UNIT 1: Force and Motion

Chapter 1: Kinematics

Page: 8 – 9

1) A) Av = $\frac{s}{t} = \frac{400}{20}$ = 20m/s

   B) Av = $\frac{s}{t} = \frac{1500}{4x60}$ = 6.25m/s

2) A) Av = $\frac{v+u}{2} = \frac{10+20}{2}$ = 15m/s

   B) S= Avxt = 15x60 = 900m

3) a = $\frac{v-u}{2} = \frac{6-0}{3}$ = 2m/s^2

4) a = $\frac{v-u}{t} = \frac{1100-600}{10}$ = 50m/s^2

5) a) v = U+at = 4+2(1) = 4+2 = 6m/s

   b) V= U+at = 4+2(5) = 4+10 = 14m/s

6) t= $\frac{v-u}{a} = \frac{0-20}{-5} \approx \frac{-20}{-5}$ = 4s

7) a) it moves with increasing speed

   b) a=$\frac{Dv}{t} = \frac{50cm/s-10cm/s}{0.6}$ = 66.6cm/s^2

8) s=vt = 4.5m/sX15s = 67.5m

9) t= $\frac{s}{v} = \frac{800m}{200m/s}$ = 4s

10) a= $\frac{v-u}{t} = \frac{80-15}{5} = \frac{65}{5}$ = 13m/s^2

11) a= $\frac{v-u}{t} = \frac{11-23}{20} = \frac{-12}{20}$ = 0.06m/s^2

12) a) a= $\frac{v-u}{t} = \frac{20-60}{5} = \frac{-40}{50}$ = 0.8m/s^2

    b) the train decreases it's velocity by 0.8m/s for every second or deceleration is 0.8m/s^2

13) a) v = U+at = 0+10(10) = 0+100 = 100m/s

    b) t= $\frac{v-u}{a} = \frac{1000-0}{10} \approx \frac{1000}{10}$ = 100s

Exercise 19 – 20

Question 1

i- 20m/s

ii- a = $\frac{v-u}{t} \approx \frac{20-0}{5} \approx$ 4m/s^2

C) when the brakes are applied the car may slide because ice reduces friction which causes difficulty in stopping the cars by the brakes

D) * increasing the speed of the car

* increasing the mass of the car

* road condition

Question 2

a) i - $a = \frac{\Delta v}{\Delta t} = \frac{20}{20} = 1 m/s^2$

ii- $s = A_1+A_2+A_3$

$= (\frac{20x20}{2})+(180x20)+(\frac{10x20}{2})$

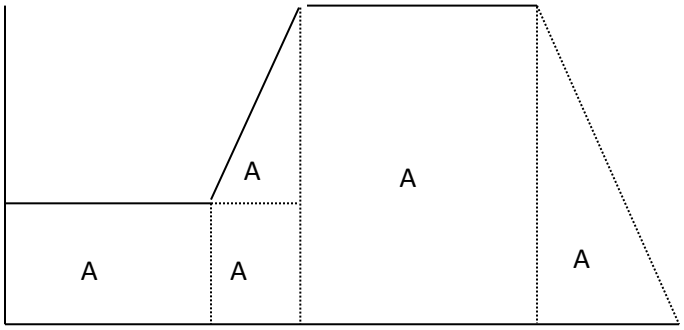
$= 200+3600+100$

$= 3900m$

b) Mean speed $= \frac{total\ distance}{time\ taken} = \frac{3900+3500}{400} = \frac{7400}{400} = 18.5m/s$

Question three:

60



b) (i) $a = \frac{v-u}{t} = \frac{60-20}{5} = \frac{40}{5} = 8m/s^2$

(ii) $S = A_1+A_2+A_3+A_4+A_5$

$S = (10\times20)+(20\times5)+(\underline{5\times40})+(60\times10)+(\underline{60\times5})$

$S = 200+100+100+600+150 =$ S = 1150m

(iii) $AV = \frac{TS}{T} = \frac{1150}{30} = 38.333$

Question four

a) $S_{car} = S_{pol}$

$72t = \left(\frac{10X90}{2}\right)+(t-10)90$

$72t = 450+90t-900$

$72t-450+90t$

$450=90-72t$

$450=18t$

$t = \frac{450}{18}$

t= 25seconds

b) S= area under graph

$S = A_1+A_2$

$S = (\frac{10X90}{2}) + (25-10)90$

$= 450+15(90)$

$= 450+1350$

$S = 1800m$

EXERCISE 3: page 23

1) $S=vt+{}^{1}/_{2}at^{2}$

$S=0(10)+{}^{1}/_{2}(1)(10)^{2}$

$S=0+{}^{1}/_{2}(100)$

S= 0+50

S=50m

2) $S=\frac{v+u}{2}$ t

$S=\frac{30+0}{2}$ 5

$S=\frac{30}{2}$ 5

$S=\frac{150}{2}$

S= 75m

3) $a=\frac{v^2-u^2}{2s}$

$a=\frac{0^2-20^2}{2X20}$

$a=\frac{-400}{40}$

a= -10m/s^2

4) v= u+at

v= 0+4(10)

V= 0+40

V= 40m/s

5) v= u+at

v=20+4(12)

v=20+48

v=68m

6) $a=\frac{v-u}{t}$

$a=\frac{40-0}{8}$

$a=\frac{40}{8}$

a= 5m/s^2

$S=vt+{}^{1}/_{2}at^{2}$

$S=\frac{V+U}{2}$ t

$S=\frac{0+40}{2}$ 10

$S=\frac{40}{2}$x10

S= 20X10

S = 200m

$S=\frac{U+V}{2}$ t

$S=\frac{68+20}{12}$ 12

$S=\frac{88}{2}$ X 12

S= 44X12

S=528m

$S=\frac{V+U}{2}$

$S=\frac{40+0}{2}$ 8

$S=\frac{40}{2}$ X8

S= 160m

7) total stopping distance = thinking distance +braking distance

$= vt_{thinking}+\frac{v^2-u^2}{2a}$

$=(10X0.5)+\frac{0^2-10^2}{2(-1.25)}$

$=5+\frac{-100}{-2.5}$

=5+40 =45m

No the track will not hit the child

Chapter 2: Dynamics

Exercise one page 28-29

1) F=ma

F=800X2

F= 1600N

2) $a = \frac{F_{net}}{m}$

a=$\frac{200,000}{5000}$

a= 40m/s^2

3) F= ma

F= m$\frac{v-u}{t}$

200=100 $\frac{v-0}{5}$

200=$\frac{100v}{5}$

200=20v

V= $\frac{200}{20}$

V= 10m/s

4) (a)F_r= 1500-500 =1000N

5) (a) F_{net}= 14-10 = 4N

a = $\frac{F_{net}}{m}$

(b) a= $\frac{F_{net}}{m}$ = a= $\frac{4N}{5}$ = a= 0.8m/s

6) a= $\frac{v^2-u^2}{2s}$ = a= $\frac{0^2-10^2}{2X40}$ = a= $\frac{-100}{80}$ = a= -1.25m/s^2

