Sindh Class 9th Physics Note

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Chapter 1 PHYSICAL QUANTITIES AND MEASUREMENT

Q.1 what is physics? Also describe its important branches?

PHYSICS :> The branch of science which deals with the study of properties, energy and their mutual relationship is called physics"

Some important branches of physics are given below

1. **Mechanics:-**It deals with the motion of bodies under the action of force.
2. **Heat and thermodynamics:-**It deals with the study of nature, properties. and uses of heat energy. And also deals with transformation of heat energy from one for to another form.
3. **Optics:-** it deals with the prorogation, reflection, refraction, dispersion and wave properties of light.
4. **Electricity and magnetism:-** it deals with the study of charges at rest as well as in motion.
5. **Atomic physics:-**it deals with the structure and properties of individual atom.
6. **Nucleus physics:-** it deals with the structure and properties of nuclease of an atom.
7. **Solid state physics:-**it deals with the properties of matter in solid state.
8. **Particle physics:-** it deals with the study of elementary particles.
9. **Plasma physics:-**which is the fourth state of matter. And occurs in ionized state.
10. **Quantum physics:-**quanta is studied is this branch which is the discrete and individuals particle of energy.
11. **Semiconductor physics:-** whose properties lie b/w conductor and insulator.
12. **Astro physics:-** it deals with the study of heavenly bodies.
13. **Bio physics:-** study of biology based on the principle of physics is called bio physics.
14. **Geo physics:-** it deals with the study of earth and atmospheric.
15. **Health physics:-** it deals with the study of diseases and their treatment.

Q.2 define measurement, unit and magnitude?

Measurement:-the comparison of an unknown quantity with some standard is called measurement.

Unit:-the standard with which things are compared is called unit-egmeter, kg,second.

Magnitude:- A number with a proper unit is called magnitude. eg 3kg is magnitude.

Q.3 what is meant by physical Quantities? Also explain basic and derived quantizes?

Physical Quantity:- Those quantities which can be measured are called physical quantities.

Basic quantities:-those physical quantities which are not derived from other quantities and but other quantities are derived from them are called basic quantities. These are seven in number. The units of basic quantities are called basic units in opposite table the units, quantities are seven and symbols.

Table.1

S.No	Quantities	Symbols	Unit	symbols
1	Length	L	Meter	m
2	Mass	m	Kilogram	Kg
3	Time	t	Second	Sec
4	Electric current	I	Ampere	A
5	Temperate	T	Kelvin	K
6	Intensity of light	L	Candela	cd
7	Amount substance	n	mole	m

Derived quantities:-those physical quantities which are derived from base quantities usually when quantity is derived or multiplied by another base quantity we get derived quantity suppose area is a derived quantity which is derived from two base quantities by multiplying with each other i.e length x length= Area. The unit of derived quantities is called derived quantities. Some derived quantities and their units are given in table.

s.no	Derived quantity	Unit	symbol
1	Force	Newton	N
2	Work	Joul	J
3	power	Walt	W
4	Pressure	Pascal	Pa
5	Speed	Meter/second	m/sec
6	Electric charge	Coulomb	c
7	acceleration	m/sec^2	m/sec

Table2

Q.4 write a short note an system international (S.I)?

Ans. In 1960 an international conference was held near Parisian which it was decided to introduce such a system of unites which could be used all over the world.so they introduce system international 2-e S.I

This system is based on seven basic quantities which are given in table 1 of Q.3.

Q.5 what are prefixes? Why we use it?

Ans. **Prefixes:-**the multiples and submultiples of the power of 10 which are used with basic units, they have their own specific names and symbols and they are called prefixes like kilo (10^3), milli (10^{-3}) etc.

Need of prefixes:-some time we have to deal with quantities that are either very small or very large as compared to basic unit in such cases we need to use prefixes.

For example:- to measure the thickness of a paper we use smaller smaller unit like milli meter (,mm) rather than meter (m). Similarly it we want to measure the distance b/w two big cities then we need greater unit like kilometer (km) rather than meter.

This under such conditions for convenience we express the table of prefixes at is given below.

Power	Prefixe	Symble	Power	Prefixe	Symble	Power	Prifixe	symble
10^{-15}	Atto	A	10^{-3}	Milli	M	10^{6}	Mega	Mm
10^{-15}	Femto	F	10^{-2}	Centi	C	10^{0}	Giga	G
10^{-12}	Pico	P	10^{-1}	Deci	D	10^{12}	Tera	T
10^{-9}	Nano	N	10^{1}	Deca	De	10^{-15}	Peta	P
10^{-6}	micro	u	10^{3}	Kilo	k	10^{-18}	exa	e

Q.6 what is scientific notation? How we convert a given number in scientific? Explain?

Ans. **Scientific notation:-** A very large number "N" expressed in the form of " M x 10^n" where "m" is a number whose 1st digit is non-zero and "n"is a + ve or – ve power of "10".

Conversion to scientific:- A number ''N"canbe expressed scientific by following method.

1. Write the number instandared form ie N= 98,000.
2. Put the decimal point after its non – zero digits ie N=9.8000
3. Now multiply 10 with "M" or 9.8 ie 9.8 x 10

4. Count the number of digits b/w new and old decimal point and write it as power of 10 .ie 9.8 x10^4
5. If decimal point is removed to left side then "n" is + ve and if decimal point is removed to right side then "n" is –ve.

Q.7 describe the purpose, construction and use of venire caliper.

Ans. Venire caliper:-A device which is used for the measurement of length and diameter etc. of small objects is called venire caliper.

Construction:- it consists of two scales is known as main scale (M.s) which is graduated in cm ormm. The other scale is known as venire scale (v.s) which slides over M.S it's length is 9mm which is divided into "10" equal parts.

The upper jaws of venire caliper are used for international diameter which the lower jaws are used for external diameter of a body.

Lest count :- the minimum distance which can be measured by a venire caliper is called its least count the least count of venire caliper is 0.01 cm or 0.1 mm.

Zero Error And its Correction. On closing the jaws of venire caliper it zero of v.s does not coin side with zero of "M.S" then there is an error in instrument known as zero error. If zero of v.s lies behind the zero of M.S then there is + ve error which is subtracted from actual reding.

Q.8 describe the purpose, construction and use of screw gauge ?

Ans. **Screw gauge:-** A device which is used for the measurement of thickness of very small objects is called screw gauge.

Construction:- it consists of u-shaped metal frame one end of this frame is fitted with a stud "A" and the other end is fitted with a graduated hollow cylinder there is a circular scale (SC) around the cylinder which consists of 100 division.

Lest count:- the minimum distance which can be measured by a screw guage is called its least count which is equal to 0.01mm.

Zero error and its correction:- if zero of circular scale does not coin side wit zero of linear scale. Then there is an error in instrument known as zero error. Af zero of circular scale remains ahead the horizontal line then there is - ve error which is added to actual reading.

If zero of circular scale remains behind the horizontal line then there is + ve error which is subtracted from actual reading.

Q.9 what is significant figure? Also give rules for determining significant figures?

Ans. **Significant figure:-** an any measurement the combination of accurately known and the 1st doubt full are called significant figures.

Suppose we want to measure the length of a rod by three persons with the help of a meter rod which 10.73, 10.74 and 10.75 respectively. So, an this case we are agree with 10.7 and these digits are called accurate known digits but about 3,4 and 5 we are in doubt so these are called doubt full digits. But the number of significant figure we have in this case is four.

Rules for determining significant figure:-Rules for determining of a significant figure are given below.

1. Zeros b/w non-zero digits are significant eg 2008 has 4 s.fig.
2. Zeros on left side of non-zero are not significant eg 0.00089 has two significant figure.
3. Zeros on right side of decimal are significant 2.e 4.3000 has five significant figure.
4. All non-zero digits are significant 2.e 4839 has four significant figures.
5. In case of scientific notation all digits before power 10 are significant. Eg 3.8×10^{-6} has two significant figures.

Q.10 what are the rules for rounding all of non-significant figures?

Ans. Rules for rounding all of non-significant figure are given.

1. If last digit is less than 5 then it will be ignored for example 475.83 is rounded to 475.8.
2. If dropping digit is greater than five. Then digit before 5 is increased by 1 eg5.37 ….> 5.4
3. If dropping digit is “5” and digit befor5 is even then it will remain unaffected eg 14.45 to 14.4.
4. If dropping digit is “5” and digit before 5 is odd then it will increased by “1” eg. 87.35 to 87.4

Q.11 write the various lab safety precaution ?

Ans. Some lab safety precautionary given below.

1. Never perform any experiment with the permission of teacher.
2. study your experiment carefully before performing.
3. Use the safety equipment available for you.
4. In case of any accident or injury informs your teacher.
5. Smother the fire by blanket.
6. Don’t taste any chemical substance.
7. Place the broken substances in the designated container.

8. If you spill certain chemicals, wash it off with water at once.
9. Keep the combust able and explosive material away from open flam.
10. Use safety goggle while performing experiment.
11. Check the electrical circuit by teacher before activation.
12. Turn off water, gas or electric circuit when your experiment is performed.

Conceptual questions

Q.1 give some examples of word done by physics?

Ans. Some examples of application of work don by physics are given below.

1. Development of electronic devices like T.V radio , computer and radar are due to discovery of electronic.
2. A geo stationary satellite helps us in forecasting weather and in geographical survey.
3. The discovery of radio= active and X-rays led to many medical uses.

Q.2 name the convenient unit you will use to measure?

1. Width of abook (b) length of a room (c) diameter of a wire.

Ans. The convenient unit for measure meant of width of book is centimeter or inch (b) for length of room is foot. (c) for diameter of a wire is millimeter.

Q.3 name the most convenient unit of you will use to measure?

(a) mass of candy (b) bag of sugar (c) mass of cricket ball?

Ans. The most convenient unit for (a) mass of candy is milligram (b) bag of sugar is kg (c) mass of cricket ball is gram.

Q.4 For Ans see page.2 .Q3.

Q.5 For Ans see page 2. Q3.derived Quantity.

Q.7 Digital stopwatch are most commonly used in physics measurement why?

Ans. Digital stopwatch are most commonly used in physics measurement because it gives more correct time as compared to analog stopwatch. An analogue stopwatch can measure to an accuracy of 0.1 sec while a digital stopwatch measure to an accuracy of 0.01 sec.

Q.8 give the names and symbols of the prefixes used to represent the values of

a)10^{-3} b)10^{-6} c)10^{-9} d)10^{-12}.

Ans. For Ans see page 3 . Q5.

Q.9 how much water in units of liter can fill a water tank of 1m3 capacity Explain?

Ans. We know that:- 1m = 100cm then $(1m)^3 = (100cm)^3$

➔ $1m^3 = 100x100x100cm^3$ ➔ $1m^3 = 1000 \times \underline{1000cm^3}$----(!)

We also known that:- 1 liter = 1000 cm^3

Putting this in equation (!) we get: $1m^3 = 1000 \times 1$ liter.

➔ $1m^3$ = 1000 liter. Hence a tank of $1m^3$ water can fill 1000 liter of water.

Q.10 explains the statement "A micrometer screw gauge measure more accurately than verniercaliper?

Ans. A micrometer screwguage can measure more accurately than a venire caliper because the least out of screwguage which is 0.01mm is less than that of venire caliper which is (0.1mm).

Q.11 For Ans see – ve error of screwguage Q.8.

Q.12 how can we find the volume of a small pebble by the help of measuring cylinder?

Ans. We can find the volume of small pebble with a Measuring by following method.

1. Take some water in measuring cylinder.
2. Note the volume and call it "vi".
3. Now drop the pebble into measuring cylinder.
4. Again note the temperature and call it "v_2"
5. Now find the volume"$\wedge v$" by following formula

   $\wedge v = v_2 - v_1$

Q.1 give the points to advocate that physics is linked with biology, Chemistry, geography and astronomy.

A. .<u>physics is linked with biology because:-</u>

(1) X-ray and radioactive x-rays are invention of physics which plays an important role in field of biology.
(2) Convex and concave mirror are used for sight effect.
(3) The moment of muscles and bones follow physics principle.
(4)the effect of gravity on organism is explained by physics.
(5) the effect of light and temperature on organism is explained by physics.

B)

<u>Physics is linked with chemistry because:-</u>

1) X-rays are the invention of physics, used in chemistry.

2) We use principles of physics in designing chemicals.
3) By principles of physics we can find mass number and charge number.
4) Various branches of chemistry are based on principles of physics like thermo chemistry, physics, chemistry etc.

c) physics is linked with geography because:-

1) Telescope is the invention of physics which is used by geologist.
2) Magnetic "N" £ "S" poles used by geologist.
3) Angle of inclination is the invention of physics which is used by geologist for finding angle of inclination.
4)with the help of pressure geologist observe various changes at sea level.

d) physics is linked with astronomy because:- equation of motion, telescope, satellite, gravity, space time etc. deals with the physics which are used by Astromomist for different purposes.

Numerical problems

Q.1 Express the following in power of 10.

Ans. (A) 7 nanometer = 7×10^{-9}m b) 96 mega Walt = 96×10^{6}walt.
c) 2 giga bite = 2×10^{9}bite d) 43 Pico farad = 43×10^{-12}farad.

Q.2for each of these identify the number of significant figures. And in scientific notation.

Ans. (A) 706.5:- there are four significant figures in 706.5
$706.5 = 7.06 \times 10^{2}$
b) 0.067800 sec: - there are five significant figure in 0.067800 inand
$0.067800 = 6.7 \times 10^{-2}$ sec

Q.3 change to scientific notation.

Ans. (A) Diameter of Hlv = 0.000 0001m = 1×10^{-7} m.
b) Diameter of sun = 1000 000 000 = $1x\ 10^{9}$m.

Q.4 A beaker contain 200ML of water(14 to = 1000 cm ^{3})

Ans. What is volume inm^3 and cm ^{3}
V = 200ml = 200×10^{-3} L
We know that:- 1 liter = 1000 cm ^{3}
Then 200ml = $200 \times 10^{-3} \times 1000$ cm ^{3}
200ml = $200 \times 10^{-3} \times 10^{3}$ cm ^{3}
200ml = 200cm^3
To get volume in m^{3}we divide cm^3 by $(100)^3$
200ml = 200 m^3/$(100)^3$
200 mL = m^3 / $(10^2)^3$
200ml= 200 m^3 /10^6
200ml = 200 x 10- 6 m3

Chapter2

KINEMATICS

Q.1 **what is kinematics? Also define rest and motion?**

Ans. **Kinematics:-**the branch of physics which deals with the study of motion of bodies without reference to force is called kinematics.

Rest :-if a body does not change its position with respect to its surrounding then the body is called in state of rest. For example a boy is setting in his chair in his class room .then he does not change his position with respect to his surrounding and we say that boy is in state of rest.

Motion:- if a body changes its position with respect to its surrounding then the body is called in state of motion. For example a cyclist changes his position every moment with respect changes his position every moment with respect to his surrounding then we say that cyclist is in state of motion.

Q.2 discuss types of motion with examples?

Ans. There are three types of motion which are given below.

Translator motion:- That type of motion in which every particle of a body move parallel to each other along any path is known as translator motion. For example motion of car, motion of airplane motion of birds and motion of boat.

Rotatory motion:- that type of motion in which every particle of a body move around a fix point is known as rotator motion. For example motion of fan, motion of wheel and motion hand 's clock.

Vibratory motion:- the to and for motion of body area the same path about its mean position, is known as vibratory motion. For example motion of a pendulum and motion of mass attached to a spring.

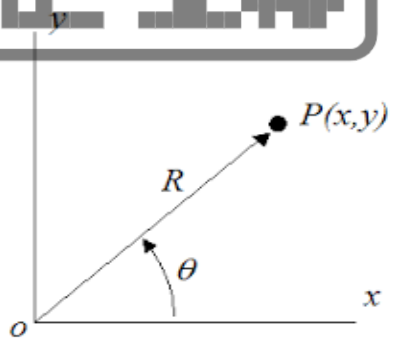
Q.3 define some terms associated with motion?

Ans. **Position:-** The location of an object relative to some reference point is known the position of that point.

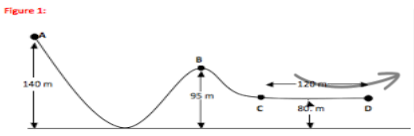
In opposite figure an object is shown at point "p" .by joining "o" and "p" we get op = r

Where r is the distance of "p" from Oregon. P(x,y) is the position of point

And Q is angle with x-axis.



Distance:-the length of actual path covered by a body during motion is called Distance it may be straight or curved. It is scalar quantity and its unit is meter.



Displacement:- the shortest distance b/w any two point is called displacement. In opposite figure AD is displacement while ABCD is covered distance.

Speed:-distance covered by a body in unit time (1 sec) is called speed.

Mathematical speed = distance covered /time **v = s/t**

It is a scalar quantity and its unit is m/sec.

i. **Uniform speed:-** if a body covers equal distance in equal interval of time then the speed is called uniform speed .
ii. **Variable speed:-** if a body covers unequal distance in equal interval of time then the speed is called variable speed.
iii. **Average speed:-** total covered distance divided by total taken time is equal to average speed. **math:-**total covered distance /total time. **<v> = s/t**
iv. **Instantaneous speed:-**the speed of a body at any particular instant of time is known as instantaneous speed. **Math:-**vins = Δs/Δt where "^s" is the small distance covered in small time "^t".

Velocity:- the rate of change of displacement is called velocity.

Mathematics Velocity = displacement / time **V =s/t**

It is a vector quantity and its unit is m/sec.

i. **Uniform velocity:-** if a body covered equal displacement in equal interval of time then the velocity is called uniform velocity.
ii. **Variable velocity:-**if a body covers unequal displacement in equal interval of time then the velocity is called variable velocity.
iii. **Average velocity:-**total displacement divided by total taken time is equal to average velocity. Math. Average velocity = total displacement /taken time. **$<\overrightarrow{v}>$ = $\overrightarrow{s}$/t**

Iv .**instantaneous velocity:-** the velocity of a body at any particular instant of time is known as instantaneous velocity. Math. $\overrightarrow{\text{vins}} = \Delta s /$ Δt Where "^ s" is the smallest. Displacement covered in small time "^t"

Acceleration :-the rate of change of velocity is called acceleration.

Math:- acceleration = velocity/time $\overrightarrow{a} = \overrightarrow{\Delta v}/\Delta t$

It is a vector quantity and its is m/sec.

i. **Uniform acceleration:-**if velocity of a body changes equally in equal interval of time is called uniform acceleration.
ii. **Variable acceleration:-** if the velocity of a body changes unequally in equal interval of time is called variable acceleration.
iii. **Linear acceleration:-** linear acceleration produced due to change in magnitude of velocity of body.
iv. **Radical acceleration:-** radical acceleration is produced due to change in direction of velocity.
v. **Negative acceleration:-** if the magnitude of velocity decreases with the passage of time then it is called –ve acceleration.
vi. **Instantaneous acceleration:-** the acceleration of a body at any particular instant of time is known as instantaneous acceleration.

Math:- αins = $\overrightarrow{\Delta v}/\Delta t$ where is the small velocity covered in small time "^t".

Q.4define and explain scalar and vector quantities with examples?

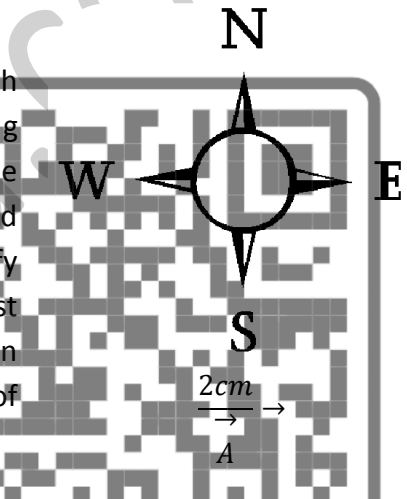
Ans. **Scale quantities :-**Those physical quantities which can be completely specified by their magnitude only are called scalar quantity For explanation of scalar quantities we need a number with a proper unit. If any one of them is ignored then our explanations incomplete. Scalar quantities can be add, subtracted, multiplied and divided by ordinary method of mathematics.

Speed , distance, mass, power, density, charge, volume current and heat etc are the examples of scalar quantities.

Vector quantity:-those physical quantities which are completely described by their magnitude as well as direction are called vector quantities for complete explanation of these quantities we need a number unit and also a direction. These three things are very necessary for complete description. If we ignore any one of them then our explanation is incomplete. Velocity, force torque, weight, displacement and acceleration etc are examples of vector quantities.

Q.5 discusses how a vector is represented?

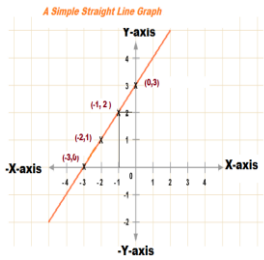
Ans. Symbolically a vector is represented by any English alphabet having an arrow head above or below it g graphically a vector is represented by a straight line having an arrow head at its one and. The arrow head indicates the direction of the vector. We should specify the direction by drawing "news" ie north, east west and south direction, for drawing a vector as shown in figure. A vector $\vec{a}$ of magnitude 2cm in the direction of east is drawn.



Q. 6 **what is graph? Describe methods of drawing graph and calculating slope?**

And. **Graph:-**A straight or curved line which shows the variation of one quantity due to change in other quantity is called graph.

Drawing of a graph:-for drawing of graph two perpendicular lines on each other are drawn. The horizontal line is known as x-axis which is shown in figure by "xox" while the vertical line is known as y-axis which is shown in figure by "yoy" the point of intersection of both lines see big "A" is called Oregon which is denoted by "o" the independent variable is taken along y- axis .



Calculation of slope:-we can calculate slope from graph by following method shown in gig B.

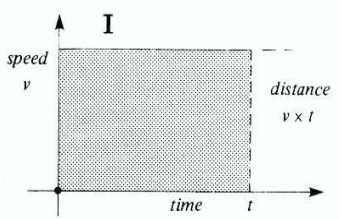
i. Pick any two points on graph and determine their co-ordinate ie.
P_1 (x_1 y_1) and p_2 (x_2, y_2).

ii. Draw perpendicular from both points to x- axis and y- axis.

iii. Find $\Delta x = x_2 - x_1$"deffernce in x-coordinate.
iv. Find $\Delta y = y_2 - y1$"difference in y-coordinate.
v. Find the slope "m"by given formula m= slope = $\Delta y/\Delta x$

Q.7 explain the distance time speed graph in state of a) rest b) uniform c)variable speed.

a. **In state of rest:-** in state of rest there is no change in distance with the passage of time. So get the line graph a straight horizontal line as shown in (a)



Distance-time graph for uniform speed

b. **For uniform speed:-** we known that during uniform speed a body covers equal distance in equal interval of time. So we get a uniform slope of graph as shown in fig (b)

c. **For variable speed:-** we known that during variable speed a body covers unequal distance in equal time. Hence in this case the slope is not constant and we get a curved line of graph as shown in fig (c

Q.8 how can determine the travelled distance from a speed time graph?

