائرة تطلب The component in the xy plane

$L_2 = I\omega = mR^2\omega = 2(0.61)^2(12) = 9$ ans: C

28 دائرة الحل L هي

$L_{net} = \sqrt{(L_1)^2 + (L_2)^2}$

$= \sqrt{(6)^2 + (9)^2} \approx 11$ kg.m²/s

منه عارفة الأرقام مابتزبط إلا هيك مستحيل تزبط مع وجود 0.75 عموماً المهم الفكرة

---

31 using parallel axis theorem

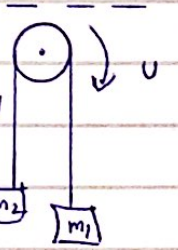
$I = I_{com} + Mh^2$ so $L = (I_{com} + Mh^2)\omega$ Ans: B

---

32 $L_1 = m_1 v R$

$L_2 = m_2 v R \Rightarrow L_{net} = (m_1 + m_2) v R + I\omega$

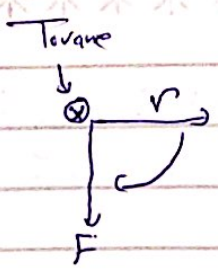
$L_{for\ the\ pully} = I\omega = (m_1 + m_2) v R + I\frac{v}{R}$



Ans: B

$L_{net} = (m_1 + m_2) v R + Iv/R$

33 ans: B



34 Ans: C

35 Ans: A

36 $F_{centripetal} = m\omega^2 R = (2)(12)^2(0.5)$
$= 144$
The distance from the origin = 0.75
$\tau = rF = 0.75\,(144) = 108$
Ans: E

---

37 $\tau = F \times r$
Force perpendicular 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 راجعوا سؤال 45 بالكتاب (ميكانيكس)

Lara 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