(b) a= $\frac{f_r}{m}$

a= $\frac{1000}{40}$

a= 25m/s^2

(c) The car will move at constant velocity

(b) F=ma

F=100X1.25

F= 125N

5) a) F_{net} = 14-10 = 4N

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

a= $\frac{4N}{5}$

7) (a) a= $\frac{F_{net}}{m}$

a= $\frac{300-200}{500}$

a= $\frac{100}{500}$

a= 0.2m/s^2

(b) the car will move at constant speed

8) F= 0.2v^2

Since F_F= F_A

F= 0.2v^2

500 = 0.2v^2

V^2 = $\frac{500}{0.2}$

V^2 = 2500 = V =$\sqrt{2500}$ = V = 50m/s

Exercise 2: page 37-42

1) A) P= mv = 5 X 2 = 10 kgm/s

   B) V = $\frac{p}{m} = \frac{20}{5}$ = 4m/s

2) Bullet because it has greater velocity

3) P_t = (2x100) + (4x(-150))

   = 200 – 600 = -400kgm/s due to west

4) A) a = $\frac{v-u}{t} = \frac{33-0}{11}$ = 3m/s^2

   B) F = ma = 950x3 = 2850N

   C) because any car can reach top speed when the forward force balances or equals the force again motion e.g (air resistance)

5) A) a = $\frac{v-u}{t} = \frac{0.6-0}{3}$ = 0.2m/s^2

   B) i- w = m*g = 200kgX10N/kg = 2000N

   ii- P = FV_A = 2000x0.6 = 1200wats

   C) F = ma = 200x0.3 = 60N

6) A) a = $\frac{v-u}{t} = \frac{10-50}{5} = \frac{-40}{5}$ = -8m/s^2

   B) i- because every time the forces act on the sky diver balances or equal each other.

   { Air-resistance = weight of sky diver }

   ii- because when the parachuse opens the air resistance increases

   C) w=mxg = 75x10 = 750N

7) A) the energy transferred is directly proportional to the square of the speed

   B) i- $M_1V_1+M_2V_2 = M_1V_1+M_2V_2$

   (9.5X20)+(0.5X40) = V (9.5+0.5)

   210 = 10V

   V= $\frac{210}{10}$ = 21m/s

   ii- Ke is not conserved

8) A) w= FS = 250N*5m ≈ 1250 N

   B) changes to kinetic energy and cause motion of the bicycle

9) A) a= $\frac{\Delta v}{\Delta t} = \frac{10-0}{4-0} = \frac{10}{4}$ = 2.5m/s^2

   B) S= Area under graph = $\frac{1}{2}bh = \frac{1}{2}x4x10$ = 20m

   C) F= ma = 75X25 = 1875N

10) A) because at first its weight is greater than the air-resistance

B) because the weight and the air resistance become equal

11) A) AV = $\frac{TS}{TT} = \frac{140}{70} = 2m/s$

B) $V_A = \frac{100}{20} = 5m/s$ $A_C = \frac{40}{20} = 2m/s$

ration $\frac{5}{2} = 2.5$

so children part A is faster than part B 2.5 times

12) A) AV = $\frac{TS}{TT} = \frac{2}{0.64} = 3.125m/s$

B) we will scan the graph on the text book

C) i- 0.64+2(0.52) = 1.68s

ii- 1.25mX2 = 2.5m

D) X_1 = its CE becomes Zero so its velocity is Zero and rests

X_2 = it reaches the maximum height (V= 0m/s)

13) $M_AV_A+M_B(-V_B) = V(M_A+M_B)$

(3X20)+(10X-2) = V (10+20)

60 – 20 = 30v

V= $\frac{40}{30}$ = 1.33 m/s

Exercise 3: page 44-45

1) $F_{Breaking} = M(\frac{v-u}{t}) = 500 (\frac{0-30}{10}) = 500 \times (-3) = -1500N$

2) Impulse = Ft = 10 X 2 = 20Ns

3) a) $F= M(\frac{v-u}{t}) = 1000 (\frac{0-15}{0.5}) = 1000(-3) = -30,000N$

b) $F= M(\frac{v-u}{t}) = 1000 (\frac{0-15}{0.01}) = 1000(1500) = 1,500,000N$

the greater time 0.5s b/c force of reaction is inversely proportional to the time of interaction

4) a) ΔP = Ft = 10 X 30 = 300Ns /2 = 150Ns

b) impulse = ΔP = 150Ns

C) average force = 5N

d) ΔP = m(V-U)

150 = 60(v-0)

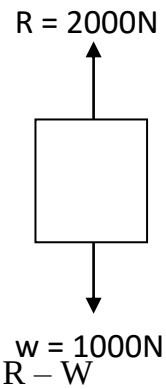
150 = 60v

v = $\frac{150}{60} = 2.5m/s$

Chapter 3: Vectors

Exercise 1: page 48

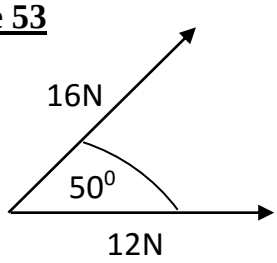
1. $R_f = f_2 - f_1$
   $R_f = 600N - 500N = 100N$ forward.
2. $R_v = V_2 - V_1$
   $R_v = 57m/s - 40m/s$
   R_v 17m/s backward
3. $R_f = R - W$
   $R_f = 0.2N - 0.1N$
   $R_f = -0.8N$ downward
4. (a)

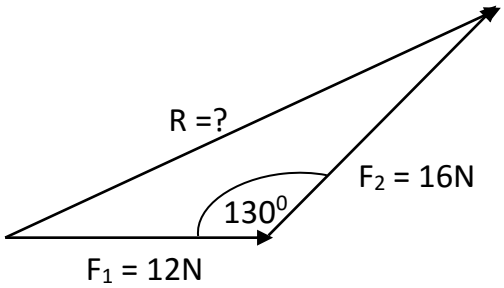


   (b) $R_f = R - W$
   $R_f = 2000N - 1000N$
   $R_f = 1000N$ upward
   (c) air resistance

Exercise 2: page 53

1.





