Principal's Message

Smartskills has been prepared with the belief that knowledge must continually be renewed with focus and effort. Our aim, as before is to help students understand, analyse and thus learn to think critically. This exercise will help them to internalize the academic goals they have set for themselves.

This question bank will, I am sure, not only reinforce their learning but also serve as an instrument of self-assessment. I hope students will make the best use of this material and maximize their scores.

ACADEMIC SESSION 2017-18

PHYSICS SMART SKILLS

CLASS IX

KEY FEATURES OF SCIENCE SMART SKILLS

- This edition is enriched with multiple choice questions, in-text questions, application based questions, very short answer type questions, short answer type questions, practice questions, figure based questions, etc. to check the child's grasp of the concept.

- The H.O.T.S. (High Order Thinking Skills) questions will help in developing child's logical and analytical thinking and will greatly enhance the development of independent thinking skills.

- The assignments will help to focus child's attention on the concept to follow and explain and reinforce the scientific concepts.

- The FACTOPAEDIA contains amazing scientific facts. This will help in creating awareness among the students about the world of science.

- Last but not the least – This smart skill has been prepared to help the children develop a scientific aptitude by
  - ✓ Reinforcing concepts
  - ✓ Strengthening expression
  - ✓ Developing independent thinking
  - ✓ Understanding the reasoning of day to day phenomena

INDEX

CONTENT **PAGE NO**

SYLLABUS ……...

1. Chapter 8 Motion ……..

2. Chapter 9 Force and laws of motion ……

3. Chapter 10 Part I Gravitation ……..

4. Chapter 10 Part II Gravitation ……..

5. Chapter 11 Work and energy ……..

6. Chapter 12 Sound ……...

Experiments ……..

Multiple Choice Questions [based on practicals] ……..

SYLLABUS

TOPIC: MOTION

Motion along a straight line, distance, displacement, speed, velocity, acceleration, uniform and non uniform motion, Derivation of the equations of motion, elementary idea of uniform circular motion. Graphical representation of motion through distance- time and velocity –time graphs.

TOPIC: FORCE AND MOTION

Balanced and unbalanced forces, Newton's 3 laws of motion, Inertia and its relation to mass, Mathematical expression for Newton's second law of motion, Momentum, Law of conservation of momentum, Derivation of the expression to prove the law of conservation of momentum

EXPERIMENT

1. To establish relationship between weight of a rectangular wooden block on a horizontal table and the minimum force required to just move it using a spring balance

TOPIC: GRAVITATION

Newton's Universal Law of Gravitation and its importance, Acceleration due to gravity, Mass and Weight, Relationship between weight of an object on the earth and that on the moon.

TOPIC: GRAVITATION

Thrust and pressure, Buoyancy, Archimedes principle, conditions for floatation and sinking, elementary idea of relative density.

TOPIC: WORK, ENERGY AND POWER

Mechanical work done by a force, conditions for work done, Energy , potential and kinetic energy, Law

of conservation of energy, Commercial unit of energy and its relationship with the S.I unit of energy, Power.

TOPIC: SOUND

Production and propagation of sound, Transverse and Longitudinal waves. Sound needs a medium to travel, Speed of sound in different media, Characteristics of sound waves, Echo, Reverberation, Range of hearing , SONAR, Structure of the human ear and the functions of each part.

LIST OF EXPERIMENTS

1. To observe and compare the pressure exerted by a solid iron cuboid / glass slab on fine sand / refined flour while resting on its three different faces and to calculate the pressure exerted in the three different cases.

2. To determine the density of solid (denser than water) by using spring balance and a measuring cylinder.

3. To establish the relation between the loss in weight of a solid when fully immersed in
   (a) tap water
   (b) strongly salty water, with the weight of the water displaced by it by taking at least two different solids.

4. To verify laws of reflection of sound.

5. To determine the velocity of a pulse propagated through a stretched string / slinky.

CHAPTER 8

DESCRIBING MOTION

Assignment 8.1

1. Motion – An object is said to be in _____ when its position changes continuously with respect to a stationary object with the passage of time.

2. Rest – An object is said to be at _____ when its position with respect to its surroundings does not change with the passage of time.

3. (a) Distance – It is the length of the actual path between the _____ position and the _____ position of a moving object.

   (b) It is a _____ quantity.

   (c) The SI unit of distance is _____(m).

4. (a) Displacement – It is the shortest distance from the _____ position to the _____ position of a moving object.