Ans. We can find the distance covered from a speed time graph by following method. We know that = speed = distance cover/time or distance covered = (speed) x (time) ….(i)

From given figure at point "B" we want to find covered distance. For which we draw perpendicular "B" on "oc"

Now speed at c:- speed = BC and BC = oA

So speed at c:- speed = oA……..(ii)

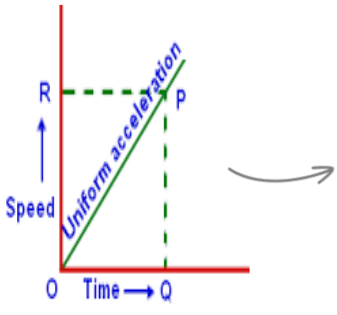
And time at c:- time = oc ……..(iii)

Putting the values of speed an time in eq (i) we get distance covered = (OA) x (OC) = OA x OC = area of OABC.

Hence distance covered= Area of rectangle "OABC"

Q.9 find acceleration and distance covered from a speed time graph when acceleration is uniform?

Ans. The speed time graph of a moving body during uniform acceleration is shown in fig we want to find "$\vec{a}$" and " $\vec{s}$" .



Speed-time showing uniform acceleration

To find acceleration:-as we know that acceleration= change ins speed or velocity/time…….(i) to find acceleration at point "B" from given figure. We draw "BC" perpendicular "OC" as shown and from graph it is clear that :- take time = OC ……..(iii)

Putting these values in eq (i), we get. Acceleration = bc/oc

Here slope OB is acceleration of moving body.

To find covered distance:-according to given figure the

Covered distance is given by distance covered = area of

△OAB…..(i) but , area of △OAB = ½ [Area of rectangle OABC]…….(ii)

Also Area of rectangle OABC= OC x OA

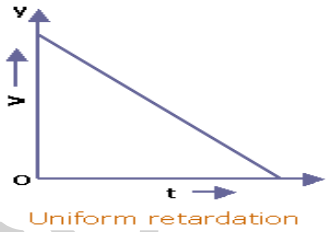
Putting this value in eq (ii) we get area of OAB =△½ (oc x OA)…….(III)

Putting eq(iii) in eq (i) we get.

Distance covered = = ½ (oc x oA)

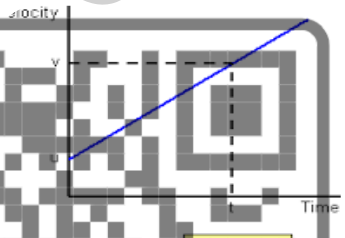
5 = ½ (BC x OC) (:.OA =BC(

Q.10 discuss the speed time graph for retarding speed?



Ans. when the speed of a body decreases equally in equal interval of time then the speed .the graph of a retarding speed is shown in figure where "OQ" represents the maximum speed. "op" represents the time while "QP" is the uniform retardation.

Q.11 find uniform acceleration and covered distance by speed time graph when initial speed is not zero?



Ans. The speed –time graph of a body is shown in figure. The body has some initial velocity "vi" at point "A" to "B" the body moves with uniform acceleration, and its changes from "vi" dto "vf " in time internal of **"t"** now we want to find acceleration and distance covered from figure.

Acceleration:-as we know that uniform acceleration = a= vf – vi/t …….(i)

Since in graph vf= BC ,vo = OA and time = t= oc putting these values in eq (i) ,we get.

Acceleration = BC – oA/oc.

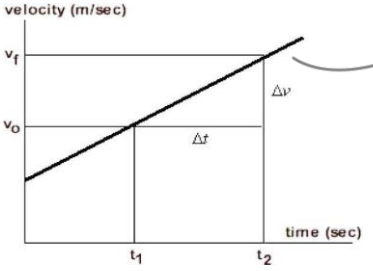
Distance covered:- according to given figure the distance covered is equal to the area of trapezium "OABC" so covered distance = Area of trapezium "OABC" ….(i) and we also know that:-

Area of trapezium OABC = ½ [(sum of parallel sides)(light)]……(ii)since in figure "oA" and "BC" are the parallel sides of trapezium while "oc" is the height of trapezium. Then,

Area of trapezium = ½[(oA+BC)(oc)]……..(iii)

Comparing eq (i) and eq (iii) we get….covered distance = ½ [(oA+BC)(OC)].

Q.12Dderive 1st equation of motion? (OR) prove that vf = vi + at.



Asn. The speed time graph of a body is shown in figure. Where the body has some initial velocity "Vi" at point "A".and from "A" to "B" it moves with uniform acceleration and its velocity changes from "Vi" to "Vf" in time "t". for completion of figure we draw "BC" perpendicular to "oc" and also draw :AD" and "BE" parallel to "oc". Then from given figure it is clear that:-

Final velocity = vf = BC ……(i)

But BC= BD+DC then eq (i) becomes,

Vf = BD+DC……..(ii)

⇨ Vf = BD+OA, because DC = OA

⇨ Vf = BD+Vi,,,,(iii) because OA= vi

Now we find out the value of BD for eq(iii) since a = AB = BD/AD

⇨ A= BD/AD => a x Ad = BD

⇨ BD = a x AD => BD = a x oc because AD = oc

⇨ BD = a x t because AD = t

Putting this value in eq (iii) we get. Vf = at +vi or =>**v f= vi + at** and this know as 1st eq of motion.

Q.13 derive 2nd equation of motion ($s = vit + ½ at^2$)

Ans.Note. Use the some figure given in equation 1.. let suppose a body is moving with some initial velocity "Vi" as shown in figure at point "A" and its velocity changes from "vi" to "vf" uniformly in time "t" .then the distance covered "S" during time "t" is equal the area of space b/w "AB" and time axis. Which is equal to area of OABC so .distance covered = area of OABC……(i) and from figure it is clear that :-

Area of OABC= area of rectangle OABC + Area oΔABD ….(ii) now we find out areas of rectangle o ADC and Δ ABD… Area of rectangle oADC = (oAxoc)…… (iii)

And Area of △ ABD = a/2 [Area of rectangle AEBD]

Area of ΔABD = ½ [AE x AD] because Area AEBD = AE x AD

Area of △ ABD = ½ [BD x AD] …… (iv) Because AE = BD putting eq (iv) and eq (iii) ineq (ii), we get, . Area of oABC = (oA x oc) + ½ (BD + aD)….(v) since from figure:- oA = vi , oc = t AD = oc = t putting these values in eq (v)

Area of oABC = (vi x t) + ½ (BD+ t)……..(vi)

Now we find out BD for eq (vi)

As a = AB = BD/AD => a = BD/AD

⇨ a x AD = BD => BD = a x AD

⇨ BD = a x t because (AD = oc = t)

Putting this in eq (vi) we get area of oABc=vit + ½ (at x t)

Area of oABC = vit + ½ at^2 ……(iii)

Comparing eq (i) and eq (vii) we get **$s = vit + ½at^2$**

This equation is known as 2nd equation of motion.

Q.14 derive 3rd equation of motion? ($2as = vf^2 – vi^2$)

Ans. Let the suppose the velocity of moving body changes uniformly from " vi" to "vf " and covers some distance "s" in time "t" now we want to derive such an equation for finding distance which does not need for time in its derived form. Then we can find the distance by the Area of trapezium oABC…….(i) but we know that:-

Area of trapezium = ½ [(sum of parallel sides)(height)….(ii) at is clear from figure that "oA" and "BC" are parallel sides of trapezium while "oc" is the hight.

Hence area of trapezium = ½ [{oA+BC)x (oc)]…..(iii)

Now we find out value of "t"from 1st eq motion vf = + at =>vf- vi = at => t = (vf – vi) /a putting value of t in equation (iv) we g.

Area of trapezium =$(\frac{vf+vi}{2})(\frac{vf-vi}{a}) = \frac{(vf+vi(vf-vi)}{(2)\quad(a)}$

Area of trapezium = $(vf^2- vi^2)/2a$ ….(V)

Comparing eq (i) and equation (v), we get. Distance covered = $(vf^2 – vi^2)/2a$

⇨ $S = (vf^2 – vi^2)/2a$

Xing b/s by 2a we get.

$2as = vf^2 – vi^2$ and this is known as 3rd equation of motion.

Q.15explain the motion of bodies under gravity?

Ans. The attraction of earth on any object is called gravity the rate of velocity due to attraction of gravity is called acceleration due to gravity or gravitational acceleration. It is denoted by "g" and its value is equal to $9.8m/sec^2$but for simplicity and eas solution of question we use $10/sec^2$.

Galileo was a famous Italian scientist who showed that all bodies of different masses when dropped from the same light will reach the ground at the sometime from this experiment he concluded that if we neglect air resistance then all bodies either lighter or heavier will fall down with same acceleration we use all the three equations of motion for free falling bodies also. In which we replace "a" by "g" in all equations. As given.

i)$vf = vi +gt$ (ii) $s= vit +1/2\ gt^2$ (iii) $2gs = vf^2 – vi^2$.

CONCEPTUAL QUESTION

Q.1 can a body at rest be regarded in motion. Give example?

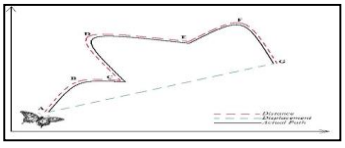
Ans. Yes a body at rest can be regarded in motion. For example a passenger setting in moving bus is in state of rest with respect to other passenger inside the bus but he Is in state motion with respect to things out side of the bus.

Q.2 is the distance covered by a body may be greater than the magnitude of displacement?

Ans. Yes, the distance covered by a body may be greater than the magnitude of displacement. As shown in figure where ABCD is the covered distance which is greater the displacement. AB.

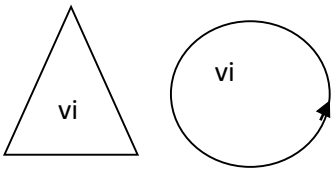
Q.3 as it possible that displacement is zero but not distance?

Ans. Yes. It is possible that displacement is zero but not distance as show in figure a body starts from initial point and comes back to its initial point other walking



along circular or triangular path. In both cases the displacement is zero but distance is not zero.

Q.4 under what condition displacement is equal to distance?



Ans. when a body moves from one point to another along a straight line. Then the magnitude of displacement is equal to the distance covered.

Q.5 can a body have acceleration with zero velocity?

Ans. yes, a body can have acceleration with zero velocity because when an object is thrown vertically upward it comes to rest at certain height and velocity becomes zero but it comes back down ward and its acceleration is not zero.

Q.6 can the speed of a body be – ve?

Ans. no the speed of a body cannot be – ve because it depends upon covered distance and take time and these both can never be – ve that's why speed of a body cannot be negative.

Q.7 is it possible that the velocity of a body be in a direction other than the direction of acceleration?

Ans. yes, it is possible that the velocity of a body be in a direction other than the direction of acceleration. Foo example a decelerating body has velocity and acceleration both in appoint direction.

Q.8 is the kinematic equation s = vit + ½ at^2 to if acceleration.

Ans. yes, the kinematic equation s =vit + ½ at^{2}can not be true if acceleration is not constant. Because it is derived on the base of uniform acceleration.

Q.9 for answer see Q2 page:15.

Q.10 give on example of an accelerated body moving with uniform speed?

Ans. when a body is moving along a circular port. Then during its circular motion its speed is constant.

Q.11 is unit kmh^{-1} s^{-1} same as kms^{-1}h^{-1}?

Ans. yes units kmh^{-1}s$^{->}$andkms^{-1}h^{-1} are the same because in math's we have A.B = B.A. similarly h^{-1} s^{-1}= s^{-1}h^{-1}have the same meaning.

Q.12 for answer see Q8 page 16.

Q.13 if an object is stationary is its acceleration necessarily zero?

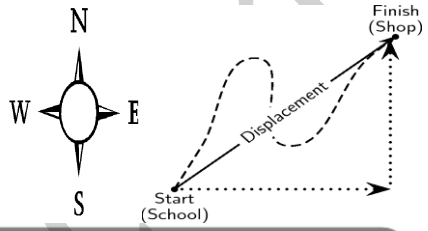
Ans. the acceleration of a stationary body may be or may not be zero. Because when change in velocity ie Δv = 0 the a = o/t i.e acceleration is zero but in case of objects thrown vertically upward comes to rest at some height the velocity becomes zero but still has acceleration because of gravity.

Q.14 when the velocity time graph is a straight line parallel to time axis, what can you say about its acceleration?

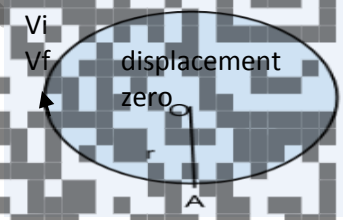
Ans. when the velocity time graph is a straight line parallel to time axis then the velocity is uniform and a body having uniform velocity has the acceleration equal to zero.

NUMERICAL PROBLEMES

1. A bus travel 15km toward west and makes u-turn back to travel a further distance of 10km find.
   a) Distance travelled b) it displacement?
   Distance covered west – ward = 15km
   ;; ;; ;; East – ward = 10km
   According to given figure.
   Distance travelled = AB + BC = 15 +10 = 25 km.
   Displacement = AB – BC = 15 – 10 = 5km.



2. A race car travel around a circulars track, covering a distance of 580m in 25 mints before stopping at point from where it started determine average velocity of the car during this period?
   Cover distance = 850m time = t = 25sec average speed = <v> =?
   $\overrightarrow{< v >}$ = total displacement/total taken time as the body moves on a circular path and comes back to its starting point, hence displacement is zero as shown.
   $\overrightarrow{< v >}$ = =0/25 =>$\overrightarrow{< v >}$ = 0.



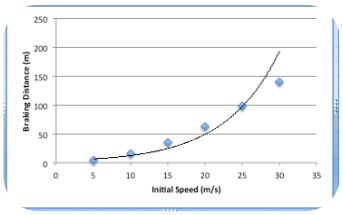
3. A truck moving at a speed of 20m/sec begins to slow at constant rate of 3m/sec^2. Fin for it goes before stopping?
   Initial speed = vi = 20m/sec

Initial speed = vi = 20m/sec	$2as = vf^2 - vi^2$
Final speed = vf = 0m/sec	$2 x - 3 x 5 = o^2 - 20^2$
Acceleration = a = -3 m/sec	-65 = - 400
Distance covered before stop's =?	$\frac{-65}{-6} = \frac{-400}{-6}^{66.6}$ =s=67m

4. The speed of a bus reducing uniformly from 15km/sec to 7m/sec while travelling a distance of 90 m (a) find acceleration (b) further covered distance before stopping

Initial speed = vi = 15m/sec, final speed = vf = 7m/sec

Distance cover = 5_{AB} = 90m (a) acceleration = a = ?



b) farther covered distance before stopping = s_{ac}=?

a) from 3rd eq of motion

$2as = vf^2 - vi^2$

$2 \times a \times 90- = 7^2 - 15^2$

$180 \times a = 49 - 225$

$180\ a = -176$ $\Rightarrow a = -176/180 \Rightarrow$ **$a = -0.977 ms^{-2}$**.

(b) to find further distance covered before we find all covered distance from A to C (S_{Ac}) and the subtract the distant covered from A to b (S_{AB}=90) we get s_{bc} as shown in fig for this we have vf = 0

From 3rd eq: motion we have 2as p $vf^2 - vi^2$

$2 \times -0.977 \times s_{AC} = 0^2 - 15^2 \Rightarrow -1.1955\ s^{AC} = -225$

$S_{AC} = -225/-1.95 \Rightarrow S_{AC} = 115.05$

Now:-

$S_{BC} = S_{AC} - S_{AB} = 115 - 90 =$ **25.04m**

5. Brakes are applied to a train travelling at 73km/hr after passing over 200m its velocity is reduced to 36kmh^{-1} at the same rate of retardation how much further will it go before it is brought to rest.

Initial velocity = vi = 72km/hr = $\frac{72 \times 1000}{3600} = 2 \times 10 =$ 20 m/sec.

Final velocity = vf = 36 km/hr = $\frac{36 \times 1000}{3600} =$ 10m/sec.

Distance covered = S = 200m (a) acceleration = a = ?

(B) further distance covered after 200 m = s ?

(a) from 3rd eq: motion,

$2as = vf^2 - vi^2$

$2 \times a \times 200 = 10^2 - 200^2$

$400\ a = 100 - 400$

$400a = -300$ $\Rightarrow a = -300/400 \Rightarrow a = -0.75 ms^{-2}$

(b) to find distance covered after 200m we will 1st total distance from A to B ie SAB for which vf = o from 3rd eq: motion:- $2as = vf^2 - vi^2$

$2 \times -0.75 \times s^{ac = o}2 - (20)^2 \Rightarrow -1.5\ S_{AC} = -400$

$S_{AC} = -400/-1.5 \Rightarrow$ st = 266.66m

Now distance covered after zoom is from B to eis$_{BC\ is}$ given by :- $S_{BC} = S_{AC} - S_{AB}$

$S_{BC} = 266.66 - 200 \Rightarrow$ **$S_{BC} = 66.66m$**

Q.6 A motor cyclist is moving on a road with an acceleration of 3m/sec^2.how much time will it require to change the velocity from 10m/sec^2 to 20m/sec?

Ans. acceleration= a = 3m/sec initial velocity = vi = 10m/sec

Final velocity =b vf = 20m/sec time required?

Sine vf vi + at =>vf – vi at

=>t =n (vf) – vi)/a => = (20 – 10/3

=>t = 10/3 => t = 3.3 sec

Q.7 initial velocity = vi = o a = 0.2m/sec, time = t= 2min = 2 x 60 = 120 sec

Ans.(a) final velocity = vf = ? (b)distance covered = s= ?

(a) Vf = vi +at =>vf = o + 0.2 x 120

Vf = o + 24 =>vf = 24m/sec

(b) $S = vit + ½ at^2$ => $s = o \times 120 + ½ (0.2) (120)^2$

$S = o + ½ \times 0.2 \times 1440^{720}$ => s =m 720 x 0.2 =>**s = 1440m**

Q.8 initial speed =v= 20m/sec final speed at height H = vf = o

Ans. distance covered = s = ? a= g = 10 m/sec^2

From 3rdeq: of motion.

$2gs = vf^2 - vf^1$ => $2 x – 10 x s = o^2 –(20)^2$

-20 s = - 400 => $s = 2_{A0\theta}$ /- 20

S = 20m

Chapter 3 Dynamic

Q.1 Define and explain force?

Ans. force:-an agent which moves or tends to move a stationary body stops or tends to stop a moving body or tends to change the speed or direction of moving body is known as force.

Force is vector quantity and its unit is Newton. One Newton is that force which moves a body of one kg with acceleration of $1m/sec^2$.

Q.2 state and explain or Newton 1st law of motion?

Ans. Newton's 1st law:-this law states that in the absence of any external force a body in rest will always remain in rest and a body in motion will always continue its motion in a straight line with uniform speed.

Explanation:-this law has two parts which are explained below.

In 1st part it is stated that in the absence of any external force a stationary body will always be at rest for example a book is laying on table so it will remain stationary and will not change its by itself unless someone move it by applying a force.

In 2nd parts it is stated that a moving will always move along a straight line unless someone stops it by applying a force but when a ball is kicked it comes to state of rest after covering some distance it is because the force friction of air and earth acts upon the ball the each moment which compels it to stop.

Q.3 state and explain law of inertia?

Ans.1 inertia:-Newton's 1st law of motion is also known as inertia "inertia" is the property of a body which opposes any change in its state of rest or motion.

Explanation:-inertia depends upon the mass of a body in fact mass is the measure of inertia. Greater the mass of a body greater will be inertia greater force will be required to stop it e.g the inertia of hard cricket ball is greater than the inertia of soft ball and greater force will require to stop hard ball.

Examples:-(1) when a jerk is given to the branch of a tree all fruits falls down from it because when branch comes into motion at on at that time the fruits in rest and tends remain in rest as a result + they separated and fall down.

(2)when a carpet is beaten with a stick. The carpet set into motion suddenly while the dust particles are at rest and tends to remain at rest and tends to remain at rest as a result they fly off from carpet.

(3) when bus suddenly stops the lower past of passenger comes into rest while the upper past is still in motion and tends to remain in motion as a result the passenger falls forward.

(4) when a person jumps from a moving vehicle, his feet come in contact with ground and comes to state of rest while the upper part is still in motion and tends to remain in motion, As a result person gets hurt.

(5) A parcel laying on the seat of a car move with same as that of the car whe breaks are suddenly applied the comes into rest but parcel is still in motion and tends to remain in motion due to inertia as a result the parcel falls into the floor.

Q.4 state and explain Newton's 2nd law in detail?

Ans. statement:-this law states that when a force acts on a body on acceleration is produced in direction of force which is directly proportional to the applied force but inversely proportional to the mass of the body.

Explanation:- if we apply a force "f" on a body of mass "m" and it produces acceleration "a" in the direction of applied force, the it mathematical from is given as

$a\varphi$ f…… (i) $a\varphi 1/m$…….(ii)

Comparingeq (i) and eq(ii) we get,

$a\varphi$ f. q/m => a φ f/m

=>a = (k)f/m ……(iii)

If f = 1 N mass = 1kg then k = 1 so by putting

k = 1 we get a = f/m =>f/,m => = ma ……(iv)

Equation (iv) represents the mathematical form of 2nd eq: of motion.

If we apply equal force on two bodies of different masses, the acceleration of lighter body will be greater than the acceleration of heavy body. Similarly greater the applied force greater will be the acceleration produced.

Example :-when a cricketer catches the ball he moves his hands backward. By doing so the acceleration of ball decreases and the force of ball caching in hand is also decreases and by catching the ball the cricketer feel less fain.

Q.5 state and explain Newton's 3rd law with the help of examples?

Ans. Newton s third law:- states that for every action there is a reaction which is equal in its magnitude but opposite in direction.

Explanation:-when a body exerts some force on another body. Then the 2nd body will also exert a force on 1st body the force exerted by 1st body on 2nd body is action and let it Is equal to $\overrightarrow{F12}$. And the force exerted of 2nd body on its body is known as reaction and let it is equal to F_{12}. These forces are equal in magnitude but their direction is opposite and the mathematical from is given as:-

$$\vec{F_{12}} = - \vec{F_{21}}$$

Example(1): when air is released from balloon the balloon [illegible] k ward direction which is action while the air pushes the balloon in forward direction which is reaction.

Examples(2):- when a fireman directs a hose pipe toward fire the water shoots out from the pipe in forward direction which is action on water. And water pushes the pipe in back ward direction which is reaction.

Example(3): when a passenger jumps from a boat they pushes the boat with their feet in the backward direction which is action. Because of this reason the boats mans generally tie the boat on the river on the bank and then the passenger are allowed to step out.

Q.6 differentiates b/w mass and weight?