$180^0 - 50^0 = 130^0$

First, find the side R by using the cosine rule:

$c^2 = a^2 + b^2 - 2abcosC$

by substituting our terms $R^2 = F_1^2 + F_2^2 - 2F_1F_2cosR$

$R^2 = (12)_2 + (16)^2 - 2x12x16\ cos130^0$

$R^2 = 144 + 256 - 384\ (-0.6427)$

$R^2 = 400 + 246.8$

$R^2 = \sqrt{646.8}$

$\sqrt{R^2} = \sqrt{646.8}$

$R = 25.4N$

Secondly, find the direction by using sine rule:

$\frac{sinf_1}{f_1} = \frac{sinR}{R}$ …….. by crossing multiplication

$Rsinf_1 = f_1 sinR$ …… by dividing both sides with R

$sinf_1 = \frac{f_1 sinR}{R} = \frac{12N\ x\ sin130^0}{25.4N} = \frac{12\ x\ 0.766}{25.4} = 0.36$

$sin^{-1}(0.36) = 21^0$

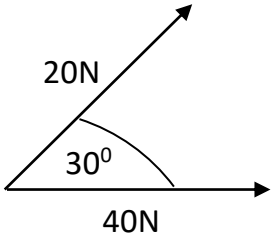
Thirdly, find the third angle:

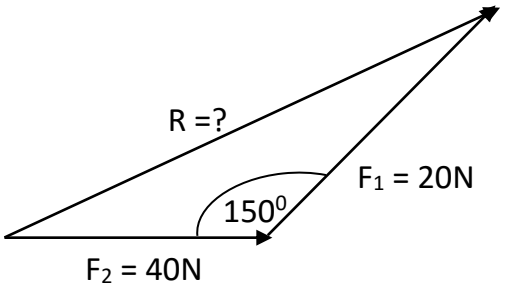
$130^0 + 21^0 + \theta_3 = 180^0$

$151^0 + \theta_3 = 180^0$

$\theta_3 = 180^0 - 151^0 = 29^0$

2.





$180^0 - 50^0 = 130^0$

First, find the side R by using the cosine rule:

$c^2 = a^2 + b^2 - 2abcosC$

by substituting our terms $R^2 = F_1^2 + F_2^2 - 2F_1F_2cosR$

$R^2 = (20)^2 + (40)^2 - 2x20x40\ cos150^0$

$R^2 = 400 + 1600 - 1600\ (-\ 0.866)$

$R^2 = 2000 + 1385.6$

$R^2 = \sqrt{3385.6}$

$\sqrt{R^2} = \sqrt{3385.6}$

R = 37.2N

Secondly, find the direction by using sine rule:

$\frac{sinf_1}{f_1} = \frac{sinR}{R}$ …….. by crossing multiplication

$Rsinf_1 = f_1sinR$ …… by dividing both sides with R

$sinf_1 = \frac{f_1 sinR}{R} = \frac{20N\ x\ sin150^0}{37.2N} = \frac{20\ x\ 0.5}{37.2} = 0.2688$

$sin^{-1}\ (0.2688) = 15.6^0$

Thirdly, find the third angle:

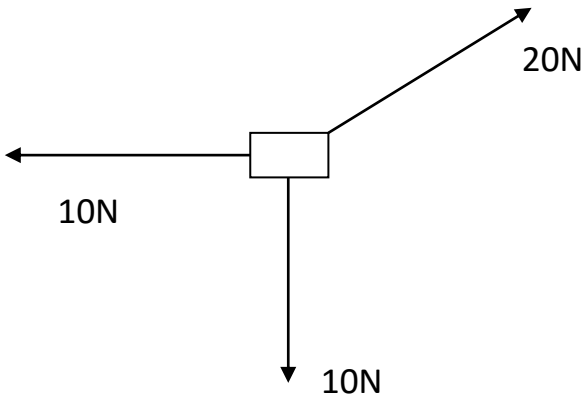
$150^0 + 15.6^0 + \theta_3 = 180^0$

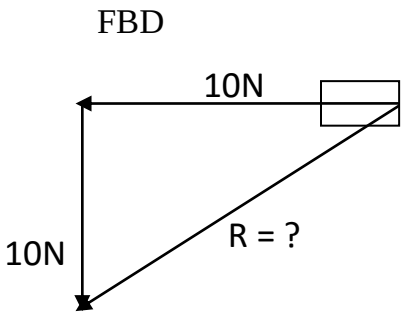
$165.6^0 + \theta_3 = 180^0$

$\theta_3 = 180^0 - 165.6^0 = 14.4^0$

Exercise 3: page 56

1. (a) First, find the resultant force of right angled forces:





$R = \sqrt{(10)^2 + (10)^2}$

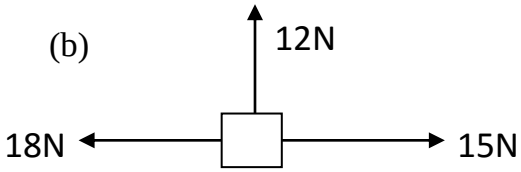
$R = \sqrt{100 + 100}$

$R = \sqrt{200} = 14.14N$

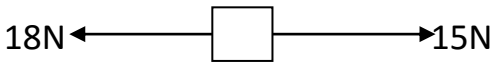
Secondly, find the resultant force of straight-line forces:

$R_f = 20N - 14.14N = 5.86N$

(b)



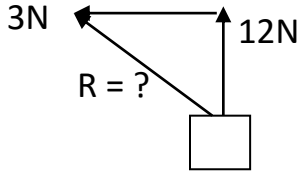
First, find the resultant force of straight-line forces:



$R_f = 18N - 15N$

$R_f = 3N$

Secondly, find the resultant force of right-angled forces:



$R = \sqrt{(12)^2 + (3)^2}$

$R = \sqrt{144 + 9}$ $R = \sqrt{153} = 12.37N$

Exercise 4: page 58

1. Given:
   F = 200N and $\theta = 60^0$
   (a) Horizontal component force
   $F_x = f\cos\theta$
   $F_x = 200N \cos 60^0$
   $F_x = 200N \times 0.5$
   $F_x = 100N$
   (b)Vertical component force
   $F_y = f\sin\theta$
   $F_y = 200N \sin 60^0$
   $F_y = 200N \times 0.866$
   $F_y = 173.2N$

2. Given:
   V = 150m/s and $\theta = 30^0$
   (a) Horizontal component speed
   $V_x = V\cos\theta$
   $V_x = 150m/s \cos 30^0$
   $V_x = 150m/s \times 0.866$
   $V_x = 129.9m/s$
   (b)Vertical component speed
   $V_y = V\sin\theta$
   $V_y = 150m/s \sin 30^0$
   $V_y = 150m/s \times 0.5$
   $V_y = 75m/s$

Projectile motion:

Exercise 6: page 62

1) Given:
   $U_x = 10m/s$
   T= 5s
   $h = \frac{1}{2}gt^2$
   $h = \frac{1}{2}(10)(5)^2 = 125m$
   $V_y = gt$
   $V_y = 10x5 = 50m/s$

2) Given
   H=200m
   Ux=300m/s
   a) T=?
   b) X = ?
   a) $H = \frac{1}{2}gt^2$
   $200 = \frac{1}{2}(10)t^2$
   $t^2 = 40$
   $t = \sqrt{40} = 6.3sec$

b) X= v x t = 300x 6.3 = 1890m

3) U = 168m/s

t = 5 second

a) Ux= ?

Vx=

b) V

a) V_x=Ux

= V_x = 168m/s

And V_y = gt

V_y= 10x5 = 50m/s

b) V= $\sqrt{Vx^2}+Vy^2$

V= $\sqrt{168^2}+50^2$

V= $\sqrt{30724}$

Exercise 6: page 65

1. Given:

u = 10m/s $\theta = 53^0$ g = -10m/s^2

u_x = ucos θ = 10m/s cos53^0 = 10m/s x 0.6 = 6m/s

u_y = usin θ = 10m/s sin 53^0 = 10m/s x 0.7986 = 7.986m/s

$V_x = U_x$ = 6m/s

Find the time by using $V_y = U_y + gt$ (take V_y = 0, due to g = -10m/s^2)

0 = 7.986m/s + (-10m/s^2) (t)

(10m/s^2) t = 7.986m/s …….. by dividing both sides by "10" we get:

t = $\frac{7.986m/s}{10m/s^2}$ = 1.25sec ((This time is the time required only for the half of the motion. Thus we multiply it with two to obtain time of flight))

t = 1.25sec x 2 = 2.5sec.

Find V_y to obtain the velocity of the projectile:

Vy = U_y +gt

V_y = (7.986m/s) + (-10m/s^2)(2.5sec)

V_y = 7.986m/s – 25m/s

V_y = -17m/s

(a) Velocity of the projectile

$V = \sqrt{V_x^2 + V_y^2}$

$V = \sqrt{(6)^2 + (-17)^2}$

$V = \sqrt{36 + 289}$

$V = \sqrt{325}$

V = 18m/s

(b) Horizontal and vertical velocity of the projectile

Horizontal velocity: $V_x = 6m/s$

Vertical velocity: $V_y = -17m/s$

(c) The maximum height it can reach

$h = u_y t + \frac{1}{2}gt^2$

$h = (7.986m/s)(2.5sec) + \frac{1}{2}(-10m/s^2)(2.5s)^2$

h = 20m – 31m

h = -11m

(d) Horizontal displacement of the projectile

$X = U_x t$

X = (6m/s) (2.5sec)

X = 15m

(e) Distance of P from O

$d = \sqrt{X^2 + h^2}$

$d = \sqrt{(15)^2 + (-11)^2} = \sqrt{225 + 121} = 18.6m$

Chapter 4: Circular motion

Exercise1: page 74

1. Centripetal force is the force acting upon such an object is directed towards the centre of a circle.

   formula: $f = \frac{mv^2}{r}$

2. This statement is true, because its velocity changes due to the changing direction of motion

3. (a) $\dot{\omega} = \frac{2\pi}{t} = \frac{2x3.14}{4x60x60} = \frac{6.28}{14400} = 4.36x10^{-4}$ rad/sec.

   (b) $a = r\dot{\omega}^2$

   $a = (4.36x10^{-4})^2 (4.6x10^3) = (19x10^{-8}) (4.6x10^3)$

   $a = 87.4x10^{-5} = 8.7x10^{-4} m/s^2$

   (c) $V = \dot{\omega}r$

   $V = (4.36x10^{-4}) (4.6x10^3) = 20x10^{-1} = 20x0.1 = 2m/s$

4. $f = \frac{mv^2}{r} = \frac{(5)(18)^2}{0.5} = \frac{5x324}{0.5} = \frac{1620}{0.5} = 3240N$
5. (a) $\dot{\omega} = \frac{2\pi}{t} = \frac{2x3.14}{84x60} = \frac{6.28}{5040} = 1.2x10^{-3}$ rad/sec.

   (b) $a = r\dot{\omega}^2$

   $a = (2.88x10^4)(1.2x10^{-3})^2 = (2.88x10^4)(1.44x10^{-6})$

   $a = 4.14x10^{-2} m/s^2$
6. (a) $V = \dot{\omega}r = (2x12.56) = 25.12m/s$

   (b) $\dot{\omega} = 2\pi f = (2x3.14x2) = 12.56rad/sec$

   $f = \frac{Gm_1m_2}{d^2} = \frac{(6.67x10^{-11})(400)(800)}{8^2} = \frac{2134400x10^{-11}}{64} = 33350x10^{-11}$

   $f = 3.335x10^{-7}N$

Chapter 5: Work and Energy

Exercise page 1 (77 – 78)