   (b) It is a _____ quantity.

(c) The SI unit of displacement is _____ (m).

5. Scalar quantities – The physical quantities which can be completely described with the help of their magnitude alone are called _____ quantities.

6. Vector quantities – The physical quantities which can be completely described with the help of their _____ and _____ are called vector quantities.

7. Distinguish between distance and displacement.

Distance	**Displacement**

NUMERICALS

1. An object travels 20m towards east, turns and moves 15m towards north. Calculate the distance travelled and the displacement.

2. A boy takes one complete round of a circular track of radius 21m while a girl walks along the diameter of the same track. Calculate the distance travelled and the displacement by the boy and the girl.

3. A particle is travelling along a circular path of diameter 15cm. Calculate the distance travelled and displacement at the end of half a round and on completing one round.

4. In a long distance race the athletes were expected to take 4 rounds of the track such that the line of finish was same as the line of start. The length of the track was 200m.
    a. What is the total distance to be covered by the athletes?
    b. What is the displacement of the athletes when they touch the finish line?
    c. Is the motion of athletes uniform or non-uniform?

Assignment 8.2

1. (a) Speed – Speed of an object is defined as _____ travelled by the object per unit _____.

   (b) It is a _____ quantity.

   (c) The SI unit of speed is _____(m/s).

2. (a) Velocity – Velocity of an object is defined as _____ of an object per unit time.

   (b) It is a _____ quantity.

   (c) The SI unit of velocity is _____ (m/s).

3. Uniform / constant speed – If an object covers equal _____in equal intervals of _____, however small the time interval may be, the object is said to travel with uniform speed.

4. Non-uniform / variable speed – If an object travels unequal distances in equal intervals of time or vice versa, however small the time intervals may be, the object is said to travel with non-uniform speed.

5. Uniform / constant velocity – An object is said to move with uniform velocity, if it covers equal _____ [equal distances in a particular direction in equal intervals of time] or if it moves with uniform speed along the same direction.

6. Non-uniform / variable velocity – An object is said to move with non-uniform velocity, if the object changes either its _____ or direction of motion with the passage of time.

7. Velocity of an object can be changed by

    i. changing the _____ of the object keeping direction of motion same.

    ii. changing the _____ of motion keeping the speed same

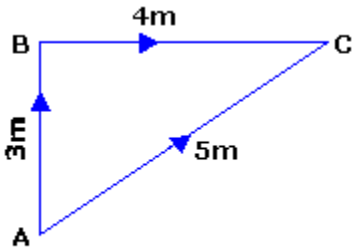
    iii. changing both _____ and _____ of motion.

1.

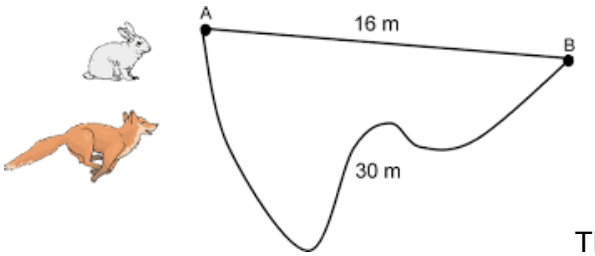
8. Distinguish between speed and velocity.

Speed	**Velocity**

NUMERICALS



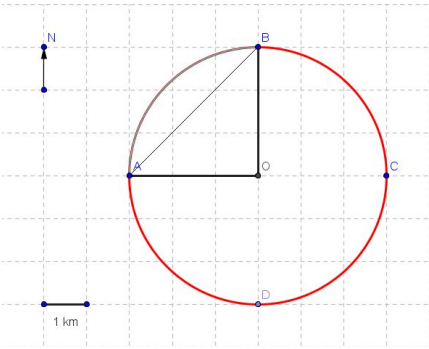
1. Distance and displacement In the above figure, an object moves from A to C along the path ABC. Find the distance travelled and displacement.

2. 

The rabbit takes the straight path from A to B whereas the fox takes the zig-zag path along AB.

(i) Who covers larger distance?

(ii) For whom , distance is same as displacement?

3. 

The diameter of the circular path is 14cm. If an object travels from A and completes one round, find its distance and displacement.

If the object travels from A to B along AOCB, find the distance travelled and displacement.