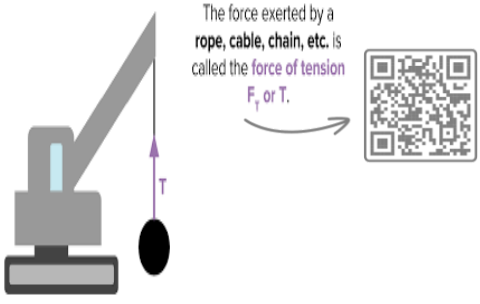
S.No	Mass	Weight.
1	The quantity of matter in a body is called mass.	1 The force with which earth attracts things toward its center is called force.
2	Mass is constant everywhere.	2 Weight is variable quantity.
3	Mass is measured by ordinary balance I-ie beam balance.	3 weight is measured by spring balance.
4	It is represented by "m".	4 it is denoted by w.
5	It is scalar quantity.	5 it is vector quantity.
6	Its unit is kg.	Its unit is Newton.

Q.7 Defines and explain tension?

Ans. tension:- the force exerted by string on the hand is called tension . It is denoted by "T".

Explanation:- suppose a man is holding a body of mass "m" in his hands with the help of string as shown in figure.

In his case the weight of object exerts a force on our hands in down direction which is action as a reaction the hands also exerts an equal force on object in upward direction .so in this case the force which is exerted by string on our hands is known as tension. Which is denoted by



"T" in state of rest tension in string is equal to its weight ie.**T = w = mg.**

Q.8 discuss the motion of bodies connected to a string [(a) a two machine (b) modified machine]

Ans. **(a) Atwood machine:-**[when two bodies move vertically consider two bodies "A" and "B" which are connected to the ends of a frictionless fully as shown in figure. This type of arrangement is known as Atwood machine.

Let mass of "A" is "M" weight is "W_1"and mass of "B" "M_2" weight is "W_2" weights are acting in downward direction while tension in string is acting in upward direction

Let $m_1 > m_2$, then m.will move downward and m_2 will move in upward direction then force on "A" is "F_1"

$F_1 = w_1 - T$ as $f_1 = m_1a$ and $w_1 = m_1g$

Then $m_1a = m_1 g - T$ .....(i)

And force o "B" is "f_2" which is given.

$f_2 = T - w_2$ as $f_2 = m_2 a$ and w_2 m_2g

then$m_2a = T - m_2 g$.....(ii)

Now we want to calculate the value of "a" and "T" so by adding eq (i) $\varepsilon_1$eq (ii) we get.

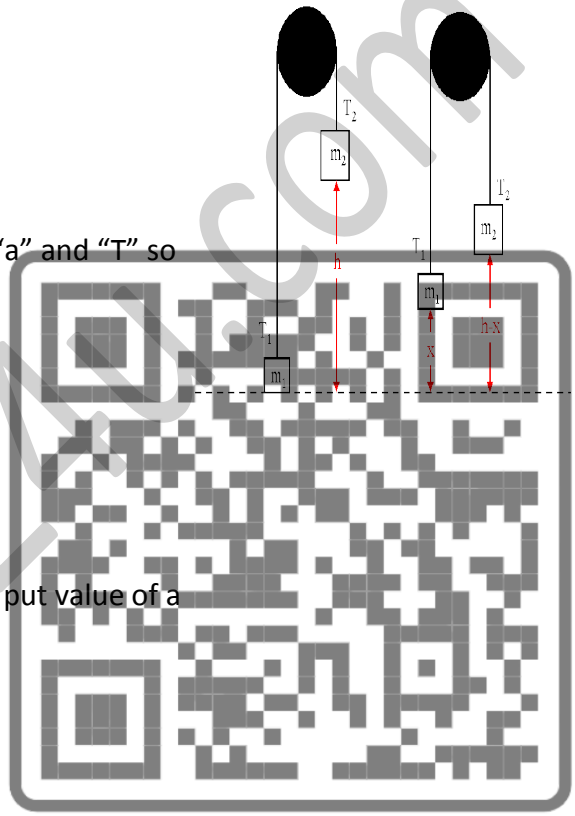
$M_1a + m_2a = m_1g - T + T - m_2g$

$M_1a + m_2a = m_1g - m_2g$

$A(m_1 + m_2) = g (m_1 - m_2)$

Deving b/son $(m_1 + m_2)$, we get

$\frac{[(m_1 - m_2)]}{m_1 + m_2} g$.....(iii)



Now we want to find "T". For which we put value of a ineq (ii) so.....

$m_2a = T\ m_2g \quad => m_2a + m_2g = T$

$T = m_2a + + m_2g$

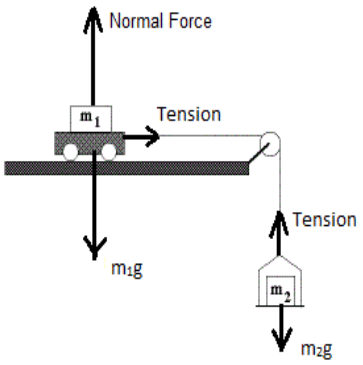
$T = m_2\frac{[(m_1 - m_2)]}{m_1 + m_2} g + m_2g$ $\quad => T = m_2g\ [\frac{(m_1 - m_{2+\ 1})}{m_1 + m_2}]$

$T = m_2g\ \frac{[m_1 - m_2 + m_1 + m_2]}{m_2 + m_1}$ $\quad => T = m_2g\ \frac{[\ 2m_1]}{m_2 + m_1}$

$$T = \frac{[2m_1m_2]}{m_1 + m_2}\ g$$

(c) Modified machine:- [when one body move vertically and other horizontally consider two bodies "A" and "B" which are connected to the ends of a string as shown in figure, one body moves vertically downward while the other horizontally.

Such arrangement is known as modified machine let mass and weight of A ε B are m_1 ,m_2 and w_1 , w_2 respectively. Let $m_1 > m_2$the



m_1 will move downward vertically while m_2 will move horizontally on

the surface of table. Then force on body A is F_1

$F_1 = w_1 - T$ as $f_1 = m_1 a$ $w_1 = m_1 g$

Then $m_1 a = m_1 g - T$ .....(i)

Since looking to "B" we see that $w_2 \varepsilon f_n$ balance each other.

Then force on body "b" is f_2 given by:-

$F_2 = T$ or $m_2 a = T$ .....(ii)

Now we want to find "a" and "T" from both equations.

$M_1 a + m_2 a = m_1 g$ => $a (m_1 + m_2) = m_1 g$

÷ ivy b/y $m_1 + m_2$

$$A = \frac{[m_1]g}{m_1 + m_2} \text{.....(iii)}$$

To calculate "T" we put value of a in eq (ii) we get,

$M_2 a = T$ => $T = m_2 a$ => $T = m_2[m_1/m_1 + m_2]g$

$$T = \frac{[m_1 m_2]g}{m_1 + m_2}$$

Q.9 Define momentum give its unit?

Ans. Momentum:- the quantity of motion in a body is called momentum (OR) the product of mass and velocity of a body is known as momentum it is denoted by "P" if mass of a body is "m" and velocity is "v" then the mathematical can be written as:-

$\underset{p}{\rightarrow}$ = m. $\underset{v}{\rightarrow}$ Momentum upon the mass and velocity of a body. Greater mass and velocity greater will be a momentum produced it is a vector quantity and its unit is kg/sec.

Q.10 explains the relation of momentum with 2nd law of motion?

Ans. let a force "$\underset{f}{\rightarrow}$" is acting on a body of mass "m" and its velocity changes from "vi" to "vf" in time "Δt" Then initial momentum of body = pi = mvi.....(i)

Final momentum of body = pi = mv_f..... (ii)

And change in momentum = $\Delta p = p_f$ - pi = mv_f– mvi

=>Δp = m (v_f – vi)

÷ing b/s on Δt, we get, $\frac{\Delta p}{\Delta t} = m \frac{(v_f - vi)}{\Delta t}$ .....(iii)

But we also know that :- a = (v_f – vi) Δt.....(iv)

Putting eq (iv) in eq (iii) we get.

$\frac{\Delta p}{\Delta t}$ = ma .....(v)

As f = ma so eq (v) become $\frac{\Delta p}{\Delta t}$ = F

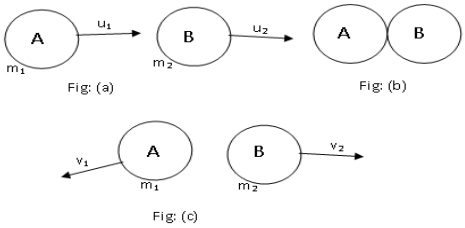
Or [f = $\frac{\Delta p}{\Delta t}$].....(vi)

Equation (vi) shows that the time rate of change of momentum is equal to applied force.

Q.11 **state and explain law of conservation of momentum in detail?**

Ans. **law of conservation of momentum**:-this law states that the total momentum of an isolated system remains constant bodies. (OR) initial momentum of bodies = final momentum of.

Explanation:-consider two bodies "A' and "B"of masses "m_1" εi "m_2" respectively. There velocities before collision are u_1 , u_2 while velocities after collision are v_1 , v_2 as shown in figure.



Momentum of bodies before collision:-

Initial momentum of body A= $p_{ia} = m_1 u_1$…(i)

Initial momentum of body B = $p_{iB} = m_2 u_2$ ….(ii)

Momentum of bodies after collision:-

Final momentum of body A = $p_{fA} = m_1, v_1$ ...(iii)

Final momentum of body B = $p_{fB}\ m_2 v_2$ …….(iv)

During collision bodies will exerts some forces on eachother let "F_{AB}" is the force exerted by "A" on "B" during collision while "F" is the force of "B" exerted on "A" so according to Newton's 3rd these forces are equal in magnitude but opposite in direction.

ie. $F_{AB} = - F_{AB}$ ……(v)

since F_{AB} = rate of change of momentum of "B"

i.e. $F_{AB} = \Delta p_B/\Delta t$

=> $F_{AB} = \frac{(p_{iB} - p_{iB})}{\Delta t}$ = ……

⇨ $F_{AB} = (m_2 v_2 - m_2 u_2)/\Delta t$ … … …(vi)

Similarly $F_{AB} = \Delta pA/\Delta t = (p_{fA} - p_{iA})/\Delta t$……(vii)

Putting eq (vi) and eq (vii) in eq (v)

⇨ $[m_2 v_2 = m_2 u_2 = - m_1 v_1 + m_1 u_1$

⇨ $m_2 v_2 + m_1 v_1 = m_1 u_1 + m_2 u_2$

⇨ $+ m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$

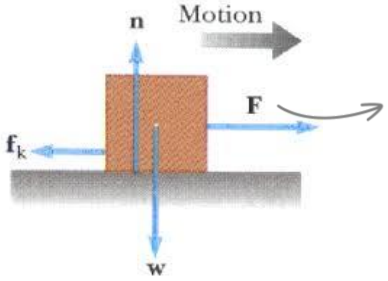
i.e total momentum before collision = total momentum after collision this shows that momentum is constant's there is no change in final εi initial of momentum.

Q. 12 Define friction and give its types?

Ans. **friction**:- a force which always opposes the motion of one body over another body in contact with it is called friction. (OR) the resistive force b/w any two surfaces during motion is known as friction.

It has two types which are given below.

(1) **Sliding friction**:- the force which opposes the sliding friction of a body we see that when a body is laying on surface and we apply some force on it. Then forces are acting on body its weight "W" in down ward direction and force of surface on body in upward direction. These both forces balance each other. Now we apply force "Fa" on it then it is still in state because of resistive force of surface "Fs" friction during this time is known as state friction. When "Fa" is increased a point comes at



which body tends to start motion. Friction during this time is known as limiting friction. When friction is increased more than body starts moving on surface. And friction of body it is observed that limiting friction also increases with on increase in normal force. Mathematically.

F φFn => f = μ Fn

Where μ is constant of proportionality and known as co – efficient of friction. Which depends on nature of surfaces?

(2) Rolling friction:- friction produced during rolling of one body over another body is known as rolling friction. Rolling friction is smaller than sliding friction because the contact area b/w surfaces in rolling are less than that of in sliding friction. For example the rolling friction of steel and steel.

Q. 13 discuss advantages and disadvantages of friction:

Ans.(1) advantages of friction:

i) We walk on ground with the help of friction.
ii) The automobile vehicles move with the help of friction.
iii) We can write on black board and pages because of friction.
iv) Brake of cycles and vehicles and words with the help of friction.
v) Due to friction nails remains fined in walls and woods.
vi) We can climb on tree due to friction.

(3) Disadvantages of friction :-

i) Because of friction heat is produced in various parts of machine which is the waste of usefully energy
ii) Due to friction parts of machine get wear and tear.
iii) Due to friction our shoes becomes useless.
iv) Because of friction theof machine is reduced.

Q.14 Describe methods of reducing friction?

Ans. we can reduce friction by following methods:-

i) By lubricating the parts of machine with grease and oil.
ii) By using rolling techniques instead of sliding techniques.
iii) To polish well the contact surface.
iv) To make the front side of the objects oblong eg airplane.

Q.15 Define and explain centripetal force?

Ans. centripetal force: - the force which compels a body to move along a circular path is known as centripetal force.

Explanation:- centripetal force "Fc" is directly proportional to mass "m" and square of velocity "V^2" of the body, and inversely proportional to the radius of circular path mathematical it is given as:-

$F_c \varphi$ m…… (i) => $F_c \varphi v^2$…….(ii) $F_c \varphi$ 1/r……(iii)

Combining eq (i) ,(ii) and we get

$F_c \varphi m. v^2 .1/r$

⇨ $F_c \varphi m. v^{2/r}$

⇨ $F_c = (k) (m. v^2/r)$ when = k = 1

Then $F_c = m. v^2/r$…….(iv)

Q.16 Define and explain centripetal acceleration?

Ans. centripetal acceleration:- the acceleration which is produces due to centripetal force is known as centripetal acceleration. Which is dental by ac?"

Explanation**:-**when a force compels a body to move in a circle the force is called centripetal forces and the acceleration which is produced because of this force is call centripetal acceleration.

Now. As we know that centripetal force "fc" is given by

$Fc = (mv^2/r$.....(i)

But according to Newton's 2nd law of motion we have $f_c = ma_c$.....(ii)

Combining eq (i) ε eq (ii) we get.

$\cancel{M}a_c = \cancel{m}v^2/\cancel{r}$

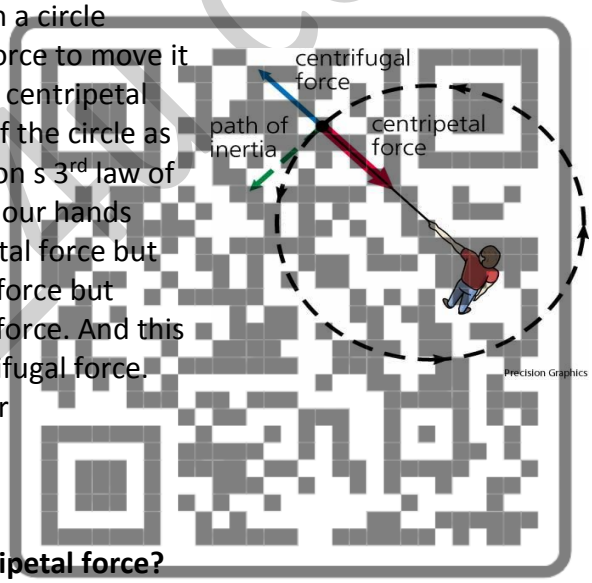
$A_c = a\ v^2/r$

Eq (iii) is the mathematical form of centripetal acceleration a.

Q.17 Define and explain centrifugal force?

Ans. centrifugal force: - the force which equal in magnitude but opposite in direction to the centripetal force is known as centrifugal force. (OR) the reaction of centripetal force is called centrifugal force.

Explanation:- when a stone is whirled in a circle through a string. Then we provide it a force to move it along a curculio path which is known as centripetal force and direction toward the center of the circle as shown in figure. But according to Newton s 3rd law of motion the stone also exerts a force on our hands which is equal in magnitude to centripetal force but opposite in the direction of centripetal force but opposite in the direction of centripetal force. And this opposite and equal force is called centrifugal force.



Mathematically:-$F_{centrigul} = -mv^2/r$

Q.19 Give some practical applications of centripetal force?

Ans. some practical applications of centripetal force are given below.

(1) Banking of road:-usually the outer edge of round bank is kept a little higher than the inner edge. It is called banking of road. When it is raining then the friction b/w the roads and tires does not provide the necessary centripetal force. And it there is no banking in road then the car will slip so the banking provides necessary centripetal force to car to move easily on a round track.

(2) **Centrifuge**:- A device with the help of which we can separate heavy and light particles from mixtures is known as centrifuge. It is based on the principal that if the magnitude of applied force becomes shorter than the required centripetal force. Then the object will move away from the center of the mixture .if a mixture of unequal densities is allowed to rotate rapidly in centrifuge then the heavy particles of liquid remains farther from the axis of rotation while the lighter liquids remain near to the axis of rotation and this these are separated from each other.

(3) **Dryer of washing machine**:- the dryer of washing machine is also based on the principle of centrifuge. Dryer consists of a cylinder which possess thousands of

small holes when wet clothes are rotated in dryer then the drops from wet cloths drained out through holes and the cloths becomes dry.

(4) **Cream separator**:- speed centrifuge with the help of which cream is separated from milk. A simple cream separator is an electric madani. The turning blades of this devise spin the milk due to which the light and heavy component of milk is separated.

CONCEPTUAL QUESTIONS

Q.1 For ans see example no 1 of inertia Q3 page 19.
Q.2 for ans see example no 2 of inertia Q3 page 20.
Q. 3 for ans see example no 3 of inertia page 20
Q.4 for ans see explanation of inertia q3 page 19.
Q.5 for ans see example no 4 of inertia Q 3 page 19.
Q.6 for ans see E g No 1 of 3rd law Q5 page 20.
Q.7 for ans see E g no 5 of inertia q3 page 20.
Q.8 why does one get hurt seriously while jumping on a hard floor.

Ans. when a person jumps on a hard floor the acceleration and velocity of the body becomes zero because the duration of impact is very small due to hardness of the floor as a result the person get hurt seriously.

Q.9**for ans see example of end law. Q 4 page 20.**
Q.10 why is the surface of conveyor belt made rough?

Ans. the surface of conveyer belt is made rough to increase the force of friction. There for the intermolecular forces and this friction also increases. As a result the things laying on the belt remains safe form falling down.

Q.11 why do cons move faster on carom board when dusted with talcum powder?

Ans. when a carom board id dusted with talcum powder the force of friction decreases sufficiently. Because the powder makes a thin layer over the board which offer less friction force to the coin and as a result the coin move faster on the board.

Q.12 **for ans see eg no of 3rd law Q 5 page 20.**
Q.13 for ans see eg no 3 of 3rd law Q5 page 20.
Q.14 how does a gunman get jerk on firing a bullet?

Ans. when bullet is fired from a gum the gun pushes the bullet in forward direction which is action and as a reaction the bullet pushes the gun in backward direction .that's why the gun man get a jerk on firing a bullet.

Q.15 why are the long jump athletes are made to jump in sand pits?

Ans. the long jump athletes are made to jump in sandy pits for softy because when they jump on sandy pits then the time of impact is increased and the impact force decreases and thus the athletes may not be hurted.

NUMERICAL PROBLEMS

Q.1 **what is the acceleration produced by a force of 10 N exerted on an object of 3000gm?**

Ans. force = F =10N Mass = m 3kg acceleration = a =?

As we = known that :- F = ma

=>a = F/m => a = 10/3 = 3.33 m/sec

[a = 3.33 m/sec^2] Ans.

Q.2 calculate the mass of a body when a force of 700N produces an acceleration of 12.5 m/sec^2.?

Ans. Force = F = 700N Acceleration = a= 12.5 m/sec^2

Mass of body = m=? As we know that F= ma

OR m= F/a => m= 700/12.5 =>**m = 56 kg** . Ans

Q.3 a force of 2 x 10^{-3}N acts a body of mass 0.04kg over a distance of 10 m assuming the mass is initially at rest find velocity and time for which the force acts:

Ans. Force = F = 2 x 10^{-3} N

Mass = m 0.04 kg

Distance = s = 10m

Initial velocity = vi = 0

(a) Final velocity = vf = 0?

(b) Taken time = t =?

(a) From 3rdeq of motion:-

2as = vf^2 – vi^2.....(i)

We find value of a for eq (i)

A = F/m = 2 x 10^{-3} /0.04 = 0.05 m/sec

Now 2as = vf^2 – vi^2

2 x 0.05 x 10 = vf^2 - 0^2

20 x 0.05 == vf^2

vf^2 1 => $\sqrt{vf2} = \sqrt{1}$

vf = 1m/sec

(b) Now we find out "t:

S = vit m+1/2 at^2

10 = 0 x t + ½ x 0.05 x t^2

10 = ½ x 0.05 x t^2

10 x 2 /0.05 = t^2

t^2 = 20^2 x 100 = 400

5

$= \sqrt{t2} = \sqrt{400}$

T = 20

Q.4 How much momentum will a dumbbell of mass 10kg transfer to the floor from a high of 0.8m ? 8 = 10m/sec

Sol:- mass = m = 10kg

Distance = s= 0.8m p = ?

Initial velocity = vi = 0 g = a = 10m/sec^2

From 3rdeq : of motion:-

2gs = vf^2 – vi^2

2 x 10 x 0.8 = vf^2 -0^2

16 = vf^2 => $\sqrt{vf2} = \sqrt{16}$

Vf = 4m/sec

Now momentum p = mv

P =mv => p =10 x 4 40 kgm/sec

Q.5 calculate the force require to stop a car of mass 1000kg and loaded truck of mass 10,00kg in 2sec .if they are moving with same velocity of 5/sec.

Ans. Sol:- mass of car = m$_1$ = 100kg

Mass of loaded truck = m_2 = 10,000kg
Taken time = t =2 sec
Initial velocity = vi =5m/sec
Vf= 0
Force required to stop truck = f_2 =?
We know that F = ma
1st we find "a" from 1steq motion a = vf – vi/t = 0-5/2 = - 2.5 m/sec$_2$
Now
F_1= m_1 m_1 a = 10,000 x – 2.5 2500 N
F_2 = m_2 a =10,000 x – 2.5 = = 25000N

Q.6 A bullet of mass 10g is fired with a rifle the bullet takes 0.003/sec to move through barllel and leaves with force exerted on bullet?

Sol:- mass = m = 10kg = 0.01kg
Time = t= 0.003 sec
Initial velocity = vi = o
Final velocity = vf = 300m/sec
Forced exerted on bullet = f =? From Newton's 2nd law we have
F = ma ……..(i)
We find for this equation so
A = (vf – vi)/t = 300-./. 0.03
A = 300/0.003 = 100,000m/sec$_2$
Now f = ma \
F = 0.0 1 x 100,000 = 1000N

Q.7 two bodies of masses 200gm and 300mg are fixed to a string which is passed over a fully has notification then find acceleration of the bodies and tension in string?