1) $W = mgh$

$W = 60x10x0.09x39$

$= 216$

2) $W = f_s cos\theta$

$= 500 \times 12 \times cos30$

$= 500 \times 12 \times 0.866$

$= 5196j$

3) $W = mgh$

$W = 84 \times 9.8 \times 4.5$

$= 3704.4j$

4) A) $W = wh$

$W = 20 \times 25 = 500j$

b) Work done = energy transferred

∴Energy transferred = 500j

Page 80

1. $W = f_s cos\theta$

800 /80x0.707 =14.15m

2. $W = fs$

$s = u + v/2$

0+ 4/2x2.5 = 5m

W = 40x5 = 200j

Exercise page 2 (81 – 82)

1) $KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 0.8 \times (20 - 18.5)^2$

$KE = \frac{1}{2} \times 0.8 \times (1.5)^2$

$KE = \frac{1}{2} \times 0.8 \times 2.25 = 0.9j$

2) $v^2 = u^2 + 2as$

$v^2 = (0)^2 + 2 \times 3 \times 8 = 48m/s$

$KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 14 \times (48)^2$

$KE = 16128j$

3) A) $a = \frac{f}{m} = \frac{40}{10} = 4m/s^2$

$s = ut + \frac{1}{2}at^2$

$s = 0 \times 2 + \frac{1}{2} \times 4(2)^2$

$s = \frac{1}{2} \times 16$

$s = 8m$

b) $W = fs$

$W = 40 \times 8 = 320j$

c) $KE = work\ done$

$KE = 320j$

d) $v = u + at$

$v = 0 + 4 \times 2$

$v = 8m/s$

Or $v = \sqrt{\frac{2kE}{M}}$

$v = \sqrt{\frac{2 \times 320}{10}}$

$v = \sqrt{\frac{2 \times 320}{10}} = 8m/s$

4) $KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 50 \times (30)^2$

$KE = \frac{1}{2} \times 50 \times 900 = 32500j$

5) $v = \sqrt{\frac{2KE}{m}}$

$v = \sqrt{\frac{2 \times 850}{2.5}} = \sqrt{680} = 26m/s$

6) $KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 0.1 \times (8)^2 = 3.2j$

$P_E = K_E$

$P_E = 3.2j$

7) $KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2} \times 2 \times (1.5)^2 = 2.25j$

8)

a) $P_E = mgh$

$P_E = 5 \times 10 \times 13 = 650j$

a) $P_E = mgh$

$P_E = 5 \times 10 \times 6.8 = 340j$

Exercise3 page (83)

1)

a) $W = fs$

$W = 15 \times 10 = 150j$

b) $KE = Work\ done$

kE = 150j

c) $v = \sqrt{\frac{2KE}{m}}$

$v = \sqrt{\frac{2 \times 150}{2}} = \sqrt{150}\ m/s$

2)

a) $P_E = mgh$

$P_E = 20 \times 10 \times 60 = 12000j$

b) $P_E = kE$

$PE = 12000J$

9) $v = \sqrt{\frac{2KE}{m}}$

$$v = \sqrt{\frac{2 \times 12000}{20}} = \sqrt{1200} = 34.6m/s$$

Exercise 4 page 87

1)

a) $P_E = mgh$

$P_E = 2 \times 10 \times 25 = 500j$

b) $kE = P_E$

Ke = 500j

c) $v = \sqrt{\frac{2KE}{m}}$

$$v = \sqrt{\frac{2 \times 500}{2}} = \sqrt{500} = 22.36m/s$$

a) $Work\ done = Ke$

$Work\ done = 500j$

2)

a) $P_E = mgh$

$P_E = 0.2 \times 10 \times 1.8 = 3.6j$

b) $k_E = p_E$

$k_E = 3.6j$

c) $v = \sqrt{\frac{2KE}{m}}$

$$v = \sqrt{\frac{2 \times 3.6}{0.2}} = \sqrt{36} = 6m/s$$

d) $P_E = mgh$

$P_E = 0.2 \times 10 \times 1.5 = 3j$

$k_E = p_E$

$k_E = 3j$

$$v = \sqrt{\frac{2KE}{m}}$$

$$v = \sqrt{\frac{2 \times 3}{0.2}} = \sqrt{30} = 5.48m/s$$

Or Rebound velocity = 6m/s

Exercise 5 page 89

1)

a) $W = pt$

$W = 50000 \times 6second$

$W = 3000000j = 3000kj$

2)

a) $P_E = mgh$

$Given$

$total\ maize = 250 + 75 = 325$

$H = 20m \quad , \quad g = 10m/s^2$

$P_E = 325 \times 10 \times 20 = 65000j$

a) $k_E = p_E$

$k_E = 65000j$

b) $v = \sqrt{\frac{2KE}{m}}$

$$v = \sqrt{\frac{2 \times 65000}{325}} = \sqrt{400} = 20m/s$$

c) At point A : The car land passengers have maximum P_E and zero KE

At point B : the car and passengers have maximum KE and zero P_E

At point C : the car and passengers have Equal KE and P_E

Or the total mechanical energy is constant

3)

a) $v = \frac{s}{t} = \frac{3.2m}{20s} = 0.16m/s$

i. $w = mg$

$w = 60 \times 10 = 600N$

ii. $P_E = mgh$

$P_E = 60 \times 10 \times 3.2 = 1920j$

$k_E = p_E$

$k_E = 1920j$

b) $v = \sqrt{\frac{2KE}{m}}$

c) $v = \sqrt{\frac{2\times1920}{60}} = \sqrt{\frac{3840}{60}} = 8m/s$

d)

Chapter 6: Deforming solids:

Exercise Pages 94 – 98:

1. (a) (i) 14mm

   (ii) $k = \frac{f}{x}$

   $k = \frac{2N}{14mm}$ = 0.142N/mm

   $ork = \frac{f}{x} = \frac{2N}{0.014m}$ = 142.8N/m

   (iii) 2N --------→ 14mm

   5N -------→ X "cross multiplication"

   $\frac{2Nx}{2N} = \frac{70Nmm}{2N}$ "Divide both sides by 2N"

   $X = 35mm$

   (b) (i) k = $\frac{F}{X} = \frac{5N}{0.035m}$ = 142.8N/m

   $K_T = K_1 + K_2$ …… (Since they are parallel)

   K_T = 142.8N/m + 142.8N/m = 285.6N/m

   (ii) x = f/k_t 5/285 = 0.017cm

2. (a) Hooke's law states that the force is directly proportional to the extension unless the elastic limit is not exceeded.