4. Priyanka takes 30 minutes to cover a distance of 3km on a bicycle. Calculate her velocity in km/min, m/s and km/h.

5. A car covers a distance of 36 km in one hour. Calculate its speed in m/s.

6. A man walks 60m in 30s. Calculate his speed in m/s. If he maintains this speed, calculate the distance covered by him in 5minutes and 10 seconds.

7. A biker travels 60km in 2 hours towards north. Calculate his velocity.

8. A body is moving with a velocity of 10m/s. If the motion is uniform, what will be its final velocity and distance covered after 5s?

ASSIGNMENT 8.3

1. Average speed – Average speed of a moving object is the ratio of the total _____ by the object to the total _____ taken by it.

   $$\text{Average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

2. (a) Average velocity – Average velocity of a moving object is the _____ of the net displacement of the object to the total time taken.

   $$\text{Average velocity} = \frac{\text{net displacement}}{\text{total time}}$$

   (b) When the velocity of a object is changing at a uniform rate over a period of time, then the average velocity of the object is the arithmetic mean of the initial and final velocity of the object.

   $$\text{average velocity} = \frac{\text{initial velocity} + \text{final velocity}}{2}$$

   $$v_{av} = \frac{u + v}{2}$$

NUMERICALS

1. An object covers first 12m in 5s, next 20m in 8s and final 13m in 2s. Calculate his average speed.
2. A ball is dropped from a height. It attains a speed of 5m/s after 0.5s. What is its average speed?
3. A boy goes to buy sweets from a shop 240m away from his house. He takes a minute to go and another minute to come back. Calculate his average speed and average velocity.
4. An object released from a height undergoes uniform acceleration of $10 m/s^2$ and attains final velocity of 28m/s before touching the ground. What was its average velocity?
5. An object travels 16m in 6s and then another 16m in 2s. What is the average speed of the object?
6. A car travels 40 km at a uniform speed of 40km/h. What should be its speed for the next 80km if the average speed of the entire journey is 60km/h?
7. Ajay travels 30km daily to his office by car. While going one day, he covers 10km at a uniform speed of 30km/h and the rest 20km at a uniform speed of 40km/h. What is the average speed of his car?

8. A train travels some distance with a speed of 30km/h and returns with a speed of 45km/h. Calculate the average speed of the train.

ASSIGNMENT 8.4

1. Uniform motion – An object is said to have uniform motion if it moves along a _____ and covers equal distances in equal intervals of time, howsoever, small these intervals may be.

2. Non-uniform motion - An object is said to have non-uniform motion if it covers unequal distances in _____, howsoever, small these intervals may be or moves with non-uniform velocity.

3. (a) Acceleration – Acceleration of an object is defined as rate of change of _____ of an object.

   (b) It is a _____ quantity.

   (c) The SI unit of acceleration is _____

   (d) $\text{acceleration} = \frac{\text{change in velocity}}{\text{Time}}$

   $\text{acceleration} = \frac{\text{_____}}{\text{time}}$

   $$\mathbf{a = \frac{v - u}{t}}$$

4. Positive acceleration – If the velocity of an object _____ with time in the direction of the motion of the object, the acceleration of the object is positive.

   Negative acceleration – If the velocity of an object _____ with time, the acceleration of the object is negative. It is also called deceleration or retardation.

5. Uniform/constant acceleration – If the velocity of an object changes by equal amounts in equal intervals of time, then the object is said to move with uniform acceleration.

6. Non-uniform/variable acceleration – If the velocity of an object changes by unequal amounts in equal intervals of time, then the object is said to move with non-uniform acceleration.

7. (a) Uniform circular motion – When an object travels equal distances in equal intervals of time over a circular path so that speed remains constant and direction changes continuously, the motion of the object is said to be uniform circular motion.

(b) It is an accelerated motion.

Assignment 8.5

DERIVATION OF THE EQUATIONS OF MOTION BY THE GRAPHICAL METHOD

FIRST EQUATION OF MOTION

INTRODUCTION

Consider an object that starts moving with initial velocity 'u' shown by point A on the graph. It attains final velocity 'v' by accelerating uniformly at the rate of 'a' m/s^2 within a time 't'. In the graph drop 2 perpendiculars from point B to the time axis and the velocity axis shown as BC and BE respectively. Draw AD parallel to OC.

GRAPH(To be drawn in class)

From the graph, acceleration, a = slope of line AB,

$$a = \frac{BD}{AD}$$

$$a = \frac{BD}{t}$$

This implies , BD = at

$$BC = BD + DC$$

$$v = u + at \qquad [BC=v \ , \ DC=u]$$

v = u+at ---------- First equation of motion

SECOND EQUATION OF MOTION

(Draw the graph and repeat the above introduction)

In the graph we can calculate the distance travelled by the object in the time 't' as follows.