Sol. M_1 = 300gm = 0.3kg
M_2 = 200gm = .02kg g = 10 sec
(a) Acceleration of bodies = a =?
(b) Tension in string = T =

(a) $\frac{a = [m1 - m2]g}{m1+m2} = \frac{[0.3 - 0.2]}{0.3+0.2} = g\ 10$

A = [0.1/0.5]x 10 = [0.2] x 10
A = 2m /sec$_2$
T = $\frac{[m1 - m2]}{M_1 + m_2}$ g = [$\frac{2 \times 0.3 \times 0.2}{0.3 + 0.2}$] x 10
T = [$\frac{0.12}{0.5}$] x 10 = 0.24 x 10 = **2.4 N**

Q.8 A girl pushes a box of mass 60kg on floor a force of 300 $_n$ is applied find co – efficient of friction b/w box ε_l floor?

Sol:- m = 60 kg , f = 300 N, μ=?
As we know that :- f = μFn = μmg
F = μmg =>μ= f/mg
X = $\frac{300}{}$ =>$\mu = 0.5$
~~60~~ x ~~10~~

Q.9 A car of mass 1000 kg is running on a circular motorway with velocity of 80m/sec the radius of circular motor way is 800m how mc centripetal force is required?

Mass = m = 1000kg velocity = v = 80 m/sec

Radius = r = 800m fc= 800m fc m=?

Fc = mv_2 /r = 100 x 8~~0~~ x 8~~0~~ /~~800~~

Fc = 1000 x 8 m= 8000N Ans.

Q.10 A body of mass 80gm attached by a spring whiles in a horizontal circle of radius 1m find speed of the stone of tension in string is 50 N.

Mass of body = m = 80gm = 0.08kg

Radius = r = 1m

Speed of stone = v =?

Tension = force = f = 50N

(a) Speed = v ?

As we now that:-

Fc = $\frac{mv^2}{R}$ => $v^2 = \frac{Fcxr}{m}$

$V^2 = m\frac{1 \times 50}{} = 625 \Rightarrow \sqrt{V2} = \sqrt{625}$

V = 25 m/sec

CHAPTER NO 4

TURNING EFFECT OF FORCES.

Q.1 explains the vaious forces acting on a body?

Ans. (a) in earth gravitation field, the attracts everything to ward its center the gravitational force acting on each particle of body is parallel as shown in fig (a)

(b) In figure (b) two a block is shown on a table. Two forces are acting on it. Its weight "w" in downward direction while the normal force of table on block in upward direction these force have some line of action and balance each other.

(c) In figure "c" two forces "p" and "Q" are shown which are acting at points "A" and "B" these forces are known as parallel forces.

(d) In figure (d) two force "l" and "m" are shown which are acting at points "c" and "D" these forces are known as " anti-parallel" forces.

Q.2 **Explain addition of forces in detail:**

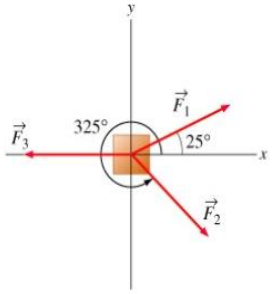
Ans:-force is a vector quantity and forces can be add with each other by vector algebra. The vector we get after addition is known as resultant vector. Some special cases of addition of vectors are given below.

1) **When angle b/w forces is zero (Q=0)**.*when* the angle b/w any two forces is zero then these vectors will be parallel to each other in this case we add the magnitude of individual forces to get magnitude of resultant forces as shown.

2) **When forces are anti parallel I Q = 180^0**:- when two forces are anti parallel then in this case we subtract the magnitude of individual forces from each other to get the magnitude of resultant forces. As shown above in fig 5 + -10 = -5

3) **When angleb/w forces is other than $0^0 \varepsilon\ 180^0$.** When angle b/w forc es is other than 0^0 and 180^0 then we add these vector by different methods in which "head to tail" is mostly used. Head to tail rule method is given below.
4) **Head to tail rules:**- that method in which we combine the tail of 2nd vector with the head of 1st vector and finally we combine the tail of is vector is joined with the head of last vector whose direction is toward last vector and this is our resultant vector this method of edition of vector is known as head tail rule.

Exampale:- in opposite figure three vectors $\overrightarrow{F1,F2,and}$ $\Rightarrow \overrightarrow{F3}$ are shown in figure separately these vectors are add to each other by head to tail rule.



1stof all we draw $\overrightarrow{F1,}$ of the same magnitude and same angle with μ axis. Then we draw $\overrightarrow{F2,}$such that its tail consider with the head of $\overrightarrow{F1,}$ then draw $\overrightarrow{F3,}$on of the same magnitude and angle whose tail is combined with the head of "$\overrightarrow{F2"}$ and at last we join the tail of 1st vector with the head of last vector which is shown by "oc" and its direction is toward last vector and it is our resultant vector.

Q.3 Explain resolution of vectors in detail?

Ans. Resolution of vectors:-the process of splitting of a force into two or more components is known as resolution of vectors.

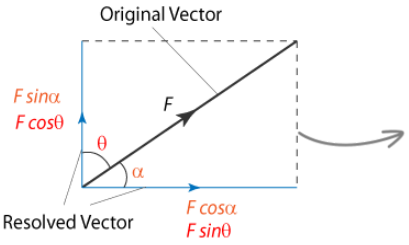
Explanation:- usually a vector is resolved into two such components which are perpendicular to each other and these components are known as rectangular components .the components and the components parallel to y- axis is known as y – component.

Consider a force (vector) $\overrightarrow{F,}$ is acting an some angle Q with X-axis to find its rectangular components we draw perpendicular "AB" on x- axis as shown in figure and thus we get two components "OB" and "AB" "OB" is the x-component of $\overrightarrow{F}$ because it is parallel to x- axis which named as$\overrightarrow{Fx}$. "AB" is represents y- component because it is parallel to y- component and it is named as $\overrightarrow{Fy}$.

We can find the magnitude of these forces by trigonometric ratio s as they are given below.

(1) Sinθ – perpendiculaire/hypoténuse=AB/OA =$\overrightarrow{Fy/F}$

Sinθ = $\overrightarrow{fy/f}$ =>Fy =fSinθ .....(i)



(2) cosθ =Base/hypotenuse= oB/OA$\overrightarrow{Fx}$/ $\overrightarrow{F}$

CosQ = $\overrightarrow{Fx}$/ $\overrightarrow{F}$ =>$\overrightarrow{Fx}$/ = FcosQ .....(ii)

(3) according to pathagorem thermo magnitude of $\overrightarrow{F}$ is given (hypotenuse)^2 = (base)^2 = (perpendicular)^2

⇨ (oA)^2 = (oB) ^{2} =(AB)^2 =>

($\overrightarrow{F}$= $\sqrt{(fx)2 + (fy2)}$.....(iii)

(4) We can find the direction by:=tanQ = perpendicular/base = AB/oB =($\overrightarrow{Fy}$/$\overrightarrow{Fx}$)

TanQ = $\overrightarrow{F}$ y/fx => Q = Tan $^{-1}$ ($\overrightarrow{Fy}$/$\overrightarrow{Fx}$).....(iv)

Q.4 what is torque? On what factors does at depends?

Ans. torque:- the toning effect produced in a body due to applied force is known as torque or moment of force(OR) the measure of an object tendency to rotate about some point is called torque or moment of force.

Explanation:- consider a door as shown when we apply a force an door, then it begins to rotate because of torque. The axis about which the door beignets to rotate is known as axis of rotation. The point at which force is applied is known as point of action and the perpendicular distance b/w point of action of force and axis of rotation known as momentum arm.

Factors upon which torque depends:- we now that mathematically torque is given by the product of moment arm and applied force. $\overrightarrow{\text{Í}}$ = $\overrightarrow{y}$ x $\overrightarrow{f}$ (OR) $\overrightarrow{\text{Í}}$= $\overrightarrow{r}$ $\overrightarrow{f}$ sinq ^n.....(i)

So eq (i) show that torque depends on following factors.

(1) Torque depends upon the torque depends on following factors. Greater the applied force grater will be torque.

(2) It depends upon the magnitude of moment arm $\overrightarrow{r}$ $greater$ the $\overrightarrow{r}$ greater will be acceleration produced eg in the above figure greater torque on some force is produced at point as compared to point "B".

(3) It also depends upon the value of Q b/w $\overrightarrow{r}$ and $\overrightarrow{f}$ for example when Q = 0^0

then→ = $\overrightarrow{y}$ $\overrightarrow{f}$ sin0 = 0 (sino = 0^0)

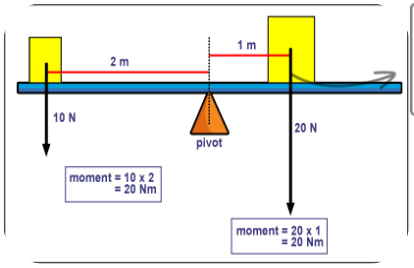
and there will be no torque at Q = 0^0

and if Q = 90^0 then → = $\overrightarrow{y}$ $\overrightarrow{f}$ sin90^0 = $\overrightarrow{y}$ $\overrightarrow{f}$ because sin90^0 =1

so, torque is produced when "$\overrightarrow{f}$ " and "y" are perpendicular Torque is a vector quantity and its unit is "N.m" if force produces rotation clock – wise in a body then it is called clock wise torque and it is taken as negative. Similarly, if a body rotates anti – clock wise then it is known as anti-clock wise torque and it is taken as positive.

Q.5 explains principal of moment in detail?

Ans. principle of moment:- it stated that a body will be in state of equilibrium, if the sum of all clock wise moments balance the sum of anti-clock wise moments taken over the same pivot.



Explanation:- A meter rod is shown in figure which is balance on a wedge such that w_1 and w_2 are suspended from right side and w_3 is suspended from left side of meter rode let i_1, i_2 and i_3 Are the torques produced by w_1 , w_2 and $w_3$respectively.

Now we see that $\tau_{1''}$ and τ_2 acts as clock wise torque and τ_3 acts as anti-clock wise torques. Since meter rods in is state of equilibrium. ie.
Clock wise torque = anti clock wise torques

$\tau_1, + \tau_2 = \tau_3$

$(r_1 \times w_1)\ (r_2 \times w_2) = (r_3 \times w_3)$
$(4 \times 5) + (1 \times 20) = (2 \times 20)$
$20 + 20 = 40$
$40 = 40 N,M$

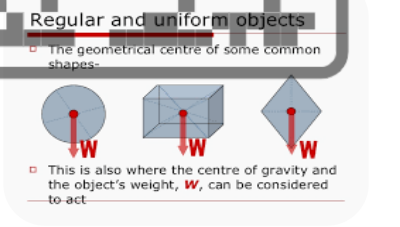
$[r_1 = 4, r_2 = 1$
$r_3 = 2, w_1 = 5$
$W_2 = 20\ w_3.w = 10$

Q.6 Define and explain center of gravity and center of mass?
Ans.(1) Center of gravity:- the point where whole weight of the body appears to act is known as center of gravity.
Explanation:- we known that everybody consists of large number of practical And each particle has a definite weight. Now the sum of weights of all particles is equal to whole weight to the body appears to act is known as center of gravity of that body.

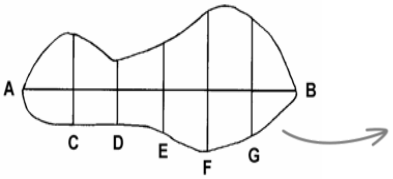
2center of mass:- we know that everybody is made of large number of small practical's which has a definite mass and the masses of all particle makes mass of the body if we apply a force on body and body starts motion. Then the point at which we have applied the force is called center of mass for example center of mass of a meter rod lies at midpoint. **.c.m**

Q.7 where the C.G of regular and irregular bodies is located?
Ans. **(1) C.G of regular bodies:-** center of gravity of regular bodies is located at their geometrical center.

a) Centre of gravity of spherical bodies is located. at its center as shown in gig (a)
b) Centre of gravity of uniform meter rod is also lies at Centre of meter rod. Fig (e)
c) The center of gravity of square and rectangle intersect each other. Fig "b" € "c"
d) The Centre of gravity of triangular shaped bodies is located as shown in fig "d".



(2) CG of irregular bodies:- to find center of gravity of an irregular shaped body we make some holes at the edges of the body then we suspend the body by every hole me by me and draw vertical lines with the help of passing a thread as shown the body in figure. The lines draw are also shown in figure after join these lines we get lines AA',BB' and CC' which intersect each other at point "O" and point of intersection is the C.G of this irregular body



Q.8 **what is equilibrium? Also give its conditions?**

Ans. Equilibrium:- the state of rest or uniform motion o a body is called equilibrium (or) if a body possess no acceleration then the body is called in equilibrium.
There are two conditions for a body to be in state of equilibrium. They are given below.

1st condition of equilibrium:- according to 1st condition of "A" body will be in state of equilibrium if the sum of forces acting on a body is zero i.e (£F = o)
For example a bulb is hanging from the ceiling with the help of a thread then the weight "w" of bulb is acting in downward direction while the tension "T" in thread is acting in upward direction in this case both forces balance each other i.e resultant of both force is equal to zero a result the bulb remains in state of equilibrium.

2nd condition of equilibrium:- according to this condition "a body will be in state of equilibrium if the sum of anti-clock wise torques is equal to the sum clock wise torques "OR" a body will be in equilibrium it the sum of all torques is equal to zero. £T = 0
A meter rod is shown in figure at which two force "p" ε΄ are acting at points "A" and "B" though the 1st condition is satisfied but it still rotates and body is not in equilibrium. Not get state of equilibrium we soul make clock wise torque equal to anti –clock wise torque then we will get equilibrium.
When there is no change in translation motion of a body then the equilibrium is known translational equilibrium. Of static objects is called static translational equilibrium eg book .the equilibrium is bodies moving with constant velocity is known as dynamic translational equilibrium. If 2nd condition is satisfied on bodies in rotation then equilibrium is known as rotational equilibrium.

Q9 Define and explain couple?

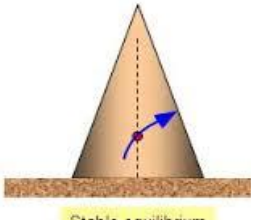
Ans. Couple:- A couple consists of two parallel forces that are equal in magnitude but opposite in direction eg turning of water top turning of door key and turning of car wheel steering wheel.

Explanation:- suppose a steering wheel of a car is gripped by two hands form two point "A" and "B" as give in figure. When both hands apply forces F_1 and F_2 of equal magnitude but in opposite direction. Then the wheel begins to rotate. Such forces applied by both hands, whose magnitude is equal but opposite the direction is called couple the shortest distance b/w two couple forces is called "arm of couple.

Q.10 explains state of equilibrium in detail?

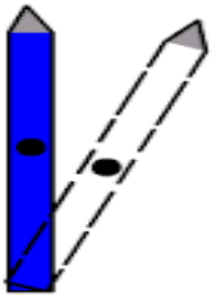
Ans. **State of equilibrium (stability)** . In different states of equilibrium we discuss the stability of an object. That how a body in equilibrium behaves and how it changes the position of center of gravity when it is disturbed by some external force.

(1) Stable state of equilibrium**:-** if a body comes back to sits initial position after being disturbed then it is called stable state of equilibrium for example when we left a book form one side laying on the table


Stable equilibrium

and then leave it the book will come back to its original position. Because when the book is lifted form one side its center of gravity raised from point "C" to "c" and comes back to its original state due torque produced by its weight.

(2) **Unstable state of equilibrium**:- when a body is slightly disturbed and it does not come back to its original state then it is called unstable state of equilibrium. For example when a pencil in vertical position is disturbed, then it falls down and does not come back to its original position because be in this case the C.G becomes lower from point "C" and the line of action of weight is directed outside of pencil and it falls down.



(3) **Neutral state of equilibrium**:- when a body is slightly disturbed and its center of gravity neither lowers nor raised from its original position then such a body is called din state of neutral equilibrium. For example we roll a ball on ground. Then its center of gravity remains at its original position but body rolls forward.

CONCEPTUAL QUSTIONS

Q.3 why is at more difficult to lean back word?

Ans. it is more difficult to lean back word because in such cases the center of gravity of the body is disturbed due which the stability decreases and it becomes more difficult to remain in state of equilibrium.

Q.4 as we know that:⇒ = →→sinQ ^ $_{y\ f\ n}$

Ans. which show that torque depends upon moment arm "r" Grater the "r" greater will be torque produced that's why handles are not put near hinges they are put away from hinges to rotate them easily.

Q.5 why does a helicopter has a second rotor on its tail?

According to 2nd condition of equilibrium if the sum of all forces acting on a body is equal to zero then the body will be in state of equilibrium. That's why there is a 2nd rotor on the tail of helicopter, the torque produced by 1st rotor is cancelled by the torque produced by 2nd rotor and this helicopter remains in state of equilibrium.

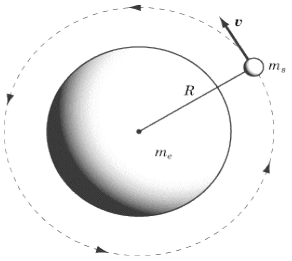
Q.6 why is it better to use a long spanner rather than a short one to tighten a nut on a bullet?

Ans. as we know that torque depends upon the moment arm "r" an "f" as long spanner has greater moment of arm. There for it is better to use long spanner rather than a short spanner to tighten a nut on a Bolt easily.

Q. 8 A girl is seated safety and steady canoe but when she tries to stand up the canes capsize explain this in term of c. m and stabile?

Ans. As the girl stand up the center of gravity and the e.m of body gets higher than its original position as result the stability decreases and this canoe capsizes.

Q10 the gravitational force acting on a satellite is always direction toward center of earth, does this force exit torque on satellite?



Ans.as the known that:-→ =→→ sinQ ^n .....(i)
□ r f

But from given figure it is clear that the angle b/w → ϵ_l "F" is 180^0
r

Hence,→ = → x →x sin 180^0
□ r f

-→ = → x → x 0 =>□= 0
□ r f

So, no torque is exerted on satellite because of gravitational from.

NUMERICAL PROBLEMS

Q.1 A force of 100N is applied perpendicularly at a distance of 0.05m to turn a nut of the wheel find the torque?

Force applied = F = 100N
Momentum arm = r = o.o5,
. □= orque □?
. □$50.00N.M$
□$50\ N.M$

Q.2 In given figure crane lifting some material to building turning effect is produced at :A: Wight of material is 10,000 calculate momentum of arm?

Force = F = w = 10.000N
Moment arm = r 15m
Moment of arm = □= ?
.□r x f =
.□= $15\ x\ 10{,}000$
.□= $150{,}000 - N.M$

Q.3 two kids of weighty 300 n and 350w are sitting at the ends of 6m long see –saw is in equilibrium in the horizontal position? The weight of 3rd kid is 25oN.

Ans. weight of 1st kid = w_1 = 300N
Weight of 2nd kid = w_2= 350N
Weight of 3rd kid = w_3 = 250N
Length of see – saw = r = 6m
As w_1,<w_2 so balance the see saw the 3rd kid will must set to left side and its distance is r_3 let $\bar{l}_{1,,}$ $\bar{l}_2$ $\varepsilon\bar{l}_3$ are $\bar{l}$torqueproduced by w_1, w_2 εw_3respectively now for balance condition .

$\bar{l}_1 + \bar{l}_3 = \bar{l}_2$

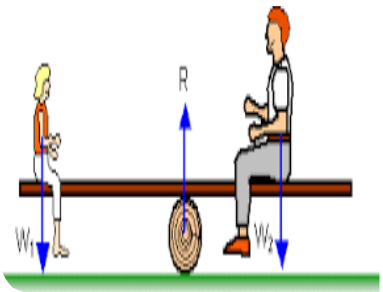


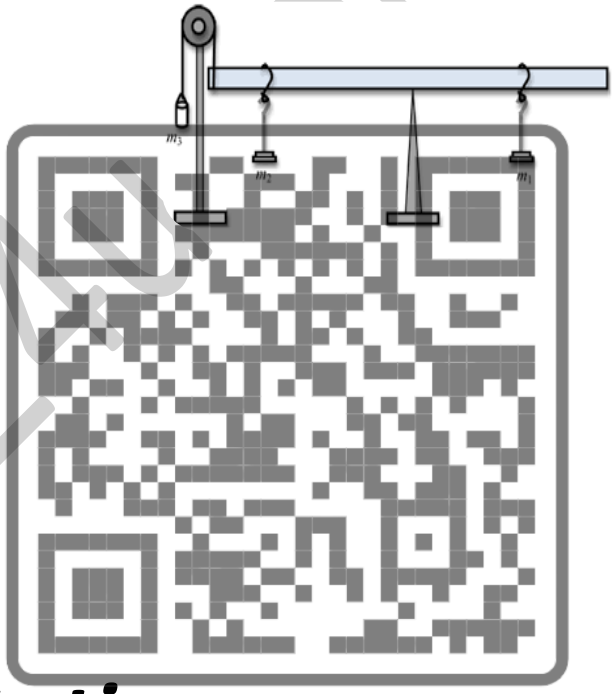
Figure 5

$R_1 w_1 + r_3 w_3 = r_2 w_2$
$R_3 w_3 = r_2 w_2 - r_1 w_1$
$r_3 = (r_2 w_2 - R_1 w_1)/w_3$

$r_3 = (3 \times 350 - 3 \times 300)/250$

$r_3 = (1050 - 900)/250$
$r_3 = 150/250$
$r_3 = 0.06$
so 3rd kid should sit at distance of 0.6m-

Q.4 A student carried out an experiment to balance a regular 4m plank at its point how much weight is placed at 80cm to the pivot so that it balances a mass of 3.2 kg is placed at 100cm to the right of the pivot:-



Ans:-solution:- Length of plank = r = 4m
Wight to left side = w_1= ?
Weight to left side = w_2 = mg
W_2= = 3.2 x 10 = 32N
Moment arm of w_1 = r_2 100cm = 1m
-vow according balance condition.
$\tau_1 = \tau_2$

$R_1 w_1 + r_2 w_2$
$W_1 = r_2 w_2 / r_1$
W_1= 1 x 32 /0.8
$W_1 = \cancel{32}^{4} \times 10/\cancel{8}$
$W_1 = 4 \times 10$
$W_1 = 40N$.

Chapter 4

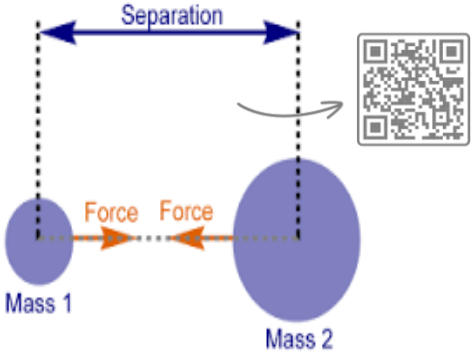
Gravitation

Q.1 state and explain Newton's law of gravitation?

Ans. **Newton's of universal gravitation :-** this law states that in this universe Avery two bodies attract each other with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance b/w them .