   (b) clamp , ruler, spring,hanging mass.

   (c) (i) 35mm

   (ii) 15 , 25

   (iii) A graph of extension (mm) against load (N)

   y – axis = load x – axis = extension

3. (a) directly proportional

   (b) (i) tension or weight

   (ii) 2.5N

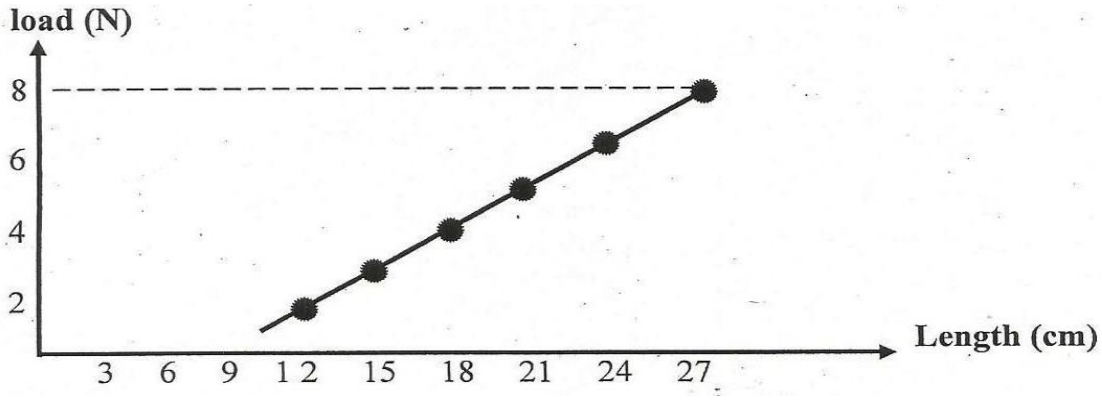
   (iii) 4.5N

   (c) (i) A

   (ii) B

   (iii) large extension for small increase in a force.

4. (a)



(b) (i) Unloaded length = 10cm

(ii) length of 7.0N load = 24cm

Extension = New length – Original length

Extension = 24cm – 10cm 14cm

(iii) New length = extension + original length

New length = 5cm + 10cm = 15cm

the load is therefore 2.5N from the graph.

UNIT 2: WAVES:

Chapter 7: Wave and sound

A) WAVE

Exercise 1: page 111

1) Disturbance

Throw a stone on water

example television and radio programs

2) Disturber or vibration of air particles

3. transverse wave :particles vibrate at right angle to the direction of wave

4. A longitudinal wave: particles vibrate parallel to the direction of wave

transverse wave : particles vibrate at right angle to the direction of wave

5. Rarefaction: is a region of medium in which the particles of medium move apart from each other

Compression: is a region of medium in which the particles of medium move closer

B) Sound

Exercise 1: page 129

1. b

2. medium

3. d

4 .a) F= $\frac{No\ of\ Wave}{Time\ Taken}$ = 160/10 = 16 Hz

b) V= $\lambda x f$ = 16x20 = 320 m/s

5. a) $30c^0$

v = (331+0.6T)m/s

v = (331+0.6×30 = 349m/s

b. 40^0

v = (331+0.6×T)m/s

v = ((331+0.6×40)m/s

v=355m/s

exercise 2: page 135

1.A boy 60m from a large wall he hammering a block ofwood every time he hits a block of wood he hears an echo 0.5 second later calculate the speed?

An) v = 2d/t = 2(60)/0.5 = 120/0.5 v= 240m/s

2) S= $\frac{Vt_1}{2} + \frac{Vt_2}{2} = \frac{340*2}{2} + \frac{340*2}{2} = 850m$

3. S = $\frac{Vxt}{2} = \frac{1531*4.02}{2} = 1561.62$

Exercise 3: page 145

P = 2.4w

A= sphere with radius 30m

A= $4\pi r^2$

= $4x3.14x(30)^2$

= 4x3.14x900

A = 12240

- I = $\frac{P}{A} = \frac{2.4}{12240}$ = 0.960 w/m^2

2)

Given

- L = 20cm = 0.2mc

  M = 0.1g = 0.0001kg

M= $\frac{0.0001}{0.2} = 0.0005kg/m$

T= 100N

F= $\frac{1}{2L}\sqrt{\frac{T}{M}} = \frac{1}{2(0.2)}\sqrt{\frac{100N}{0.0005}} = \frac{1}{0.4}\sqrt{200{,}000} = \frac{1}{0.4}x447 = 1118HZ$

b. frequency of the first and third overt

* frequency of the 1st overtone = $2(F_o)$

= 2 x 118 = 2236Hz

Frequency of the 3rd overtone = $4(F_o)$

= 4472Hz

UNIT 3: Telecommunication

Chapter 8: Telecom

1) The limitation of sending information of
   a) line of sight method
   * building
   * mountains
   * hills
   * trees / geographical obstacle
   b) Telegraphy
   c) telephony
   - Slow speed or no enough information

2) a) (i)Aerial
   (ii) amplifier
   (iii) loud speaker
   b) (i) amplitude the radio frequency increases and then decrease
   (ii)
   a) A ⟶ Aerial
   B ⟶ coil
   C ⟶ diode
   D ⟶ capacitor
   b) purpose of D is set the resonant frequency

3) 1- Aerial 2- tuner 3- amplifier 4- battery 5- Electrical 6- sound

4) Amplifier boots the carrier waves energy
   encoder converts the signal in to a code before a placing on the carrier waves
   receiver receives the carrier waves
   transmitter radiator carrier waves in to the surrounding
   Decoder removes the signal from the carrier wave

5) Encoder ⟶ voice box
   Transmitter ⟶ mouth
   Receiver ⟶ outer ear
   Decoder ⟶ Brain

UNIT 4: Radioactivity

Chapter 9: Radioactivity

Exercise1: page 173

1) 1 $\xrightarrow{x}$ ½ $\xrightarrow{x}$ ¼ $\xrightarrow{x}$ 1/8 $\xrightarrow{x}$ 1/16 $\xrightarrow{x}$ 1/32 $\xrightarrow{x}$ 1/64 $\xrightarrow{x}$ 1/128 $\longrightarrow$