Distance, s = Area of the quadrilateral OABC

s = Area of triangle ABD+ Area of OADC

s = ½ AD BD + OC OA

Substituting AD= OC ='t' , BD=at and OA =u ,

s = ½ t at +ut

$s = ut + \frac{1}{2} at^2$ ----------Second equation of motion

THIRD EQUATION OF MOTION

(Repeat the introduction and draw the graph)

Distance covered by the object in time 't', s = Area of quadrilateral OABC

$s = 1/2 (OA + BC) OC$

Since OC=t , OA= u , BC=v

$s = 1/2 (u +v) t$

Since t=v-u / a , $s = 1/2(u+v) (v-u / a)$

$s = 1/2(v^2-u^2) / a$

$v^2 - u^2 = 2as$

$v^2 = u^2+2as$ ----------Third equation of motion

EQUATIONS OF MOTION FOR FREELY FALLING BODIES

v=u+gt

$h=ut+1/2gt^2$

$$v^2=u^2+2gh$$

where h= vertical distance covered ,g= acceleration due to gravity =9.8m/s^2

NUMERICALS

1. A bicycle increases its velocity from 10km/h to 15km/h in 6s. Calculate its acceleration.

2. An object moves along a straight line with an acceleration of 2m/s^2. If its initial speed is 10m/s, what will be its speed after 5s?

3. A car travelled at a velocity of 54km/h is brought to rest by applying brakes in 3s. Calculate its retardation.

4. A bullet hits a wall with a velocity of 20m/s and penetrates up to a distance of 5cm. Find the deceleration of the bullet in the wall.

5. A ship moving with a constant acceleration of 36km/h^2 in a fixed direction speeds up from 12 to 18 km/h. Find the distance travelled by the ship in this period.

6. A train starts from a station and moves with a constant acceleration for 2 minutes. If it covers a distance of 400m within this period, calculate its acceleration.

7. A car accelerates uniformly from 18 km/h to 36 km/h in 5s. Calculate the acceleration and the distance covered by the car.

Assignment 8.6

MULTIPLE CHOICE QUESTIONS

1. For a moving body,

   a. displacement = distance
   b. displacement $\leq$ distance
   c. displacement $\neq$ distance.
   d. distance $\leq$ displacement.

2. A child runs along a circular path. On completing 4 rounds, distance travelled is-

   a. the circumference
   b. twice the circumference
   c. four times the circumference
   d. twice the radius

3. The rate of change of displacement is-

   a. retardation
   b. velocity
   c. acceleration
   d. speed

4. When the distance covered by a body is directly proportional to time, the body is said to have-

   a. zero velocity
   b. zero speed
   c. uniform acceleration
   d. uniform speed

5. The distance time graph of a body is a straight line inclined to the time axis. The body is in-

   a. uniform motion
   b. rest position
   c. uniform acceleration
   d. uniform retardation.

6. Which of the following is not a vector-

   a. displacement
   b. velocity
   c. acceleration
   d. speed

7. The average velocity of a body is equal to the mean of the initial and final velocity. The acceleration of the body is –

a. variable
b. 0
c. negative
d. uniform

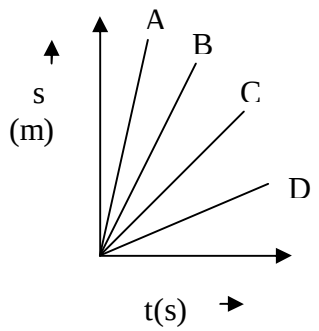
8. Which of the following is not a unit of acceleration?

a. km/s^2
b. cms^{-2}
c. km/s
d. m/s^2

9. When a car runs on a circular track with uniform speed, its velocity is said to be changing because

a. car has a uniform acceleration
b. direction of car varies continuously
c. car travels unequal distances in equal time intervals
d. car travels equal distances in equal time intervals

10. Four cars A, B, C and D are moving on a leveled road. Their distance- time graphs are shown in thE figure. Choose the correct statement.