Explanation:- consider two bodies a and b as shown in figure let their masses are m_1 and m_2 respectively and the distance b/w them is "r" then according to Newton's law of gravitation the force of attraction :f: is given as:-

$F \varphi m_1 m_2$ ..... (i)
$F \varphi 1/r_2$ .....(ii)
Combining eq (i) and eq (ii) we get.

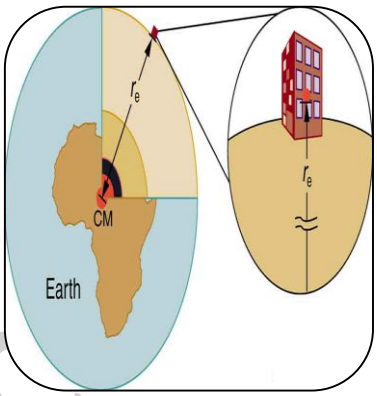


F φ m_1m_2 $_1/r_2$

F $= G$ m_1m_2 $_1/r_2$.....(iii)

Eq (iii) is the mathematical form of Newton's law of gravitation. Where "G" is gravitational constant and its value is equal to 6.673 x $10^{-11=}$ $N.m^2$ $/kg^2$

Q.2 using law of universal gravitation find mass of earth?



Ans. we can find mass of earth "Me" by using universal gravitation by following method suppose we have a body of mass "m" laying on the on the surface m of earth as shown in figure.

Let "m" is the mass of body "Me" is the mass of earth "Re" is the radius of earth which is the distance b/w the centers of body and earth. Now according to law of universal gravitation the force b/w earth and object is given by:-

F = GMem/R_{e2} .....(i)

We also know that the force with which a body is attracted toward the center of earth is equal to its weight

ie F = W = =>~~m~~ F = mg .....(ii)

Combining eq (i) and eq (ii) we get.

GMe~~m~~/R^{e2} = => me = gRe^2= ..... (iii)

⇨ GMe = gRe^2 => Me gR^2 = /G

Now as we know that g = 10m/sec^2

Re = 6.4 x 10^{6m} G = 6.67 x 10^{-11} NM /kg^2

Putting these values in eq (iii) we get

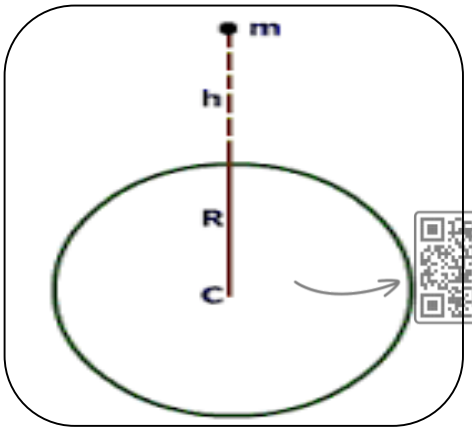
Me = (10) (6.4 x $10^6)^2$/6.67 x 10^{-11}

Me = (10) (4096) (10^{12}) / 6.67 x 10^{-11}

Me = 409.6 x 10^{12} x 10^{11} /6.67

Me = 61 x 10^{23} => Me = 6 x 10^{24} kg

Q.3 Explain variation of "g" with altitude?



Ans. considers an object laying on the surface of earth as shown in figure. Where me is mass of earth Re is radius of earth and "h" is the height of object from the surface of earth then according to law of universal gravitation the formula of mass of earth is given by

Me = gRe^2/G => Me G = gRe^2

=>g = Me G/Re^2.....(i)

Eq (i) shows the formula with the help of which we can find value of "g" now according to figure we want to find value of "g" at point "A" i.e when body is laying at the surface of the earth where value of "g" is "go" and given by:=

Go = GMe..... (ii)

Re^2

Now we find out value of "g" again when body is at hight "h" from the surface of earth and the distance b/w their centers is equal to "Re+ h" in figure the value of "g" at point "B" is shown by "g" which is given by:-

G h = $\frac{GMe}{(Re + h)^2}$ ……(iii)=

So, eq (ii) and eq (iii) shows that the value of "g" is inversely proportion to the square of the distance from earth's center ie the value of "g" decreases with altitude. That's why the value of "g" is greater at poles than the equators. Similarly the value of "g" will be greater in plane areas as compare to hilly areas. For example value of "g" at Karachi will be greater than the value of "g" at muree.

Q.4 what is satellite? Derive the formula of orbital speed of an arbitral speed?

Ans. satellite:- A satellite is an object which can move around a planet. Suppose a satellite of mass "m" is revolving around the earth in a circular orbit of radius "r" as shown then according to Newton's law of gravitation the force of attraction b/w them is given by following:-

F = (GMem)/r^2…… (1)

As the satellite performs circular motion so, the gravitation force in this acts as centripetal fore.

I.e F = (mv^2)/r…… (2)

Comparing eq(i) and eq (ii) we get,

(~~m~~v^2)/~~r~~ = (GMe~~m~~)/r^2

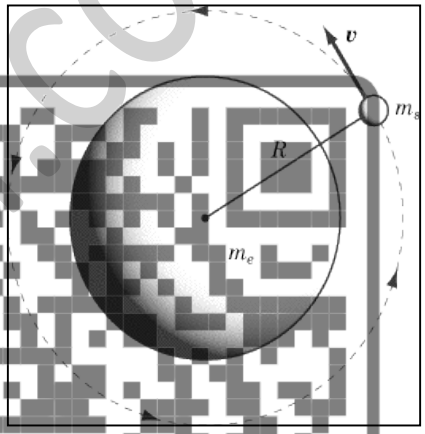
⇨ v^2= (G Me)/r

⇨ $\sqrt{v^2} = \sqrt{(G\,Me)/r}$ => V = $\sqrt{(G\,Me)/r}$ ….(3)

As "r = Re +h" so, eq (iii) becomes

V = $\sqrt{(GMe)/(RE + h)}$……(4)

Eq (4) is the formula for orbital speed of satellite.



CONCEPTUAL QUESTIONS

Q.1 what will be the weight of a body if it raised above the earth equal to its radius?

Ans. we that the weight of a body at earth's surface is given by.

F =W (GMem)/Re^2 =>Wo = (GMeM)/Re^2 ……(i)

When it is raised above earth equal to earth's radius then "Re" became "Re + Re = 2Reso. Eq (i) becomes

Wh = (GMem)/$(2Re)^2$ =>wh = (1/4) (GMem/Re^2)

Wh = (1/4) (wo) ……(ii)

So it a body is raised above earth's radius equal to its radius then its weight reduced one fourth times.

Q.2 moon is attracted by earth why it does not fall on ground?

Ans. moon is attracted by earth toward its center due to its tangential speed, but it does not fall on ground. Because the gravitational forces of earth on moon in this case is acting as centripetal force.

Q.3 why the water does not fall out of a bucket when it is whirled in a vertical center?

Ans. when water whirled in a vertical circle in a bucket it does not fall down because of centripetal force.

Q.4 why is it not easy to whirl a hammer by a longer chain?

Ans. it is not easy to whirl a hammer by a longer chain because the moment of inertia is greater and the moment of inertia depends upon mass of the body and radius of the circle. That's why we can't whirl a hammer easily by using longer chain.

Q.5 explains if a stone held in our hands released it falls tower earth center?

Ans. we know that everybody is attracted by earth toward it's center because of force of gravity so that's why when a stone held in our hands is released it falls toward the earth center.

Q.6 what is the value of "G" on moving?

Ans. the value of "G" is constant every where it does not depends upon the nature and size of the masses and nor it depends upon the nature of medium b/w bodies But it is same in all universe.

Q.7 if distance b/w the objects is tripled what is decrease in gravitational force?

Ans. gravitational force b/w bodies in 1st case is given by

F_1 (G m_1 m_2)/r^2……..(2)

When distance is tripled then r is replaced by 3r ie

$R_2 = (1/9)\ (Gm_1m_2/r^2)$ => $F^2 = 1/9\ (F^1)$

Hence force decrease by 1/9

Q.8 what is the difference b/w force of gravity and force of gravitation?

Ans. the force which exerts earth on bodies to attract them toward its center is called force of gravity. While the force of attraction b/w any two bodies in this universe is known as force of gravitation.

Q.9 if mass of earth is taken as doubled but remain in same size, what will happen to the value of "g" and "G"

Ans. (1) value of G:-it is a universal constant it does not depend upon masses of bodies it will remain the same.

(2) Value of "g" we know that g_1 = (GMe) Re_2……(i) when mass is doubled then g_2 = G.2Me/Re_2

=>g_2 = 2. (GMe/Re^2) => g^2 = 2 (g1)

Hence value of g is doubled if mass of earth is doubled.

Q.10 if mass in earth field is doubled what will happen to the force exerted?

Ans. when mass is single then, F_1 = (GMem)/r^2……(1)

When mass is doubled then, F_2 = (GM .2m)/r^2

⇨ F_2 = 2 (GMem/r^2) => F_2 = 2F_1

Hence force b/w them is doubled if mass is doubled.

Q. 11 what provides the force that produces centripetal acceleration in an orbit?

Ans. The gravitational force provides the force that produces the centripetal acceleration in an orbit because gravitational force acts as centripetal force on satellite to move it in a circular path.

Q.12 A satellite is moving around the earth on which of the following does it depend (a) Mass of satellite (b) distance of satellite? (c) mass of earth?

Ans. we know that formula of speed of satellite is V = $\sqrt{GMe/r}$ so this equation shows that speed of satellite depends upon mass of earth.

Numerical problems

(1) Calculate the force of gravitation due to earth on child weight 10kg standing on ground g = 10kg
= g = 10m/sec^2
Gravitation force = F = ?
As we know that:-
F = w = mg
F = mg = 10 x 10 = 100 N

(2) Calculate the gravitation of force of attraction b/w a stone weighing 1kg and earth what will be acceleration produced in stone?
Mass of stone = m= 1kg
Mass of earth = Me = 6 x 10^{24} kg
Distance = Re = 6.4 x 10^6 m
(i) Gravitational force = F = ?
(ii) Acceleration of in force = F = ?
(a) We know Theta
F = GMem/Re^2
F = 6.673 x 10^{-11} x 6 x 10^4 x 1 /(6.4 x 10^6)^2
F 6.673 x 6 x 10^{13-12}/40.96
F = 0.977 x 10
F = 9.77N
F = 9.8 N
(b) Also g = $\frac{GMe}{Re2}$
G = 6.673 x 10 -11 x 6 x 10^{24}/(6.4 x 10^6)^2
G = 9.8 m/sec^2

(3) Find the gravitational force at attraction b/w lead spheres each of mass 1000 kg placed with their center 1m apart?
Solution:- $m_1 = m_2 = 1000$kg
R_1 = 1m gravitational foresees?
F = Gm_1 m_2 /r^2
F = 6.673 x 10^{-11}x 100 x 100/1^2
f = 6.673 x 10^{-11} x 10^3 x 10^3/1
f = 6.673 x $10^{-11 + 3+3}$
f = 6.673 x 10^{-5} W

(4) A body of mass 25kg is placed on the surface of earth? Calculate the gravitational force? If body is raised to a distance equal to radius of earth? How will the weight of the body change?
Solution:-
Mass of the body = m = 25kg
G = 10m/sec^2
(a) Gravitational force = F =?
(b) "W" at hight equal to "Re" =?
(i) As we know that

F = w = mg

=> f = mg = 25 x 10 = 250N

Weight at hight "h" is wh.

Wh = mgh……(i)

Where gh is given by.

Gh = $\frac{GMe}{(Re+h)2}$

Putting this value in eq (i)

Wh = m $[\frac{GMe}{CRe+h)2}]$.....(ii)

Now As h = /re so eq (ii) becomes

Wh = m $[\frac{GMe}{(Re+Re)2}]$

W h = m $[\frac{GMe}{(Re)2}]$

W h = $[\frac{GMem}{4Re2}]$

W h = $\frac{6.673 \times 6\ 10^{-11} \times 6 \times 10^{24} \times 25}{4 \times (6.4 \times 10 \times 10^{6})^2}$

Wh = $\frac{6.673 \times 6 \times 25 \times 10^{24-11}}{4 \times 6.4 \times 6.4 \times 10^{12}}$

Wh = $\frac{1000\ 95 \times 10^{13-12}}{163.\ 84}$

W h = 6.1 x 10

W h = 61N

(5) Two spherical objects masses of 10kg and 100g are 90cm apart. Find gravitational force b/w them?

Ans. Solution:-

M_1 = 10kg m_2 = 100kg

R = 90 cm = 0.9

Gravitationnel force = F = ?

$F = \frac{G\ m_1\ m_2}{R^2}$

$F = \frac{G\ m_1\ m_2}{r^2}$

$f = \frac{6.673 \times 10^{-11} \times 10 \times 100}{(0.9)^2}$ N

$F = \frac{6.673 \times 10^{-11} \times 10^{3}}{0.81}$ N

Type equation here.

$F = \frac{6.673 \times 10^{-11+3}}{0.81}$

F = 8.23 8 x 10^{-8} N

F = 8.24N

(6) Mass of earth is 6 x 10^{24} kg using law of universal gravitation find ladius of earth?

Ans. solution :- mass of earth = Me = 6 x 10^{24} kg

G = 6.673 x 10^{-11}N .m^2/kg^2

G = 10m/sec^2 Re =?

As we know that :-

$$G = \frac{GMe}{Re^2}$$

⇨ $$Re^2 = \frac{GMe}{G} \quad \sqrt{Re} = \sqrt{\frac{GMe}{g}}$$

$$Re = \sqrt{\frac{6.67\ x\ 10^{-11} \text{ x } 6 \text{ x } 10^{24}}{9.8}}$$

$$\textbf{Re} = \sqrt{\frac{\mathbf{6.673\ x\ 10\ x\ 10^{24-11}}}{9.8}}$$

$$Re = \sqrt{\frac{40\ n.038\ x\ 10^{13}}{9.8}}$$

$$Re = \sqrt{4.08\ x\ 10^{13}} = \sqrt{40\ .8\ mx\ 10^{12}}$$

Re = 6.4 x 10^6

CHAPTER NO: 6 WORK POWER AND ENERGY

Q.1Define and explain work? Also give its unit?

Ans. work:- when force acts on a body and body covers some distance in direction of force, then it is called work (OR) the product of force and displacement in its direction is called work.(OR) when a force displaces a body its own direction then it is called work.

Explanation:_ work done on a body depends upon applied force and displacement covered in its direction.

i.e work done = force x displacement

$w = \underset{f}{\rightarrow} \text{ x } \underset{s}{\rightarrow}$ .....(i)

it also depends upon angle b/w force and displacement if there is any angle b/w then eq (i) can be written as,

w = fscosQ.....(ii)

if Q = 0^0 then w = fscos0^0 =>**w = f x s (1)** because cosQ = 1

if Q.90^0 then w = fscos 90^0 => w = f x s x o =>**w = 0** [sos90 = 0

if shows that work done will be equal to zero if force and displacement are perpendicular. Work is a scalar quantity and its unit is jual. If one Newton force acts on a body and displaces it to one meter then work done is equal to 1 joul.

Q.2 Define energy? Also give its different types?

Ans. energy:- The ability of a body to do work is known as energy it's unit same as work that is joul.

forms of energy:- different types of energy are given below.

(1) **Chemical energy:-** energy which is obtained during chemical reaction and burning of substances is called chemical energy eg burning of wood coal and petroleum etc.

(2) **Nuclear energy:-** that type of energy which produced during nuclear reaction is known as nuclear energy for example process of nuclear fission .

(3) **Radicand energy:=**the energy of electromagnetic waves is called radiant energy . for example radio waves micro waves x – rays etc have radiant energy.

(4) **Electrical energy:-**that type of energy with the help of which we can operate different electrical equipment is called electrical energy.

(5) **Internal energy:-**the energy of atoms and molecules which is usually in the formula kinetic energy and potential energy is called internal energy.

(6) **Mechanical energy:-**the energy produced by moving parts of a machine is called mechanical energy.

(7) **Kinetic energy:-** the energy produced in a body during motion is called kinetic energy.

(8) **Potential energy:-**energy possessed by a body by virtue of its position is called potential energy

(9) **Heat energy:-**a form of energy which tranllers from one body to another body due difference of their temperature is called heat energy.

(10)**Sound energy:-**the energy which gives sensation of hearing is called sound energy.

Q.3 Define and explain kinetic energy? Also derive K.E = ½ mv^2

Ans. Kinetic energy:-energy produced in a body during motion is called kinetic energy (K.E)

Kinetic energy of a body depends upon mass and velocity of a body if we want to stop or move a body then the work done in this form is equal to K.E

To prove :- K.E = ½ mv^2 : suppose a body of mass "m" is moving because of kicking and after covering it comes to state of rest the work done in this form is equal.

Work done = F x s ……..(i)

Now we find out values of "f" and "s" for equation (i)

We know from 2nd law :- f = ma ……..(ii)

By 3rd equation of motion we can find "s"

$2as = vf^2 – vi^2$……..(iii)

Now as vf = 0 vi = v an a = - a [are sign shout deceleration]

$2 \times a \times s = 0^2 - v^2$ => $-2as = - v^2$

$S = v^2 /-2a$ => $s = v^2 /2a$……..(iv)

Putting eq (ii) and eq (iv) in eq (i) we get.

Work done = ~~ma~~ x $v^2/2$~~a~~

Work done = $mv^2/2$ OR work done = ½ v^2

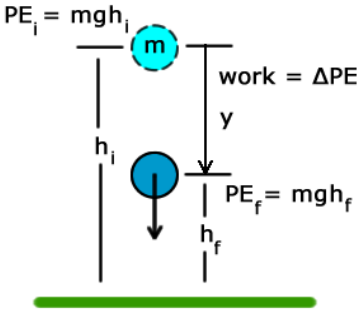
But work done in this case appears as K>E i.e k.E = ½ mv^2

Q.4 defines and explains potential energy? And prove P/E = mgh.

Potential energy: The energy possessed by a body by virtue of its position is known as potential energy (P.E).

Explanation:- this type of energy is produced in different cases. For example when a body is raised up to certain height or when an elastic spring is string is stretched then these bodies will posses potential energy the energy of a body by virtue of its hight "h" from surface of earth is gravitational potential energy because in the case we have to do some work against gravity on lifting the object and that work appears as potential energy

To prove:- **P.E mgh** :- suppose we have a body of mass "m" light to a certain hight "h" from the surface of the earth as shown in fig. now on lifting the mass we have to do some work against gravity which is given by: Work done = F x s ……(i)



Now we find out value of values of "F" and "s" for equation (i) so, we know that:- F = w = mg => F = = mg……(ii)

And here the distance covered "s" is equal to hight "h" to which the body is raised i.e s = h ……..(iii)

Now putting values of "F "ε "s" in eq (i) we get

Work done = mg x h

Work done = mgh

And the work done in this case appears as P.E i.e P.E = mgh

Q.5 State and explain law of conservation of energy with the help of examples?

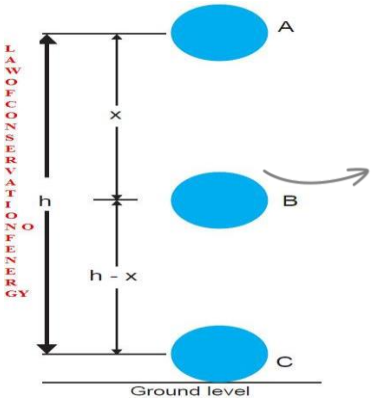
Ans. Law of conservation of energy :- this law states that energy can neither be created nor destroyed, it can be converted from one form to another form or it can be trash ferried from one body to another body but the total amount of energy remains constant.

Explanation:- Law of conservation of energy can be explained with the help of following examples.

1. A diver bend diving board because of chemical energy stored in his body and also because of this elastic potential energy stored in diving board which is then converted into kinetic energy for the diver by giving him an upward push.
2. When water is stored at certain hight. Then they have P.E when these water are allowed to fall on turbines to produce electrical energy their P.E is converted to k.E.
3. A battery has chemical energy when a lamp is connected to it the chemical energy is converted to heat and light energy in the filament of lamp.

Q.6 Explanation of law of Conservation by 2nd method.

Ans. This law states that energy can neither be created nor destroyed but can be convert from one from to another form or transferee form one body to another body"



Explanation: - we can show it by following experiment. Let suppose we have a body of mass of mass: m: which raised up to a hight: h: from the surface of earth. We find out its total energy at points A,B and C.

At point A:- total energy at point "A" is given by;

$(E_t)_a = (P.E)_A + (K.E)_A$ ……1

Now P.E at A is mghie $(P.E)^a = mg$

And as there is no motion so, K.E = 0

Putting these values in eq (i) we get

$(E_t)_A = mgh + 0 \Rightarrow (ET)_A = mgh$…….(2)

At point B;- total energy $(E_t)_B$ at "B" is given by

$(E_T)_B = (P.E)_B$…… 3

Now P.E at "B" $(P.E)_B = mg(h - x) \Rightarrow (P.E)_b = mgh - mgx$……4

And k.E at "B" $(k.E)_B = 1/2mv^{2-}$ ……5

We find value of "v" for eq (5) by 3rd eq: motion

$2as = vf^2 - vi^2$ where a = g s = x vf = v ε vi = 0

50, $2gx = v^2 - vi^2\ 0^2 \Rightarrow v^2 = 2gx$

Putting value of v^2 in eq (5) we get

$(K.E)_B = ½\ m2gx \Rightarrow (K.E)_b = mgx$……..(6)

Putting eq (4) ε (6) in eq (3) we get $(E_T)_B = mgh \div mgx + mgx$

So, $(R_T)_B = mgh$……7

At point c :- total energy at c $(E_T)_c$ is given by:- $(E_T)c = (P.E)_c + (K.E)_c$……(8)

At point c $(p.E)_c = 0$ because object is on ground.

And $(K.E)_c = ½\ mv^2$……(9)

We find v by 3rd equation of motion.

$2as = vf^2\ vi^2$

Putting a= g s = h vf = v εi vi = 0 we get

$2gh = v^2$ in eq (9) we get

$(k.E)_c = ½\ m2gh \quad (k.E)_c = mgh$

Putting values of (p.E), ε (K.E) in eq (8) we get

$(E_{T)} = 0 + mgh = (E_T)_c = mgh$……(10)

So, from eq (2) eq (7) and eq (10) it is clear that energy does not change but remains constant.

Q.7 Discuss the relation b/w mass and energy?

Ans. Mass and energy are deeply related to each other Einstein has established the relationship between mass and energy in mathematical form according to Einstein mass and energy are interchangeable that is mass can be converted to energy and energy can be converted to mass.

Einstein mathematical relationship between mass and energy is given as: $E = mc^2$

In "E" is energy and "m" is mass of mother where as "c" is a constant it is conservation factor which is known as velocity of light and its value is equal to3 x 10^8/sec.

Q.8 discusses the electrical energy production from fuel?

Ans. We use different type of fuels like petrol gas and coal etc. to produce electrical energy in power station. We burn these fuel under boiler in which water is boiled where steam is produces this steam is allowed to turbines on a high pressure which rotate the dynamo and produced electrical energy.