$\frac{7x}{7} = \frac{49}{7}$

x=7day: the half-life of this substance is 7 days

2) (i) 800g $\xrightarrow{2hr}$ 400g $\xrightarrow{2hr}$ 200g $\xrightarrow{2hr}$ 100g $\longrightarrow$ $\longrightarrow$

-: the remaining is 100g after 6 hr

(ii) (i) 800g $\xrightarrow{2hr}$ 400g $\xrightarrow{2hr}$ 200g $\xrightarrow{2hr}$ 100g $\xrightarrow{2hr}$ 50 $\xrightarrow{2hr}$ 25g $\longrightarrow$ $\longrightarrow$

3) 120Bq $\xrightarrow{x}$ 60Bq $\xrightarrow{x}$ 30 Bq $\xrightarrow{x}$ 15Bq

X = 30/3 days

X= 10 days

4) A) 16000 $\longrightarrow$ 8000 $\longrightarrow$ 4000 $\longrightarrow$ 2000

The remain will be 2000

b) 16000 $\longrightarrow$ 8000 $\longrightarrow$ 4000 $\longrightarrow$ 2000 $\longrightarrow$ 1000 $\longrightarrow$ 500

the remain will be 500 g

5) A) 1 $\xrightarrow{20min}$ $\frac{1}{2}$ $\xrightarrow{20min}$ $\frac{1}{4}$ $\xrightarrow{20min}$ $\frac{1}{8}$ the remain fraction = $\frac{1}{8}$

B) 8000 $\xrightarrow{20min}$ 4000 $\xrightarrow{20min}$ 2000 $\xrightarrow{20min}$ 1000

Remaining is 1000g

6) 160 unit $\xrightarrow{20min}$ 80 unit $\xrightarrow{20min}$ 40 unit $\xrightarrow{20min}$ 20unit $\xrightarrow{20min}$ 10unit

T= nt

T = 4x5730

T= 22920 years

7) A) 1 $\xrightarrow{2.5h}$ $\frac{1}{2}$ $\xrightarrow{2.5h}$ $\frac{1}{4}$ $\xrightarrow{2.5h}$ $\frac{1}{8}$ $\xrightarrow{2.5h}$ $\frac{1}{16}$ $\xrightarrow{2.5h}$ $\frac{1}{32}$ $\xrightarrow{2.5h}$ $\frac{1}{64}$ $\xrightarrow{2.5h}$ $\frac{1}{128}$ $\xrightarrow{2.5h}$ $\frac{1}{256}$ $\longrightarrow$ $\longrightarrow$ $\longrightarrow$

The remaining fraction is $\frac{1}{256}$

N = No $(\frac{1}{2})^{\frac{T}{t}}$

N = 400 $(\frac{1}{2})^{\frac{20hr}{2.5}}$

N = 400 $(\frac{1}{2})^{8}$

N = 400 x $\frac{1}{256}$

N = $\frac{4000}{256}$

N = 15.625

Exercise (2) of radio activity page 180

1) a) isotope: is an atom with same element, with same atomic number but different of mass number

b)

Symbol	No. of protons	No. of neutrons
$^{238}_{92}U$	92	146

c) (i) balance the atomic number only

x+0=56+38

x= 94

(ii) 239+1=147=90+y

240= 237+y

240-237=y, y =3

y=2 means 2 neutrons

d)(i) $^{15}_{7}N + ^{1}_{1}P \longrightarrow {}^{m}_{6}C + {}^{4}_{n}X$

15+1=m+4 7+1=6+n

16-4=m 8-6=n

m=12 n=2

$^{15}_{7}N + ^{1}_{1}P \longrightarrow {}^{12}_{6}C + {}^{4}_{2}X$

2) a) $^{235}_{92}U + ^{1}_{0}U \longrightarrow {}^{72}_{30}Zn + {}^{160}_{x}Sm + Y\,^{1}_{0}N$

i. 92+0 = 30+x

92-30 = x

X = 62

ii. 235 + = 72+160 + y

236 – 232 = y

Y = 4

b) the importance of these neutrons is to initiate other remaining element to make a fission reaction or to split another nuclear reaction

c) fission reaction is the process that large nucleus split into two or more light daughter nucleus

d) i) $^{2}_{1}H + ^{3}_{1}H +$ energy $\longrightarrow$ $\boxed{^{4}_{1}He}$ + $\boxed{^{1}_{0}N}$

ii) this reaction is called fusion reaction

3) A) $^{4}_{2}H + {}^{x}_{13}A1 \; {}^{30}_{15}P + {}^{1}_{0}N$

4+x = 30 + 1

X = 31-4

X = 27

b) Reaction three is a fusion reaction because two light nucleus fuse together and it form one large nucleus and other neutron

c) 235: is the mass number of uranium

4) A) i) reaction type is a fission reaction

Explanation: only one nucleus is split in to two nuclei

ii) x = 7

B) i) Name : water

ii) explanation: to control the speed of neutrons

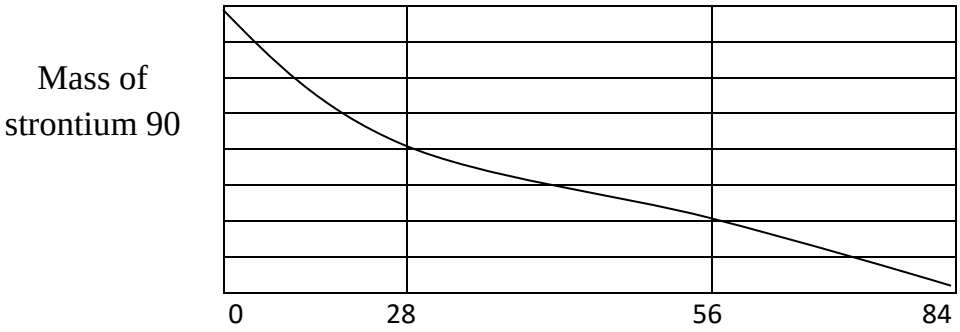
C) energy released in nuclear reactor is used to produce a super-heated steam at high pressure which turns generators and produce full electricity

D) i) the mass number of the nucleus is uncharged but atomic number increases by 1

ii) because alpha is the least penetrating power and can't pass through the paper while the gamma is most penetrating power and pass through the paper and both of them is affected by the thickness of paper

e) ${}^{90}_{38}Sr = {}^{90}_{39}Y + {}^{0}_{-1}\beta$

f)



g) Uses of Gamma: to kill cancer disease by the process called radiotherapy

5) A) half-life: is the time for half-life of the atom in a given sample to decay