a. A is faster than D
b. B is slowest
c. D is faster than C
d. C is slowest

Assignment 8.7

SHORT ANSWER QUESTIONS

1. A body continues to move with the constant velocity. Name the physical quantity that becomes zero?

2. Displacement of a body is 3m when distance travelled by it is 2m.Can it be true?

3. What is the nature of the distance time graph of an object that is in a state of rest ?Write your answer in words.

4. A body falls freely. Which physical quantity is constant?

5. What is the name given to speed in a specific direction?

6. What do the speedometer and odometer of a car measure?

7. Under which condition, the magnitude of average velocity equal to average speed?

8. What is the acceleration of a body moving with uniform velocity?

9. What type of motion is exhibited by a freely falling body?

10. What remains constant and what changes continuously in uniform circular motion?

11. Name the quantity which is measured by area occupied under velocity-time graph?

12. What does the slope of speed-time graph and distance-time graph indicate?

13. What can you say about the motion of a body if its speed-time graph is a straight line parallel to the time axis?

14. A train is moving out of a railway station. Is the platform at rest or in motion with respect to the train?

15. Two moving objects appear to be stationary to each other. When is this possible?

16. What is the other term for negative acceleration?

Assignment 8.8

Plot the graph for the following data:-

1.

Distance(m)	0	5	10	15	20	25	30
Time(s)	0	2	4	6	8	10	12

2.

Distance (m)	3	3	3	3	3	3	3
Time(s)	0	1	2	3	4	5	6

3.

Distance(m)	0	3	6	12	21	30	39	54
Time(s)	0	5	10	15	20	25	30	35

4.

Displacement (m)	0	3	6	9	12	12	12	12
Time(s)	0	5	10	15	20	25	30	35

5.

Speed(m/s)	12	10	8	6	4	2	0
Time(s)	0	3	6	9	12	15	18

6.

Speed(m/s)	0	5	10	15	20	25	30
Time(s)	0	2	4	6	8	10	12

7.

Velocity(m/s)	0	2	4	6	8	10	12
Time(s)	0	1	2	3	4	5	6

8.

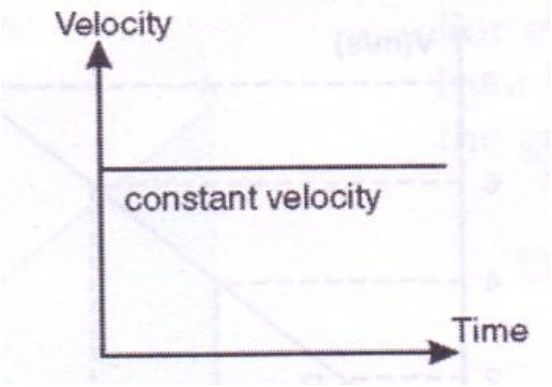
Velocity(m/s)	0	2	4	6	8	6	4	2	0
Time(s)	0	3	6	9	12	15	18	21	24

9.

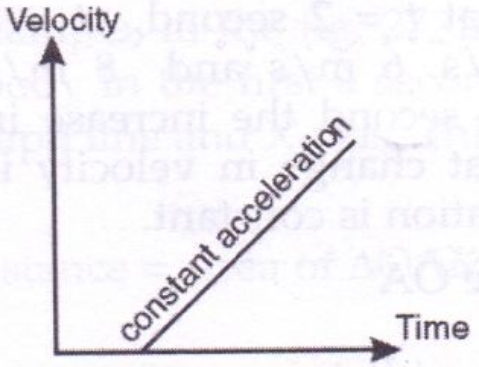
Velocity(m/s)	0	2	6	12	22	36	56	80
Time(s)	0	5	10	15	20	25	30	35

ASSIGNMENT 8.9

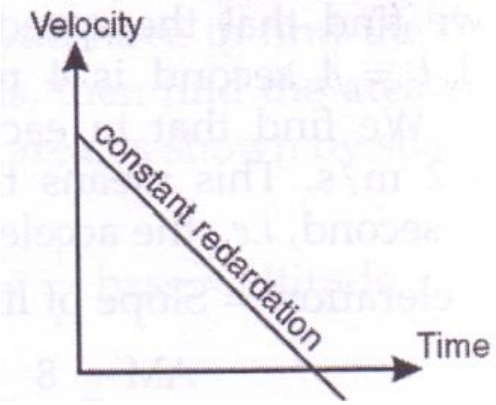
What is the nature of the graph in the following figures?