The produced electrical energy is feuded to transformer which falls or raises the level of voltage according to our desire and the transformer feed the power to transmission lines which transmit the electrical power form ne place to another place i.e to cities, villages and homes.

Q.9 Define and explain efficiency?

Efficiency:-the ratio b/w output and input of a machine is called efficiency.

Explanation:- during the operation of a machine some energy is supplied to that machine or engine which drives it. For example we supply electrical energy to on electric motion. Similarly we supply diesel to diesel engine but it is observed that on engine cannot convert the who input into use full work because on engine has to supply some of input energy is wasted which is transferred or radiates to the surrounding in the form heat therefore, A machine has never 100% efficiency but less than 100% the efficiency can be find by following felled. Efficiency = $\mathcal{M}\frac{out\ put}{input}$ x 100

Q.10 Define power give its unit? Also prove that $\overrightarrow{P}=\overrightarrow{F}.\overrightarrow{v}$

Ans. Power:- the rate of doing work is called power OR the rate of conservation of energy is called power mathematically we can writhe It as;

Power = work/time =>p = w/t

Also Power = energy/time => p = E/t

The unit of power is watt. One watt is equal to on joul per sec ie 1w = 1joul /sec

To prove that $\overrightarrow{P}=\overrightarrow{F}.\overrightarrow{v}$

As we know that; p = w/t……(i)

We also know that w = $\overrightarrow{f}$ x $\overrightarrow{s}$**……..(ii)**

puttingeq (ii) in eq(i) we get p = $\overrightarrow{f}$ **x** $\overrightarrow{s}$**/t**

⇨ P = $\overrightarrow{f}\frac{\overrightarrow{s}}{t}$ ……. (iii)

Since $\overrightarrow{v}$ **=**$\overrightarrow{s}$/t so, eq (iii) becomes as; p = $\overrightarrow{F}.\overrightarrow{v}$

CONCEPTUAL QUESTIONS

Q.1 for answer (sec q 10 at page 47) only proof of $\overrightarrow{P}.\overrightarrow{F}.\overrightarrow{v}$

Q.2 what type of energy conservation can be observed in water dams?

The stored water in dame's possessing potential energy when these water are allowed to run turbines. The P.E of water converted to K.E when turbine runs the K.E is converted into mechanical energy. Turbines run generators which converts mechanical energy to electrical energy.

Q.3what happens to K.E of a bullet when it penetrates into a sand bag?

Ans. When a bullet penetrates into a sand bag. The sand opposes it motion by a retarding force so K.E o air molecule. And some is transferred to the K.E of bullet is used against the regarding force of sand.

Q.4 A meteor enters into earth's atmosphere and burns. What happens to its kinetic energy?

Ans. When a meteor enters into earth's atmosphere it burns and its K.E is converted into heat an light energy. And some is transferred to the K.E of air molecule.

Q.5 what do you understand by term energy transformation support your answer by two examples?

Ans. Energy transformation is a process which converts energy from one form to another form it example are given.

1. When electrical energy is given to an electric motor it converts it to mechanical energy.
2. When fuel are burnt in an engine it converts fuel energy to mechanical energy.

Q.6 for ans(see Q9 page 46 (efficiency).

Q .7 for ans (se Q.5 page 45 – q.5 page 46)

Q.8 what kind of energy is possessed in the following cases?

a) A stone laying on the top of a root b) Flaying airplane. C) Flaying airplane.
b) A wound up spring of a toy car
c) A speeding train?
   a) A stone laying on the top of a root posses gravitational potential energy
   b) Flying airplane posses K.E energy due to motion and P.E due to its position.
   c) A wound up spring of a boy car posses elastic P.E?

Q. 9 in each of the following situation the system consists of a ball and earth describe the work done and changes in energy forms. A) you throw a ball horizontally B) horizontally thrown by a fielder c)a ball is thrown vertically and t comes to rest at top of its flight (d) the ball back to earth where you catch?

Ans. (a) when a ball is thrown vertically then there is no work done by gravity and no change in energy

b) Same as (a)

c) When a ball is thrown vertically some work is done against gravity and at the top of it flight its K.E is changes to P.E

d) When the ball falls back its P.E is converted to k>E and work is done by force of gravity.

Q.10 for ans see Q8 at page 46 and compare question)

Q.11 which would have a greater effect on the k.E of an object doubling the mass or doubling the velocity?

Ans. When mass is doubled then energy increases two times ie K.E ½ (~~2~~m) (v^2) => $(K.E)_2 = mv^2$ or $(K.E)_2 = 2$ (K.E) when velocity is doubled then energy increases 4 time ie K.E = ½ (m) $(2v)^2$ => $(K.E)_2$ => $(K.E)_2 = 4$ (K.E)

Numerical problems

(1) A 2kg object is released from rest from a hight of 10m above the ground calculate:-

i. The initial potential energy at the moment of release?

ii. The K.E at the moment it reaches 4m above ground?

iii. The speed of the object just before impact with ground?

After the impact the object finally comes to rest? Explain what happens to the lost K.E?

Solution:- Mass of object = m = 2k

Hight = h = 10m

(1) P. E at hight h = mgh

P . E 2 x 10 x 10

P.E = 200 Jouls

When

(2) k. E h = 4

k.E = ½ mv^2 .....(i)

we find "V" by 3rd eq of motion

$2as = vf^2 - vi^2$.....(ii)

A = g = 10 m/sec^2 s = 6m

Vf = v ε vi = 0

Putting these values in eq (iii)

$2 \times 10 \times 6 = v^2 - 0$

$120 = v^2 \Rightarrow v^2 = 120m$

Putting these values in eq (i)

k.E = ½ x ~~2~~ x 120

k.E = 120 joul

(3) speed of objet .according to law of conservation of energy

K.E at bottom = P.E at hight

$1/2 mv^2 = mgh$

$V^2 = 2gh \Rightarrow \sqrt{v^2} = \sqrt{2gh}$

V = $\sqrt{2gh} = \sqrt{2\ x\ 10\ x\ 10}$

V = $\sqrt{200}$ =v 14. 1 m/sec

(4)after impact when It comes to rest its K.E is transferred to surrounding.

(2) In the following situation calculate the power involved?

(i) A force of 50N moves a body through a distance of 10m in 5 sec?

(ii) an object of mass 1kg is lifted up vertically throuy 5m in 10sec?

Solution :-

(i) force = F = 50N 5 =n 10 t = 5sec P =?

As p = w/t => p = f x s /t

P = ~~10~~^{2} x 50 /~~5~~ => p = 2 x 50 = 100

(ii) m = 1kg h 5m

t = 10sec power = p =?

Now energy in this is P.E

I.e p = P.E/t

p = mgh/t

p = 1 x ~~10~~ x 5/~~10~~ => P = 5w

(3)A rubber ball of 0.12 kg is held at a hight of 2.5m above the ground and then released

(i) Calculate the K.E of ball ground.

(ii) Calculate velocity of ball just before it hits the ground.

Solution:-mass of ball = m = 0.12kg hight from ground = h = 2.5m

(i) K.E just before lilting ground = K.E =?

(ii) Velocity before lilting ground = v = ?

(i) K.E = ½ mv ^{2}.....(i) we find out value of v by 3rd equation.

2as = vf^2 - vi^2 for which a = g = vf = v 10m/sec^2 vi = 0 s = 4 = 2.5

So, 2 x 10 x m2.5 = v$^{2+ -}$v2+ - 0^2

⇨ 50 = v^2 putting value in eq (i)

K.E =½ x 0.12 x ~~50~~^{25} => K.E - = 0.12 x 25

K. E = 3Jouls

(iii) we can find velocity by 3rdeq: if motion

2as = vf^2 – vi^2

Putting a = g = 10 s = h = 2.5 vf = v vi = 0 vi = 0 we get

2 x 10 x 2.5 = v^2 - 0^2

$\sqrt{v2} = \sqrt{50}$ => v = 7.1 m /sec

(4)two bodies of equal masses moves with uniform velocities "v" find the ratio of their K.E?

Solution? :-

M_1 = m = m v^1 = v v^2 = 3k

Ratio b/w K.E (i) $(K.E)_1$: $(K.E)_2$ =?

We know ratio of K.E is given by: $(K.E)_1/(K.E)_2$.....(i)

Now we find $(K.E)_1$ and $(K.E)_2$ for eq(i), so.

$(K.E)_1 = 1/2m_1v_1^2$ => $(K.E)_1$ = ½ mv^2

Also $(K.E)_2$= ½ m_2 v_2 => $(k.E)_2$ = ½(m) (3v)^2

$(k.E)_2$=½m_2v_2 =>

(K.E)2in eq (i) we get

$\frac{(K.e)1}{(K.E)} = \frac{1/\cancel{2mv2}}{9/\cancel{2mv2}}$ = 1/9

$(K.E)1 : (K.E)2 = 1:9$

(5) A man whose mass is 75kg walks up a flight of 12 step each 20cm high in 5 sec find the power he develops in watts?

Solution:-

Mass of man = 75kg
No of steps = 12
Hight of one step = 20cm
Hight of 12 steps = h = 12 x 20 = 24 cm = 2.4m
Taken time = t =5sec
Power developed = p =? As we know that p = t
But energy in this case is P.E so. P = P.E /t

- ⇨ P = PE/t =>p = mgh/t
- ⇨ P = 75 x ~~10~~^{2}x 2.4/~~5~~ => p = 75 x 2 x 2.4
- ⇨ P 360w

(6)A mason of 600 N weights is climbing a loader 10m high. Find his P.E at middle of the loader.

Solution: -weight of mason = w = 600 N
Hight of loader r = h_1 = 10m
Hight to middle of loader = h_2 = 10/2 = 5m
P.E at h2 = P.E =?
As we know that that;
P.E = mgh => P.E = wh_2 [w = mg]
H = h_2

- ⇨ P.E = 600 x 5 = 3000 joule;

(7) A ball of weight 100 N is moving on a frictionless surface with a velocity of 10m/sec complete its K.E = ?

Solution:-weight of = w= 100N => m = w/g = 10~~0~~/10 = 10kg
Velocity of moving ball = v = 10m/sec
K.E =?
Since K.E = ½ mv^2 => K.E = ½ x 10^5 x 10^2
k.E = 5 x 10 x 10 => K.E = 500 joul

(8) A car of mass 800kg accelerates uniformly from rest to a speed of 25/sex in 10se what is its power?

Solution:- Mas of car = m 800kg
Velocity of car = v = 25m/sec
Time = t = 10sec power = p =?
As we know that p = E/t
But energy in this case is K.E so, p = K.E/t
P = ½ mv^2 /t => p mv^2 /2 x t

- ⇨ P = ~~800~~^{40} x 25 x 25 /~~2~~ x 1~~0~~ => p = 40 x 25 x25
- ➢ P = 25000W

(9)A gril does work of 800j in lifting a 40kg bucket from a well if the acceleration due to gravity is 10/sec^2 calculate the depth of well?

Solution:-work done = 800joul g = /sec^2
Mass of bucket = 40 kg depth of well = h = ?
The work done in this case is equal to P.E i.e
Work done = P.E = mgh

- ⇨ Work done = mgh => h = work done /mg
- ⇨ H = ~~800~~/1~~0~~ x ~~40~~ => h = 2m

CHAPTER 7:

PROPERTIES OF MATTER

Q.1 explains the kinetic molecular model of matter?

Ans. **kinetic molecules model of matter:-** according to this theory matter consists of small particle called modules. Modules are its made of small particle called atoms. These molecules are always I state of motion. Their motion may be linear vibrational or rotational and this motion is increased with increase in temperature there is a force of attraction between the molecules which depends upon the distance between them their kinetic energy is due to their motion and potential energy is due to force of attraction between them.

Q.2 explains the states of matter on the bases of molecular model of matter?

Ans. State of matter explained below on the bases of molecular theory?

1. **Solids:-**
   - **i.** solids have defined shape and definite volume.
   - **ii.** In solids molecules cannot transfer from one place to another.
   - **iii.** Their molecules perform vibratory motion.
   - **iv.** Their molecules are increased with increase in temperature.
2. **Liquids:-**
   - I. Liquids have definite volume but no definite pe.
   - II. Molecules in liquids are loosely bided to each other.
   - III. In liquids molecules can transfer from one place to another.
   - IV. Force of attraction b/w molecules is weaker then solids.
   - V. Their K.E increase with increase in temperature.
3. **Gases:-**
   - i. they have neither definite shape nor volume.
   - ii. Their molecules are at large distance from one another.
   - iii. Their molecules can move freely and perform random motion.

iv. Force of attraction b/w molecules in temperature.

4. **Plasma:-** this is the 4th state matter which is found in ionized state it is called plasma exist in sun.

Q.3 Define and explain "Density"?

Ans. Density:- the mass f unit volume is called density it is denoted by (Rho).

Explanation:-if mass of a body is "m" and volume of that body is "v" then we can write its mathematical form as; $\beta\, m/v$

From its mathematical form it is clear that density the inter molecular force b/w then.

Density is a vector quantity and its unit is kg/m^3.

Q.4 Defines pressure?

Pressure:- force per unit area is called pressure if we have a unit area "A" at which force "F" is acting then the press "P" is given by/

Pressure = force/area => p = f/A

It's unit is Pascal.

Q.5 Define and explain atmospheric pressure?

Ans. The force excreted by the thick layer of air surrounds earth is called atmospheric pressure

This is a layer of air around us which is called atmosphere we live in the ocean of air which exerts a force upon our body and it is equal to 100,000 Pascal which is called one atmospheric presser.

Q. 6 write a note on barometer?

Ans. Barometer :- A devise which is used for measurement of atmospheric pressure is called barometer consists of a glass filled with mercury one end of glass is sealed and the other is dipped in mercury when atmospheric pressure presses the mercury toward the mercury rises up in glass tube the glass is graduated with different values the height of mercury in glass shows the value of atmospheric pressure at sea level the mercury can rise up to 16cm at 0^0c and it is known as standard of atmospheric pressure.

Q..**7 write application of atmospheric pressure in our daily life?**

Ans. Some applications of atmospheric pressure are given below.

Sucking throw straw:- when we suck any liquid through a straw the volume of lungs increases and the air pressure decreases. As a result the atmospheric rise in straw.

Suring:- when we draw any liquid with the help of syring the pressure inside the syring decreases while the pressure an surface of liquid increases which forces the liquid on going into syring.

while the pressure an surface of liquid increases which forces the liquid on going into syring.

Q.8 **explains that how weather changes with atmospheric pressure.**

Ans. If we keep barometer at same high above the see level if will show the changes of day by day pressure. These pressure changes are shown a weather map. These lines which loins all places at the same atmospheric pressure are called I so bar. The unit which is used for weather map is called mill bar (m bar)

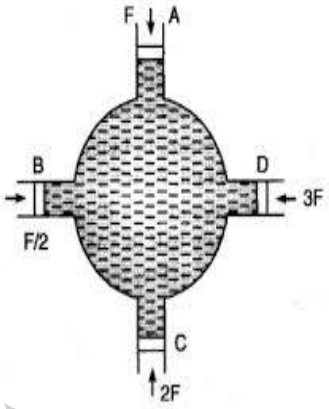
100m bar = 1 bar => 1bar = 100kpa

The atmospheric pressure usually changes from 1040 mbar to as low as 950 mbar. The wind moves from high pressure regions to low pressure regions. The winds of low pressure areas move anti-clock wise while the wind of high pressure areas move

clock-wise in northern hemisphere. The strength of wind is determined by the pressure gradient.

Q.9 state and explain Pascal's law?

Ans. Pascal's law:- This law states that pressure exerted at any point an liquids in any container is distributed equally in all direction.



Explanation:- consider a container having four openings A,B,C and D as shown In figure. There are moveable pistons in every opening.

Now if we this container with water or any other liquid. Then we apply some force on any one piston of them. Suppose we apply force on "A" as soon as we apply force on piston "A" at the same time the other three pistons will also start moving outwards. This experiment shows that a pressure exerted on any liquid in any container is distributed equally in all direction.

Q.10 write some practical applications of Pascal 'slaw?

Ans. Hydraulic lift:- a devise which is use for lifting heavy leads, and works with the help of liquid pressure is called hydraulic lift. If works on Pascal's principles diameter which are connected with each other by a tube. These cylinders are filled with some liquid and their top ends filled with piston.

When some pressure is exenterated on piston "A" in downward direction. Then this pressure is transmitted to piston "B" in upward direction and by this way it lift. Lead.

If "F_1" is the force applied on piston "A" and "A_1" is its area then pressure on it is given by $P_1 = F_2 / A_1$.....(i)

Similarly pressure on pis to B is P_2 F_2 / A_2.....(ii)

But according to Pascal's law we have ;

$P_1 = P_2 \Rightarrow f_1/A_1 = F_2/A_2 = \Rightarrow F_2 = F_1A_2/A_1$

By this equation we can find force exerted on piston "B"

Hydraulic brake system:- such brake system in which oil is used for stopping wheel is called hydraulic brake system.

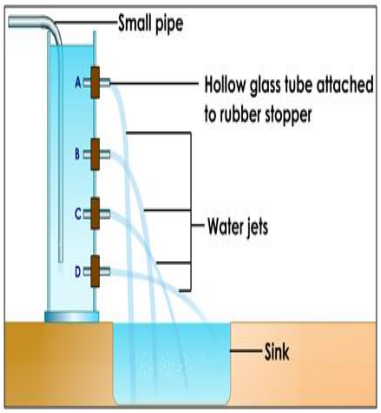
Explanation:- it consists of five cylinders. One of then is bigger cylinder called master cylinder. The other four small cylinders are connected with master cylinder by a tube. The other end of smaller cylinders is connected with wheel.

When a pressure is applied on oil transmits this pressure to small cylinders through liquid. Which finally stops the wheel?

Q.11 explains pressure in liquids with its mathematical form?

Pressure in liquids:- liquids have weight and the ability of flowing because of which pressure of liquids can be easily explained. Liquids have pressure which they exerts in all direction equally. The pressure of liquids depends upon their weight, density and hight.

Explanation:- let suppose we have a container filled with a liquid. If "W" is they weight of liquid "A" is area



of bottom of container and "h" is hight of container. Which is filled with water as shown in. then the pressure in given by?

Pressure = force /Area => force

- ⇨ Pressure = weight /Area because force = Wight.
- ⇨ P = w/A => p= mg/A ..,.....(i) [w = mg]

Now as we know that L = m/v => m = Lv

Putting value of ineq (i) , we get;

P = lvg/A……(ii)

But we also know that v = area x hight => v = Ah

So, eq (ii) becomes; p = L~~A~~hg/ ~~A~~**P= Lhg**

this equation shows us the pressure exerted by liquid.

Q.12 Explain the up thrust force in l liquid?

Ans. Up thrust force:- the force exerted by a liquid in opposite direction against the weight of the body is called up thrust force.

Explanation:-when we immerse a cork in water it floats on the surface of water because the up thrust force on cork is greater then its weight.

Similarly when a balloon is filled with helium gas and then released, it will move in upward direction because air is dense than helium gas. And up thrust force on balloon is greater than its weight and as a result it moves in upward direction.

Q.13 state and explain Archimedes principle?

Archimedes principle:- This principle states that when a body is wholly or partially immersed in a fluid, then on up thrust force (Fb) acts on body which is equal to the weight of displaced water. (OR) simply we can say that;

Beyond force or up thrust acting on an object = weight of liquids displaced by it.

Explanation:-when a body is body is immersed in liquids then two forces act on body its weight "w" acting in down ward direction. The up thrust force "Fb" acting in upward direction.

Which is equal to the weight of displaced water now if Fb<"W" then the weight exceeds up thrust force and body will sink down. If Fb= w then weight and up thrust balances each other and body floats in liquid. So, the above discussion can also be stated as;

Law of floatation:- A floating body displaces its own weight of the fluid in which it floats"

Explanation:-the sinking of objects can also be explained in term of their densities. Suppose we have a body of mass "m" it's volume is "V" and density is "f" let volume of liquid is "v" and density is "f" in which it is immersed then according to law of flotation we have;

Weight of the object = weight of the fluid displaced.

Mg = mg (w = mg)

- ⇨ Fv~~g~~ = fv~~g~~ (m = fv)
- ⇨ Fv = fv => f/f = v/v
- ⇨ Now I density of the object is less than the density of fluid (f < f) then the object well float in fluid and will be immured totally

Q.14 what is effect of buoyant force on floating bodies?

Ans. Effect of buoyant force on bodies :- when a body is immured in liquid, two forces act on body its weight "w" in downward direction and up thrust force (Fb)m in upward direction; now

1. If weight is greater than up thrust forces W>Fb then body will sink.
2. If weight of body is less than up thrust force ie W <fb then body will float on the surface of water.
3. If weight and up thrust force are equal ie W = fb then the body will either sink or float buy it will remain floating water surface.

Q. 15 define and explain elasticity? Also define be elastic limit?

Ans. Elasticity:-the property of a substance due to which it can regain its original shape after the removal of applied force is called elasticity.

Explanation:-when we compress a spring it changes its shape because of force but when we remove the applied force from body. It comes back to its original shape this property of bodies is known as elastic and the body having this characteristic is called elastic body. Not only metals and other bodies are elastic but our body muscles are also elastic most of the actions of our body are possible due to expansion and contraction of muscles.

Elastic limit :-with in which a body can regain its original shape is called elastic limit

If the deforming force crosses the elastic limit then under such conditions permanent changes occurs in shapes of body and the body is unable to regain its original shape.

Q. 16 define and explain hook's law?

Ans. Hook's law:-this law states that with in elastic limit the compression or extension is directly proportional to the applied force.

Explanation:-let "F" is the force applied on a body which produces extension or compression in a body then according to Hook's law;

F = x

⇨ F = k x .....(i)

Equation (1) shows mathematical form of Hook's law where "k" is constant of proportionality

Now if F = $\sigma$and x = E where "σ" is stress and "E" is strain then eq (1) becomes;

⇨ σ= k E .....(2)

So, we can also define Hooks law that with in elastic limit stress is directly proportional to produced strain.

Q.17defines (i) stress (ii) linear stress (ii) strain (iv) linear strain?

i. stress :- the force applied on unit area of on object which changes its shape is called stress. It is denoted by "σ" mathematically is given as;

Stress = force/ Area =>σ = F/A

it's unit is N/m^2

ii. **linear stress:-**the force applied on a body along it length is called linear stress"

iv. **strain:-**the extension or changes per unit length or area is called strain it is denote by "E".

v. **linear strain:-** the changes occurred in length of a body due to linear stress is called linear strain

E =$\Delta L/L$

Where "ΔL is change in original long "L"

Q.18 Define young's modulus? Also give its unit?

Ans. young's Modulus:- The ratio of linear stress and linear strain is called young's modules it is represented by "Y" and given by;

Young Modulus = $\frac{linear\ strewss}{linear\ strain.}$

⇨ Y = σ = F/A

And also $\in = \frac{\Delta L}{L}$

So, putting these in equation (1) we get.