B) i) approximately the age of the fossil is 10,000 years

C) i) the mass number goes down by 4 and the atomic number goes down by 2

ii) ${}^{14}_{6}C = {}^{14}_{7}N + {}^{0}_{-1}\beta$

D) Given

T = 7 minutes No = 156/sec N = 39/sec

First, find number of half – lives by using box

156 $\xrightarrow{1^{st}\text{ half life}}$ 78 $\xrightarrow{2^{nd}\text{ half life}}$ 39

The number of half lives = 2 half – lives

Secondly, find time of half-live

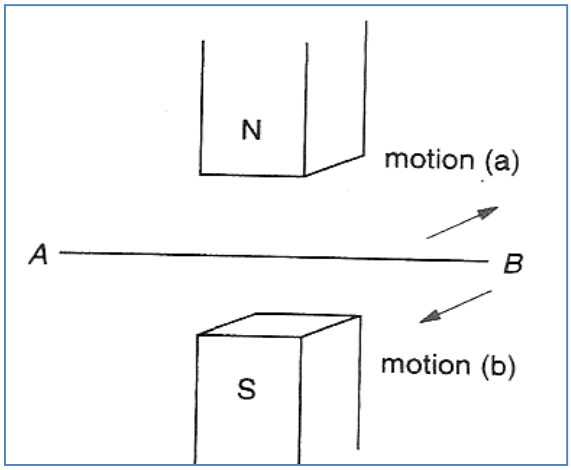
$t = \frac{T}{n} = \frac{7minutes}{2} = 3.5$ minutes

UNIT 5: Electromagnetic induction

Chapter 10: Induction

Exercise 1: Page 190-191

1) The figure below shows a conductor AB in a magnetic field.



a) Mark in the direction of the magnetic field?

Answer : the direction of magnetic field from N to s (show on the diagram)

b) Which direction will a current flows in the conductor AB when it is

i. Moved into the page?

Answer : by using Fleming's right hand rule its direction is from B to A

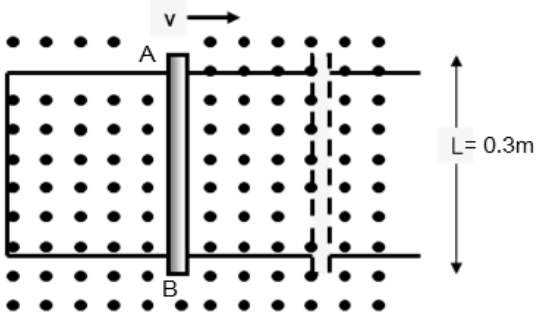
ii. Moved out of the page?

Answer : by using Fleming's right hand rule its direction is from A to B

2) 5cm length of wire passes through a magnetic field at right angles the field with speed 12m/s. the field is 1.5T. Calculate the induced EMF?

Answer: EMF = BLV $1.5T \times 0.05 \times 12m/s = 0.9v$

3) A conducting rod of length 0.30 m and resistance 10.0 Ω moves with a speed of 2.0 m/s through a magnetic field of 0.20 T which is directed out of the page.



a) Calculate the EMF induced in the rod?

Answer: EMF = BLV $0.2\text{T} \times 0.3 \times 2 = 0.12\text{v}$

b) Find the magnitude of the current in the rod and the direction it flows.

Answer: Answer: $I = \frac{v}{r} = \frac{0.12v}{10} = 0.012A$

by using Fleming's right hand rule its direction from A to B

c) Calculate the force acting on the rod as it moves through the coil?

Answer: $F = BIL = 0.2 \times 0.012 \times 0.3 = 0.00072N$

***Exercise3 Page* 194 – 195**

1) A and D
2) A) because the coil cuts the magnetic field lines, so the EMF is induced in the coil , the EMF makes the current to flow, then the pointer of the galvanometer deflects to and fro
   b) Electromagnetic induction
   c) When the wire moves the in the magnetic field
   d) The movement of magnet is faster
      Increase the number of turns in coil
      By using strong magnet
   e) Mechanical energy to electrical energy.
3) Draw straight line from each experiment to what happen on the meter

Push the south end of the magnet in the	coil needle flicks to right
Pull the south end oof magnet out of the coil	Needle flicks to left
Hold the magnet still in the coil	Needle doesnot move

Page 203 exercise

1. a) the first becomes electromagnet which its magnetic field line cut through second coil then the current is induced the second coil

b) The first coil loses its magnetism and induce current in opposite direction

2.a) more current is induced in the second coil

b) changing the magnetic flux is produced in the first coil which cut continuously in the second coil inducing current

Exercise Page $212 - 213$

1) a) it is the step down transformer because the number of turns in the primary coil more than the number of turns in the secondary
   b) $\frac{vs}{vp} = \frac{ns}{np} = \frac{vs}{240} = \frac{40}{1600} v_s = 6v$
   c) $I_S v_s = I_P V_P$

$$6I_S = 2 \times 240$$

$I_S = \frac{2\times240}{6}$= 80A

2) a) $\frac{vp}{vs} = \frac{is}{ip}\frac{240}{12} = \frac{6v}{ip}$ $I_p = 0.3A$

b) P = $I_p v_p$ P = $0.3 \times 240 = 72W$

c) The ideal transformer in put power =out put power

out put power = 72W

Exercise 4: Page 216

1) To reduce power loss in transformer
2) Ac voltage can be stepped up or stepped down using transformer

Ac generators are simple, cheaper and more efficient than DC

3. The voltage of the current produced by a generating station can reach voltage step-up transformer located in the generating station's switchyard, the electricity is transmitted at much higher voltages, from 44,000 to 765,000 volts.

Once in the transmission system, electricity from each generating station is combined with electricity produced elsewhere.

The electricity passes through cables which are suspended from towers. These towers are arranged in a series from the generate stations to source substations–which lower the voltage–and then reach substations, which further reduce the voltage

4. To change the voltage from one value to right value or the transformers can be used to increase or decrease the voltage

$$5.\ I = \frac{p}{v}I = \frac{4000}{200} = 20A$$

$$6.\ p = i^2 r = 20 \times 20 \times 8 = 3200w$$