Y = $\frac{F/A}{\Delta L/L}$ => y = $\frac{FL}{AAL}$

It's unit is N/m^2

CONCEPTUAL QUESTIONS

Q.1 why is the cutting edge of the knife made very Sharpe?

Ans. we know that pressure is inversely proportional to area that's why cutting edge of the knife is made very sharp by doing so, the area becomes smaller and the pressure becomes greater. This we can cut things easily by knife.

Q.2 for ans see Q7 at page 54.

Q.3 why we cannot use water instead of mercury in barometer?

Ans. we cannot use way we instead of mercury because;

- Water density is less than mercury.
- Water is not sensitive as mercury to change by pressure.
- Expansion of mercury is uniform.
- Water is not easily visible to record data.
- Freezing point of water is higher than that of mercury

Q.4 see for ans Q8 at page 55 .

Q.5 why miners in mines face breathing problems/

Ans. the miners in mines face breathing problems due to lack of ventilation. Deficiency of oxygen and excess of carbon dioxide gas.

Q.6 what is the basic principle hydraulic press?

Ans. The basic principle of hydraulic press is Pascal's principle that is liquid exerts presser in all direction equally.

Q.7 why water tanks are constructed at high level our increases?

Ans. We know that water pressure increases with height therefore easy flow of water and high pressure in a pipe system water tanks are constructed at the highest levels in our houses.

Q.8 why a small needle sinks in water but huge ships travels easily in water without sinking?

Ans. A small needle sinks in water because the weight of needle is greater that weight of water displaced by it. While a huge ship does not sink but flow on water surface because the weight of ship is less than the weight of water displaced by it.

Q.9 which material is more elastic steel or rubber, why?

Ans. Steel is more elastic than rubber because for a given stress the strain produced in a steel is much smaller than rubber.

Q.10 walnuts can be broken in the hands by squeezing two together but not one why?

Ans. Walnuts can be broken in the hands by squeezing two together but not one, because the contact area decreases significantly due to which the stress or pressure increases and as a result the walnuts can be broken easily.

Q.11 explains how how and why camels have adapted to allow them to walk more easily in desert condition?

Ans. As we know that camels have feet with comparatively large surface area, therefore they exerts little pressure and can walk easily in desert.

NUMERICL PROBLEMS

1. **The atmospheric pressure 100kpa. What is force exerted by the atmospheric on a rectangle surface that measure 0.05m by 0.4m.**
   Solution:- Atmospheric pressure = 100 kpa = 100 x 10^3 pa
   Area of rectangular surface = A = n0.5 x 0.4 = 0.2m.
   Force exerted = F = ?
   As we know that P = F/A ➔ F = PA
   F = 100 x 10^3 x 0.2 => f = 20 x 10^3 N => 20KN
2. **What is hight of a Colum of turpentine oil that would exert the same pressure as 50m of mercury? Density of mercury is 13600kg/m^3 and the density of turpentine oil 840 kg/m?**
   Solution :-Hight of turpentine oil Colum = h_1 =?
   Mercury = h_2 = 5cm =

   Density of turpentine oil = L_1 = 840kg/m^3

   Mercury L_2 = 1300kg/m_3

   Pressure of turpentine oil = p_1

   Mercury = p_2

   As it is given that :- $p_1 = p_2$

   ie $L_1 h_1 g = L_2 h_2 g$ p = (Lhg)

   $L_1 h_1 = L_2 h_2$

   $H_1 = \frac{L2\ h2}{\varphi}$

   H_1 = 1360~~0~~ x 0.05/84~~0~~ => h_2 = 0. 80 9m => 80 .9cm

3. **A rectangular glass blocks of dimensions 300 cm by 5cm by 100cm. weight 37.5N calculate the least and greater pressure it can exert when resting horizontal.**
   Solution:- force = wnb f = 37.5 N

Length = l = 30 cm = 0.03m
Width = b = 5cm = 0.05m
Hight = h = 10cm = 0 .1m

1. Least pressure = pmin =?
2. Greatest Pressure =p mix = ?

⇨ Area for maximum = Amax = l x h = 0.3 x 0.1 = 0.03m^2
⇨ Area for minimum = Amin = b x h = 0.5 x 0.1 = 0.005m^2

1) P min = F/A max = 37.5/0.03 = 1250pa
2) P max = F/A min = 37.5/0.005 = 7500pa.

4. calculate the pressure at a depth of 100cm of water g = 10m/sec^2?

Solution:- Depth of water h = 100m
G = 10m/sec^2
Pressure = p = ?
Density of water = l = 100kg/sec^3
P = lgh = 100 x 10 x 100 = 10^6 pa

5. in a hydraulic press the area of he load piston is en time the area of he offer piston. How much load can be lift with if by applying a force of 100n on effort piston?

Solution:- Area of effort piston = A_1
Area of load piton = $A_2 = 10A_1$
Force on effort piston = F_1 = 100N
Force on load piston = F =?
AS we know that :- $F_2 = F_1A_2/A$
F = 100 x 10 A_1 => f = 100N

6.calculate the extension in wire o force constant 200n/m when a force of 200n is applied on it within elastic limit?

Solution:- force constant = k = 200N/m
Applied force = F = 200N
Extension = X =?
According to Hook's law F = k x

⇨ X = F/k => x = 200/2000=> x = 1/10
⇨ => x = 0.1m

7.An elastic wire of length 2m and cross section area 0.02 m^2 is stretched 0.10m by a 300N weight

calculate the young's modulus of material.

Solution:- length of wire = 2m

Area of cross section = A = 0.02m^2

Change in lengt6h = $\Delta L = 0.10m$

Force = w = f = 300m

Young's modulus = y =?

$Y = \frac{F\ x\ L}{A\ x\ \Delta l} = \frac{300\ x\ 2}{0.02\ x\ 0.10} = \frac{600}{0.002}$

Y = 300,000 N/m^2

CHAPTER: NO 8

THERMAL PROPERTIES OF MATTER

Q.1 Define heat and temperature? Also show deference b/w them?

Ans. Heat:- The form of energy which transfers from one body to another body due to difference of temperature between them is called heat
(OR) The total K.E of molecules of a body is called heat.

Temperature:-The degree of coldness or hotness a body with respect to some standard is called temperature (OR) The average K.E of molecules of a body is called temperature.

⇨ **Difference b/W heat and temperature**

S.NO	Heat	S.NO	Temperature.
1	it is the total K.E of molecules of a body.	1	It is the average K.E of molecules of a body.
2	It gives the sensation of warmth	2	It is the degree of coldness or hotness of a body.
3	It's units are joul and calories.	3	It's units are kelvin, centigrade and Fahrenheit.

Q.2 Define thermometry? Also explain thermometric property? And temperature scale?

Ans. Thermometric: - The branch of physics which deals with the measurement of temperature.

Thermometric property:-we measure temperature by on instrument called thermometer. For construction of a thermometer we use certain physical property of matter which decreases or increases uniformly with change in temperature and this property is used for measurement of temperature which is known as thermometric property.
Usually we use the property of expansion. For example the expansion of mercury and alcohol is uniform which is mostly used for measurement of temperature in thermometer.
Temperature Scale:- see Q4

Q.3 what is thermometer? Also explain liquid in glass thermometer and clinical thermometer?

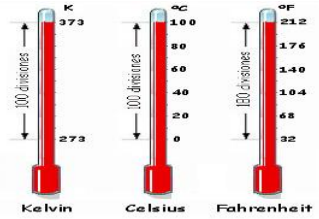
Ans. Thermometer:- The instrument which is used for measurement of temperature is called thermometer it is based on the principle of expansion of liquids on heating.

⇨ **liquid in glass thermometer:-** it consist of a graduated glass tube whose one end is sealed and the other is filled with a bulb. And glass is filled with mercury. When bulb of thermometer is heated the mercury expands up and we can easily record the reading liquid in glass thermometer is most commonly used in labor tries and it has a temperature of –10^{o}c to 110^{o} c.

⇨ **clinical thermometer:-** this thermometer consists on a glass stem whose one end is fitted with a bulb and other is sealed the stem is filled with some standard liquids like mercury etc. A small bend is given to glass stem near the bulb, so that to prevent from the easy flow of mercury toward bulb.
This thermometer is mostly used by doctors and nurse its scale only extends over a few degrees on either sides of normal body temperature 37^{o}c of 98^{o}F. There for the range of a clinical thermometer is from 35^{o}c to 43^{o}c or from 95^{o}c to 110^{o}f.

Q.4 what is meant by thermometric scale? Also discuss different sales?

Ans. Thermometric or temperature scale :- the scale which is made for the measurement of temperature is called temperature or thermometric scales. There are two reference points which are called fixed points and the distance b/w these points is divided in small parts and each has given a specific numerical value. There are three scales of temperature which are given below.



i. **Celsius or centigrade scale:-** that scale at which ice fixed point is marked o°c and steam fixed point is marked 100°c. the distance between these two point is divided into 100 equal parts and each part is known as 1 Celsius or centigrade and it is denoted by "°c" it is shown in figure.

ii. **Fahrenheit scale (°F):-** that scale at which ice fixed point is marked at 32°F and steam fixed point is marked at 212° F is called Fahrenheit scale the distance between these two points is divided into 180 equal parts ands each part is called one degree Fahrenheit which is denoted by :"° F"

iii. **Kelvin (OR) Absolute scale:** That scale at which the ice fixed point in marked at 273k and boiling point is marked at 373k. The distance between these two points is divided into 100 equal parts and each part is known as on Kelvin and denoted by k.

Q.5 Explain conversion of temperature scale?

Ans. Relation b/w different scales of temperature:-some time we need to convert the temperature measured co efficient of linear expansion and "d" is give by;

D = $\Delta L/Lo\Delta T$ ……(4)

If we have Lo = 1m and $\Delta T = 1^o$ then eq (4) becomes;

D = $\frac{\Delta L}{1.1} => d = \Delta L$ … … … … … ….(5)

So, according to eq (5) we can define "a" as the increase in per unit length per degree is called co efficient ;of linear expansion of that body the value of a depends upon the nature of material and it is different for different materials the S.i unit of co efficient of linear expansion is K.

Now as we know that find length of rod is given by;

L_t = L + ΔL……(6)

Putting value of $\Delta L\ from\ eq\ (3) in\ given\ by;\ \Delta L = a\ Lo\Delta T$

Lt = Lo + d Lo ΔT … … … … … … . (7)

Eq (1) shows the final length of rod.

Q.6 Define and explain volume(cubical) expansion?

=> **cubical expansion:-**the expansion occurred in the volume of substance due to heat is called volume or cubical thermal expansion.

Explanation:- let suppose the initial volume of a block is "vo" at temperature to when temperature is increased by $\Delta T\ then\ its\ volume\ is\ also\ increased\ by\ \Delta v$ .the increase in volume is directly proportional to original volume of block and change in temperature.

i.e $\Delta v\ \varphi$ vo ……(1)

.$\Delta v\ \varphi\ \Delta T$ … … … … … … . (2)

Combining eq (1) and eq (2) we get

.$\Delta v\ \varphi v_o \Delta T$

⇨ $\Delta v = \gamma v_o \Delta T$ $=> \gamma = \frac{\Delta v}{vo\Delta T}$……(3)

⇨ $where$ "γ" is constant and it is co efficient of volume expansion now of v_o=1m^3 and $\Delta T = 1^o$ then eq (3) becomes,

$\gamma = \Delta v/1m.1^o$

$\gamma = \Delta v$……(4)

$so\ we\ can\ also\ define\ y\ as\ change\ per\ unit\ volume\ per\ degree$ rise in temperature is known as co-efficient of volume expansion it depends upon material and is different for

different materials its unit is K^{-1} co efficient of volume expansion of solids is three times the co efficient of linear expansion y = 3d

now the final volume of a body is given by;

$v = v_o + yv_o\Delta T$

$v = v_o (1 + y\Delta T)$

$by\ this\ equation\ we\ can\ find\ the\ final\ volume\ of\ a\ body;$

Q.7 Give some practical application of thermal expansion?

Ans. Some practical application of thermal expansion in our daily life is given below.

- **Railway line:-**During the construction of railway lines small gapes are lift in rails, Because they are made of steel which expand in summer and contract in winter so by gapes we can prevent by bending of rails.
- **To remove a tight glass stopper from a bottle:-** when a bottle top is too tight to open then we place the bottle top in got water for a while because of which the bottle top expands which can be opens easily.
- **Fixing of iron ring to a cart wheel:-** when we place on iron ring around Tonga wheel we heat it before placing because the diameter of wheel of Tonga is greater than ring at room temperature but on heating the ring expands. Which can be placed around wheel?
- **Gapes b/w the roof girders and steel bridges:-**Gapes are lift at the end of roofs. Iron girders and steel bridges. Because in summer the girders and steel of bridges expands due to heat so by gape we can avoid bending.
- **Bimetallic strips:-**bimetallic strips are consists of two strips who co efficient of expansion are very different from each other. When there is increase in their temperature they expand unequally and this property of bimetallic is used for different purposes.

Q.8 what is meant by thermal expansion of liquids? Also explain real and apparent expansion of liquids?

- **Expansion of liquids:-**The increase in volume of liquid is known as thermal expansion of liquids as we know that liquids have neither length nor area so, we study only volume expansion of liquids in case of liquids there is two types of expansion given below.
- **Real expansion of liquids:-**The real increase in the volume of a liquid because of heat is called real expansion (Vernal) of liquid?
- **Apparent expansion of liquids:-**apparent increase in the volume of a liquids because of heat is called apparent expansion (V apparent) of liquids.
- **Explanation:-**we can explain the expansion of liquids as well as real and apparent expansion of liquids when a liquid is heated in container as shown 1st the volume of liquid falls from "A" to "B" when this liquid is more heated it rises again to point "c" in this experiment expansion b/w "A εc"

  Is known as apparent expansion while expansion.

  b/w "B ε C is known as real expansion.

  Ie real expansion = Apparent expansion + expansion of flask.

  BC = AC + AB

  Where expansion b/w "A εB" shows expansion of flask. Because on heating 1st the container expands and then liquid expands. Real increase in a cubic meter volume of liquid because of 1k rise in temperature is called co efficient of real expansion and it is represented by $\gamma_y = \gamma a + \gamma g$

Q. 9 explain the anomalous expansion of water? Also describe its effect's?

Ans. **Anomalous expansion of water:-** Generally when the temperature of liquids increases from O^oC .they begins to expand but when the temperature of water increases form 4^oC it begins to expand.
Similarly when temperature decreases the water begins to contract. When temperature falls from4^oC to O^oC then the water begins to expand. Thus the ice possesses greater volume than water and can float easily on surface irregular or anomalous expansion of water.

- **Effects of anomalous of water.**
  In cold season, the surface water of lake may be frozen. But at depth, the water remains at 4^oc which keeps the marine animals in safe and sound condition.
- In winter season, the water may be frozen inside the pipes and due to expansion the frozen water the pipes often burst in winter season.
- The water absorbed by rocks freezes in winter season and thus expand as a result breaks occurs in rocks.

Q10: Define And Explain Heat Capacity?

Ans: **Heat Capacity:** "The quantity of heat required to rise the temperature of a substance by 1 ^0c or 1K is called heat capacity of a substance".

Explanation:

If "ΔQ" is change in heat and "ΔT" is change in temperature then heat capacity is given by following cm=ΔQ/ΔT

The value of "cm" depends upon the following.

1) The nature of material.
2) The mass of material.
3) The rise in temperature.

It's unit in S.I is jowl per Kelvin i.e. J/k.

Q11: Define and explain specific heat capacity?

Ans: Specific Heat Capacity: "The amount of heat required to raise the temperature of 1Kg of a substance by 1^0C or 1 K is called specific heat capacity.

Explanation: The amount of heat depends upon mass of body "m" and change in temperature "ΔT" as given below.

ΔQ ∝ m (i)

ΔQ ∝ ΔT(ii)

Combining Eq (i) and Eq (ii) we get.

ΔQ ∝ mΔT = ΔQ=Constant mΔT

=ΔQ = C. mΔT = C= ΔQ/mΔT.

Where "C" is knowing as specific heat capacity of substance and its unit is J/Kg.K.

Q12: Describe the effects of high specific heat of water?

Ans: As we know that water has a highest specific heat. So in this universe it is a very useful material for storing and caring huge amount of heat energy. Some effects of its high specific heat are given below.

1) **Hot Water bottles:** A hot water bottle remains warm for a long time. It can be use for therapeutic and other useful purposes.
2) **Water as coolant in radiator:** Water carries the unwanted heat from engine of a car to radiator and keep the engine in working condition.
3) **Internal heating of building:** The water can be used the internal heating of a building during winter season. The hot water carries huge amount of heat from the surface to the room. By this way moderate temperature can be maintained inside the room.

Q13: What is meant by latent heat of fusion of solids and specific latent heat of fusion of solids? Explain the hidden heat by molecular theory?

Ans**: Latent heat of fusion of solid:**

The amount of heat required to convert a given mass of a substance from solid state of liquid state without any rise in temperature is called latent heat of fusion of solids.

Specific latent heat of fusion of solids:

The amount of heat energy required to convert a mass of 1 KG from a solid state without any rise in temperature is knowing as specific latent heat of fusion of solids.

Explanation of hidden heat by molecular theory:

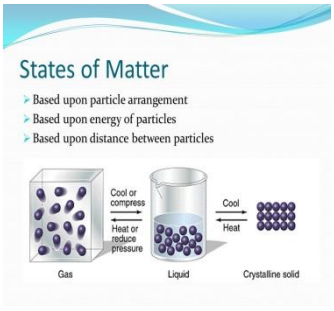
When a solid is heated The K.E of molecules increases because of which vibration and amplitude of molecules also increases due to which the intermolecular force among molecules becomes weaker and weaker. As a result the molecules of solids begin to separate from each other and this solid starts to melt. This process continues until the whole solid is converted into liquid state.

During this process the given heat is totally used for conversion of solid into liquid state. So temperature remains constant An this constant heat is known as latent heat of fusion of solids.

If "ΔQ" is the amount of heat given to a mass "m" then the latent specific can be written as: Hf=ΔQ/m

Q14: Explain change of state of water an ice to water phase diagram?

Ans: **Change of state of matter:**

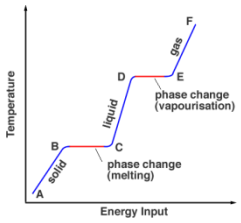


Suppose a heat is given to a beaker which is filled with pieces of ice and a thermometer is also inserted in ice as shown .

Let the initial temperature of ice is -10^0c which changes 0^0c because of heat and ice begins to melt. At this stage there is no further change in temperature because of total amount of heat supplied is used to convert ice into liquid and this heat is called latent heat of fusion of ice.

Now when ice is totally converted into water and then temperature is reaches to 100^0c and water start boiling . Now on further heating there is no change in temperature because the total amount of heat is used to change water into vapors. And this heat is known as latent heat of vaporization.

Ice to water phase diagram: Ice to water phase diagram is shown in figure. Where point shows total ice at -10^{0}c. "AB" shows rise in temperature from -10^{0}c to 0^{0}c because of heat.



Point "B" Shows melting point of ice. Line "BC" shows latent heat of fusion

Of ice and there is no changes in temperature.

Line "CD" show rise in temperature from 0^{0}c to 100^{0}c and point "D" shows

Boiling point of water.

At line "DE" there is no change temperature and it shows latent heat of vaporization.

Q15: What do you mean by latent heat of vaporization and specific latent heat of vaporization?

Explain hidden heat by molecular theory?

Ans: **Latent heat of vaporization:**

The amount of heat energy required to vaporize a given mass of liquid at its boiling points without any rise in its temperature is known as latent heat of vaporization.

Specific latent heat of vaporization:

The amount of heat energy required to vaporize 1kg of a liquid at its boiling point without any rise in temperature is called specific latent heat of
vaporizatio

ΔQ *is the amount of heat energy whic vaporize a mass* m*then the latent heat of vaporization is given by;*

ΔQ = mHv =>**(HV) liquid =** $\Delta Q/m$

Where Hv is latent heat of vaporization of liquid.

Explanation by molecular theory:-when a liquid is heated. The KE of molecules increases. Because of which vibration and amplitude of molecules also increases due to molecular force among molecules become weaker and weaker. As a result the molecules of liquids become able to move away from each other and at 100^o c begins to evaporate. This process is continues until the whole liquid is converted into gaseous state.
During this process the given heat is totally used for conversion of liquid into gasses state. So temperature remains constant and this constant heat is known as latent heat of vaporization liquids.

Q.16 what is meant by evaporation of liquids? On which factors does it depend?

Evaporation of liquids:- The process by which a liquid slowly changes into its vapors below its boiling point is called evaporation (OR) the process by which a liquid changes into its vapors at any temperature without the aid of any external source of heat is known as evaporation of liquids.
Explanation:-evaporation can occur at any temperature even when temperature is below the boiling point for e3xampale a spreader wet cloth becomes dry on big exposed to the air in a short time due to evaporation of water molecules.
Factor4s on which it depends:- the evaporation of liquid depend upon the following factors.

- **nature of liquid:-** liquids having low boiling point well evaporate rapidly than liquids having high B.: for example rate of evaporation of alcohol is higher.

- **Temperature of liquids:**- if the temperature is higher, then the molecules well have more K.E and they can easily evaporate from the surface of liquids. For example when iron is pushed on wet cloths, it dry out quickly and easily.
- **Temperature of surrounding:**- The higher the temperature of surrounding, the higher well be3 the rate of evaporation. Because wet cloths in summer season dry quickly as compare to winter season.
- **Area of exposed surface of liquid:**- if the surface are of liquid is greater then the molecules will evaporate more easily for example roads dry out quickly become.
- **Movement of air:**- evaporation also depends on moment of air greater the speed of flow of air higher well rate of evaporation. For example cloths dry sooner on windy day.
- **Air pressure on the surface of liquid:**- it also depends upon the pressure on the surface of liquid. If there is more then evaporation well be slow.

Q.17 How evaporation produce cooling?

Ans. according to K.E theory of molecules every liquid contain molecules which possess different K.E ranging from minimum to maximum.

Now those molecules whose K.E is maximum are able to overcome the inter molecular forces and escape out form liquid surface. The remaining molecules possess low K.E. we also know that K.E is directly proportion to the temperature. So the molecules of low K.E possess low temperature thus evaporation cause cooling effect.

Q.18 write the application of evaporation by cooling?

- **Cooling by Fans:-**in hot seasons we use fan. They increase the speed of air due to which rate of evaporation of perspiration from bodies also increases. And we get a cooling sensation. By this way perspiration help us cooling our and regulates temperature. Similarly room of water.
- **Fever control:-**when a person is suffering from high fever. We apply a wet towel on forehead of patient. When water dope evaporates from to well they absorb the heat from his head

And the patient remains safe and does not suffer any brain damage.

- **Refrigerators:-** A volatile liquid is used in refrigerator called Freon. The Freon evaporates in the pipes of freezer which draws the necessary latent heat from food inside Refrigerators and cooling is produced.

COCEPTUAL QUESTIONS

Q.1 see for ans Q10 b/w the ……..)

Q.2 why liquid have two coefficients of expansion?

Ans. When heat is supplied to liquid in a container. Then expansion occurs in liquid as well as the container. The expansion only liquid is known as real expansion while that of liquid plus container is called apparent expansion that's why liquid has two coefficient of expansion. ie (i) coefficient of real expansion. (ii) Coefficient of apparent expansion.

Q.3 ice melts to form water at o°cAt what temperature does water freezes to form ice?

Ans. We know that during phase change the temperature remains constant. Therefore the water will freezes at same temperature at O°C to from ice.

Q.4 see for ans Q5 water is cooling.

Q.5 why do we sweet in summer?

Ans. We sweet in summer because the temperature of our body rises. We want to keep the temperature suitable we give out heat from our body because of which sweet drops comes out from our body through pores of our skin.

Q.6 what is the effect of high specific heat of water on the climate of cloistral area?

Ans. In cloistral area during day time the land is heated more. So the heated air rises up and its place it occupied by cold air of sea level. Such movement of air is known as see breeze. This process is reversed during night. Thus in cloistral areas a moderate are maintained throughout the year.

Q.7 why does the temperature does not change during change of state?

Ans. The temperature dos not change during change of state because matter the supplied heat only increases P.E of molecules because of which their bonds becomes weaker and separate from each other. As there is no change in K.E there for temperature remains constant.

Q. 9 see for ans Q10 at page 63 .

Q.10 if a hot piece of thick glass is dipped in hot cold water it breaks give reason?

Ans. If a hot piece of thick glass is dipped in cold water it breaks because the outer surface contract and the interior side is still hot and because of this unbalanced condition it breaks.

Q.11**why do soda water bottles often burst in summer? How can burstable minimized?**

Ans. In summer soda water expands because of which because of which at the bottle burst to minimize this bursting space should be left at the tope of soda water in bottle which expansion of soda water in bottle.

Q.12 does land cool at a slower or faster rate than sea water? Give one reason for your answer?

Ans. The land cools faster than sea water because the specific beat water is more than that of soil.

Q.13 why is water at the bottom of a water fall is warmer than water at the top of water falt?

Ans. We now that K.E of a water fall is maximum at bottom and K>E is directly proportional to temperature that's why water at bottom of a water is warmer than water at top.

Q.14 why is ice at O°C a better coo lent of soft drinks than water at O°C?

Ans. The ice at **O°C**a better coo lent of soft drinks than water at **O°C** because ice will absorb more heat from the soft drinks to change to change into water at **O°C.**

Numerical problems

1) **A person running fever has a temperature of 104° F. what is his temperature in degree centigrade "°C" .?**

Solution:- temperature in Fahrenheit = TF = **104° F**

Centigrade = Tc= ?

$TF = \frac{9}{5} = Tc + 32$ $\Rightarrow \frac{9}{5} Tc = Tf - 32$

$Tc = \frac{9}{5}(Tf - 32$ $\Rightarrow Tc = \frac{9}{5}(140 - 32)$

$Tc = \frac{5}{\cancel{9}} \times \cancel{72}^{8}$ **=>Tc = 40°**

2) **A railway line 1200km long is laid at 25^{oC} .by how much will it contract in winter when the temperature falls to 15°C ? by how much well it expand when the temperature rises to 40°C in summer? A = 12 x 10^{-6}m °C^{-1}**

Lo = 1200km = 1200 x 10^3m = 1.2 x 10^6m

To = 25°C i) T = 15°C ii) T = 40° C

Fin ΔL in both cases ie ΔL =?

(i) As we know that ΔL = LOΔT

⇨ $\Delta L = (12\ x\ 10^{-6})$ (1.2 x 10^6) [25 – 15]

$\Delta L = 12\ x\ 1.2\ x$ ~~10^{-6}~~ x~~10^6~~ x 10

ΔL = 12 x 1.2 x 10 =>ΔL = 12 x 12 =>$\Delta L = 144m$

(ii) now at T = 40°C:-

$\Delta L = a\ Lo\ \Delta T$ =>ΔL = (12 x 10^{-6}) (1.2 x 10^{+6})(40 – 25)

⇨ ΔL = 12 x 1.2 x 10^{-6} x 10^6 x 15

⇨ $\Delta L = 12\ x\ 1.2\ x\ 15$ =>$\Delta L = 216m$

3) **The volume of a brass ball is 800 cm³ at 20°C. find out new volume of ball if temperature is raised to 52°C? y = 57 x 10^{-6} c^{-1}.**

⇨ Vo = 800cm^3 To = 20°C

Final temperature = T = 52°C y = 57 x 10^{-6} c^{-1}

Volume = v =?

As we know that v = v_o (1 + ay ΔT)

V = 800 [1+57 x 10^{-6} (52 – 20)]

⇨ v = 800 (1+57 x 32 x 10^{-6}) => v = 800[1+ 1824 x 10^{-6}

⇨ v = 800 (1 + 0.001824) => v = 80/45cm^3

4) **A brass disc dt 293k has a diameter of o.o30m and a hole of diameter 0.10m is out in center calculate diameter of whole when temperature of disc is raised**

T 323k d = 19 x 10^{-6} k^{-1}

Solution:- initial diameter of whole = do = 0.10m.

Temperature = To = 293k

Final temperatur3e = T = 323k

Initial length of whole = Lo = do d = 19 x 10^{-6} k^{-1}

Final length of whole = L = d

Now we know that:- L = Lo (1 + d ΔT)

⇨ D = do [1 + a (T – to)]

⇨ D = d= [1 + 19 x 10^{-6} (323 – 293)]

⇨ D = 0.10[1 + 19 x 10^{-6} x 30]

⇨ D = 0.10 [1 + 570 x 10^{-6}] => d = 0.10 [1 +_ 0.000570]

⇨ D = 0.10(1.000570) => d = 0.100057m

5) **0.5kg of copper needs 1950T of heat to rise its temperature through 10°C. calculate the heat capacity?**

Solution:- mass of copper = 0.05kg

Required heat = $\Delta Q = 1950T$

Change in temperature = ΔT = 10^{oC}

Heat capacity = C =?

As we know that:-

C = $\Delta Q/\Delta T$ => C = 195~~0~~/1~~0~~

⇨ C = 195/T/C

CHAPTER NO:9

TRANSFER OF HEAT

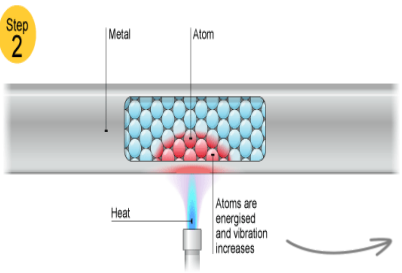
Q.1 Define conduction of heat and explain mechanism of heat? Also give a few practical example?

Conduction of heat:-the process by which heat energy is transferred from particle to particle by collision is called conduction of heat.

⇨ Mechanism of heat conduction:- there are two ways by which heat energy is transferred.

i) Vibration of atoms in metals:-

A metal consists of large number of atoms which vibrates about their mean position. When heat is supplied to its one end. Then because of this heat the vibration of atoms increases. These atoms collide with their neighbor atoms and transfer their he3at to neighboring atom and by this way heat is transferred to the other end.



ii) Motion of free electron in metal:-

iii) We know that a metal consists of free electron which can carry heat from one point to another end. When heat is supplied to metal rod. It's K>E o atoms increases. They transfer their heat to the free electrons by collision and these

free electrons transfer their heat to other free electron and thus heat is transferred to the other end.

⇨ **Practical application heat conduction:-**

i. We use met5al pots for cooking which transfer the heat easily to the food placed in side them.

ii. Plastic foams and fiberglass are bad thermal conductors. They are used in the wales and ceiling of homes. And keep them warm in winter.

iii. Woolen clothes have fine pores which contain air. The air and wall are bad thermal conductor. Thus they avoid the flow of heat from our body to the surrounding and keep us warm in winter.

Q.2 Describe conduction of heat in solid, liquid and gas?

Ans. **Conduction in solids:-**usually metallic solid are good conductors of heat. Which contains free electrons and packed atoms and they play very important role in conduction of heat which can carry heat energy inside a metal from one point to another point. And they are considered god conductors while plastic wood and rubber etcare poor solid conductor because they have no free electron.

Conduction in liquid:-liquids are mostly poor conductor of heat as compare to metallic solids because the inter molecular distance is larger in liquids than solids. Therefore the rate of conductivity is also smaller than solid.

Conduction in gases:- there is a large distance among gas molecules. Thus the rate of conductive collision in gas is very smalls as compare to solids and liquids thus gases are the poorest conductors of heat. The conductivity of air is of waters 20 times smaller than that of water.

Q.3 state and explain thermal conductivity?

Thermal conductivity:- The measure of ability of a substance to conduct heat energy is called thermal conductivity (OR) the amount of heat flowing through a unit area of a substance in one second having a temperature difference of 1k across at a length of one meter is called thermal conductivity.

Explanation:-consider a rod of length "L" having area of cross section "A" and difference of temperature ΔT then the amount of heat "Q" supplied depends upon the following factors.

i) "Q" is directly proportional to area of cross section "A"
Q φ A.....i
"Q" is directly proportional to change in temperature ΔT
ΔT $\varphi \Delta T$.....ii
"Q" is directly proportional to time "t"
Q φ t iii
Q is inversely proportional to length "L" of rod
Q φ 1/L.....iv
Combining eq (i),(ii), (iii), we get.

Q φ A. ΔT .t 1/L
Q ΔT A . ΔT t/L
Q = k A ΔT t/L……..v

Where "K" is constant of proportionality and called thermal conductivity of a substance. It's value depends upon nature material and its unit is J/k. m .sec.

Q.4 Define convection heat and explain its mechanism?

Convection of heat:-The transfer of heat fro one place to another by the actual motion of the heated particles is called convection of heat. (OR) the process in which heat is transferred from one place to another due to transfer of molecules is called convent of heat.

Mechanism of heat convection:-the mechanism of the convection of heat con be explained by the behavior of medium b/w hot and cold objects. Convection occurs only is fluids (liquids ei gases) and not in solids because the molecules of solids are tightly bounded with each other. And they can easily move from on place to other place in a body.

Consider a beaker filled with water and a few crystals of potassium per magnate are also dropped in it. When heat is given to beaker. Potassium per magnate dissolve in water and du4e to which the water of bottom becomes colourd. After sometime colourd water will rise to the top which shows that water molecule moved form bottom to upper pat because they become less dense due to heat so, hot Particle's or molecules move upward while cold molecules move downward. And the hot molecules transfer heat to the surface and the transfer of heat by this way is known as convection of heat.

Q.5 Give some practical examples of heat convection?

Ans. Heating water:-when heat is supplied to a kettle filled with water. Then the bottom layer of water becomes heated and these layers are less denser than water at bottom so these hot layers move upward while the cold layers move downward. This process is continued unless the whole water becomes heated.

Ventilation:-During the construction of houses ventilators are installed in rooms. The warm and stale air is less denser. So it rises up and go out through ventilators. By this way fresh air comes inside the room through door, windows and ventilators while the warm air goes out and keeps the room at moderate temperature.

Refrigerator:- convection used in refrigerator on where the layers of air is cooled by freezer compartments. This cold air moves downward and the warm air at the bottom rises to the top. This process continues and after some time the whole environment inside the refrigerator becomes cold which keep the food items in safe condition.

Riding on thermals:- thermal are streams of hot air which arises from the sun the gliders airplanes are able to arise by riding on the thermals the birds can also fly in thermals with flopping their wings.

Q.6 what is radiation of heat and explain its mechanism? Also give a few practical applications?

Ans. Radiation of heat:-the process by which heat is transferred from one place to another with or without any material medium is called radiation of heat.

Mechanism of heat radiations:-transfer of heat from one place to another place because of convection and conduction require a material medium. While in case of transfer of heat by radiation does not need a material medium.

the mechanism waves. Radiations can transfer energy through vacuum and also through certain material medium like glass the mechanism of heat radiation is electromagnetic phenomenon and not molecular motion. The heat energy from sun passes through vacuum and reaches us by radiation.

Practical application of heat radiations:-

i. In summer seasons, we often give a coat of white colour to the upper surface of the roof of our room.it is because the white colour reflects most of sun radiation. and thus the room remains at moderate temperature.

ii. We wear light colour cloth because, light colour cloth absorb minimum radiations and maximum radiations. Thus we feel cooling effect.
While in winter seasons, we wear dark colourd clothes absorbs maximum sun radiations and thus keep our body warm.

iii. Greenhouse effect is another application of heat radiation during the day the sun radiations enters green house and is absorbed by the soil and plants inside the green house. At night, the energy radiated by the soil cannot go out f the green house and thus keep house warm. As a result, the plant growth rate increases.

Q.7 what are thermal radiations also explain good and bad absorbers?

Thermal radiations:-the radiations which are emitted by a body due to its temperature is called thermal radiations.

Explanation:-All bodies weather cold or hot can radiate heat. A hotter body radiates more heat than on identical colder body. At constant temperature a body from surrounding radiates as much heat to its surroundings as it absorb thermal radiations can be radiated from a body at all temperature. How ever at high temperature3 a body radiates more radiation. The radiation which are less energetic than light are called infrared radiation while the radiation which are more energetic than light are called ultraviolet radiations. The heat which we receive from a hotter object is mostly in the form of infrared radiations. Good and bad absorbers:- the body which absorbs all radiation or maximum radiations are called good. Absorber while the body which absorbs minimum radiations are called bad absorber

A dull black kettle absorbs heat better than a polished silvered kettle. So a black kettle is a good absorber than polished silvery kettle. A silvery mirror like surfaces reflects all radiations falls upon it. So, such surfaces are called bad or poorest absorbers.

We wear often white clothes in hot seasons because white cloths are good reflectors and poor absorbers. While in winter season we wear dark color cloths. Because they are good absorbers and bad reflectors.

Q.8 discusses global warming How is it a threat to human life?

Ans. The earth's surface receive radiation from sum. The temperature of earth is about look and that of earth is about 300k.

The sun emits radiation of very high frequency like ultraviolet rays because its temperature is very high while the earth emits low frequency radiation because its is low as compare to sun these low frequency radiation are absorbed by water and co2 which are present in the atmosphere of earth the atmosphere of earth radiates back most of its energy to earth. As a result the temperature of earth increases. The earth's globe warms gradually this type of effect which gives rise to global warming is called green house effect the amount of co2 in earth atmosphere increases day by day due to fumes coming form factories and vehicles. Due to co2 the global warming increases with the passage of time if this process is continue then a stage will come that everybody will become hot. There will be no cold body on earth's surface. The disorder will reach to it's peak energy wil not be available for useful work. every living thing will face certain death which is called heat death universes. So, global warming is a great threat to human life.

Q.9 Discuss the green house effect How this effect keep the green house warm?

Green house effect:-The warming of on enclosure such as green house due to selective absorption of radiations such as green house due to selective absorption of radiations by the boundary of the Endo sure is called green house.

Explanation:- we can use glass green house for warming purposes the high frequency sun's radiation pass through the glass and absorbed by soil and plants inside the Endo sure as the soil is at low temperature as compare to sum so the soil and plants emits low frequency radiations at night. These low frequency radiations can not pass through glass and absorbed in it.

The glass emits some of these radiations back toward soil and plants. In this way warming effect is produced in the Endo sure which is known as green house effect.

CONCEPTUAL QUESTION

Q.1 why a wire=gauze is often placed over a burning flame for heating on object?

Ans. A wire gauze is often placed over a burning flame for heating a object. Because wire gauze conducts heat outward form flame a glass beaker can be heated safely o wire gauze because it protects the beaker from the contracted heat of the flame.

Q.2 Give three ways in which insulating material can be used to reduce head losses from a houses?

Ans.

i) use air filled cavity walls instead of solid bricks walls.
ii) In roof a layer of insulating material like plastic can be used to reduced heat conduction.
iii) Houses with small windows and doors will loss small amount of heat energy.

Q.3 see for ans Q8 page 72 we wear often white clothes.

Q.4 why is the freezer compartment kept at the top refrigerator?

Ans. The freezer compartment of a refrigerator is kept at top because it cools the air of surrounding and makes it denser compare to the air of bottom the cool air moves downward while warmer air moves upward, where it is cooled.

Q.5 why does thermal radiations pass more easily into a green house than out of it?

Ans. The heat is transmitted into a green house in the form of high frequency from sun these radiation are eraitted back inside the green house in the form of low frequency. Which cannot escaped from a glass block and are trapped inside.

Q.6 How heat losses are reduced in a thermos flask?

Ans. a thermos flask consists of doubled walled glass vessel silvered on the inner side. The silvered surface reflects back all radiant heat trying to leave vessel by radiations. The space b/w two walls is highly evacuated to prevent convection. The glass being a poor conductor, minimize the conduction of heat.

Q.7 How the interior of a car parked in the hot sum warms easily?

Ans. Heat is transmitted into a car in the form of high frequency from sun these are reflected inside and losses some energy and appears as low frequency radiation which cannot escaped car and are trapped back.

Q.8 A black car, standing in the sun warms up more quickly than any other why?

Ans. A black car standing in the sun warms up more quickly than any other because the black surface is a good absorber of heat radiator than any other surface.

Q.9How air filled cavity walls keep a hose warmer in winter than a solid brick wall?

Ans. the air is a bad conductor of heat so an air filled wall keep a house warmer because

It stops the flow of heat from hose to outside. It stops the flow of heat from house to outside.

Q.10 why a tile floor feels colder to bare feet than carpeted floor?

Ans. A carpet is bad conductor of heat as compare to tile floor when a bore foot is put on the floor more heat is lost by the foot which is absorbed by tile floor and as a result we feel cool. If we put the foot on carpet floor we feel less cool because tile in this case our feet losses no heat that' why a floor feels colder to bare feet then a carpet floor.

Q.11 See for ans Q1 page 69.

NUMERICAL PROBLEMS

1. **window glass has thermal conductivity of 0.08 $wm^{-1}k^{-1}$calculate the rate at which heat is conducted through a window of are 2.0m^2 and thickness 4.0mm. the temperature insid4e on air conditioned room is 20°c the out doors temperature is 35°c.**

   Solution:- thermal conductivity = k = 0.8w/mk A = $2m^L$

   Thickness of windows = L = 4mm = 4 x 10^{-3}m

   T_1 = 20°C T_2= 35°c rate of change of conduction = Q/t

   Q/t =?

   We know that Q = K.A $\Delta T.t./L$

   ⇨ Q/t = K.A $\Delta T.t./L$

   ⇨ Q/t = 0.8 x 2 x (35 -20)/4 x 10^{-3}

   ⇨ Q/t =

   ⇨ 1.6 x 15 x 10^3 /4

   ⇨ Q/t =

   ⇨ 0.4 x 15 x 10^3

   ⇨ Q/t = 6.0 x 10^3

   Q/t = 6 x 10^3

2. **one end of a metallic rod of cross sectional are 90nn^2**and thermal conductivity 0.32 kw m^{-1} k^{-1} is kept at hight temperature. When steady condition is staid. The temperature gradient from one end to the there is 4.6 x 10^2 km^{-1} calculate rate of flow of heat only rod.

   Solution:-Area = 90mm^2= 90 x $(10^{-3})^2m^2$ = 90 x 10^{-6} m^2

   Thermal conductivity = k= 0.32 kw /m.k = 0.32 x 10^3 w/m.k

   Temperature gradient = $\frac{\Delta T}{L} = 4.6\ x\ 102\frac{k}{m}$

   Rate of flow of heat = Q/T = ?

   We know that Q = k. A$\Delta T.T/L$

   ➢ Q/t = kA .$\Delta T/L$

- $Q/t = 0.32 \times 10^3 \times 90 \times 10^{-6} \times 4.6 \times 10^2$
- $Q/t = 0.32 \times 90 \times 4.6 \times 10^{3\ -6\ +2}$
- $Q/t = 132.48 \times 10^{-6+5}$
- $Q/t\ 132.5 \times 10^{-1}$
- Q/t = 13.25 walt

3. The external wall of a brick hose has on area of $16m^2$ and thickness of 0.3m. the temperature inside and outside the house are respectively 20^oC ε O^oC calculate the rate of heat lass thought the walls.
   Solution:- area =A= $16m^2$ thickness = L = 0.3m
   $T_1 = 20^oC$ $T_2 = O^oC$ $\Delta T = T^2 - T_1$ $\Delta T = 20 - 0 = 20^oc$
   Thermal conductivity of to concreter = k = 0.5 w/k.m
   Rate of heat loss = Q.t
   As Q. k.A $\Delta T\ t/L$
   - Q/t = k.A ΔT/L
   - Q.t = 0.5 x 10 x 20 /0.3
   - Q/t = 533T/sec or walt
4. Two vessels of different metals are similar in shape and size they are fully filled with ice at o- O^oC by the heat from outside all the ice in one vessel melts in 25 mile and that in other verse lie 20 mints compare there thermal conductivities?
   Solution:-
   $A_1 = A_2 = A$, $L_1 = L_2 = L$ because both vessels are same in shape and size.
   T_1 = 25min = 25 x 60 = 1500sec
   T_2 = 20min = 20 x 60 = 1200sec

   Ratio of thermal conductivities = k_1/k_2 =?

   As we know that:- Q = k . A ΔT.t/L

   ⇨ K = QL/A$\Delta T.\ t$
   K_1 = QL/A_1 $\Delta L\ t_1$.....k_2 = QL/$A_2\Delta L\ t_2$
   Now => $k_{1/}$ = ~~QL~~/A$\Delta L\ t1/$
   k_2 ~~QL/AΔL~~ t_2
   ⇨ $K_1/k_2 = t_1/t_2 = {}^4$~~1200/~~$_5$1500 = 4/5 =>

$k_1/k_2 = 0.8$

5. A Houses losses a lot of heat through a window. Calculate the rate of flow through a glass window area of a $0.3m^2$ and thickness 3.2 mm the temperature at the inner and outs surface are respectively 15.0^0C and $-5\ ^0C$.

   Solution:- Area = A = $3m^2$

   Thickness = L = 3.2mm = 3.2×10^{-3}

   $T_1 = 15^oc$ $T_2 = -5^oc$ $\Delta T = 15 - (-5) = 15 + 5 \Rightarrow \Delta T = 20\ ^oc$

   K = 0.8 w/k.m

   Rate of flow of heat = Q/t = ?

   As we know that:

⇨ $Q = k.\Delta T.A.t/L$

⇨ $Q/t = k.\Delta T.A./L$

⇨ $Q/t = 0.8 \times 20 \times 3/ 3.2 \times 10^{-3}$

⇨ $Q/t = \frac{0.8 \times 20 \times 3 \times 10^3}{3.2}$

⇨ $Q/t = \frac{48}{3.2} \times 10^3$

⇨ $Q/t = 15 \times 10^3$ walt => Q/t = (5k walt

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