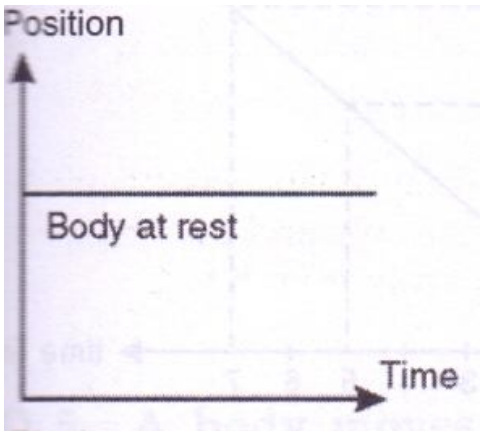
_____



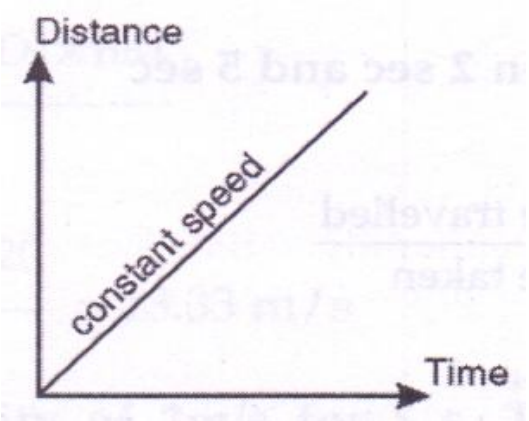
_____

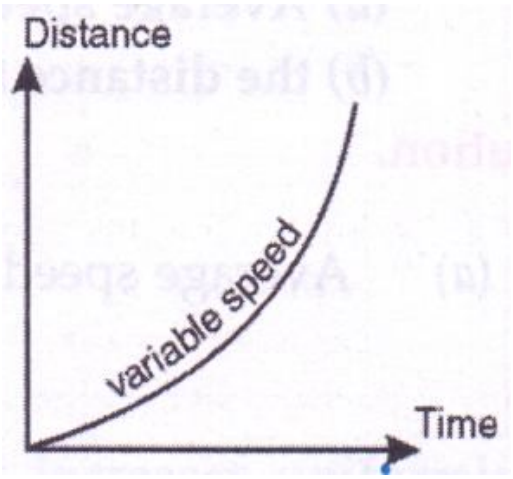


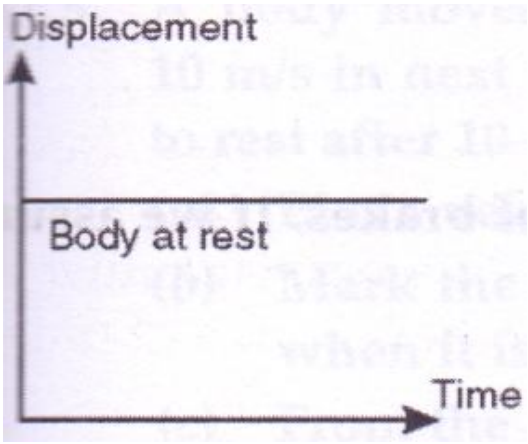
_____

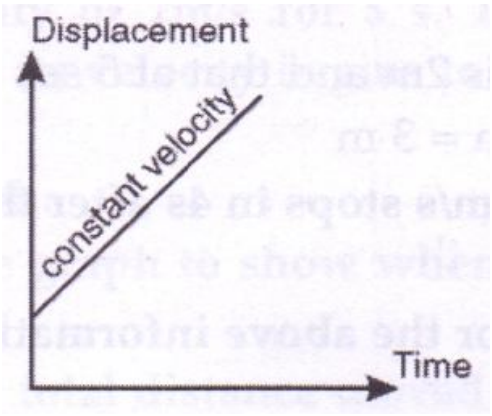


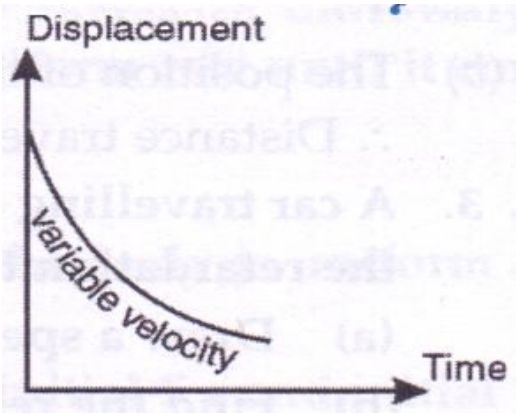
_____

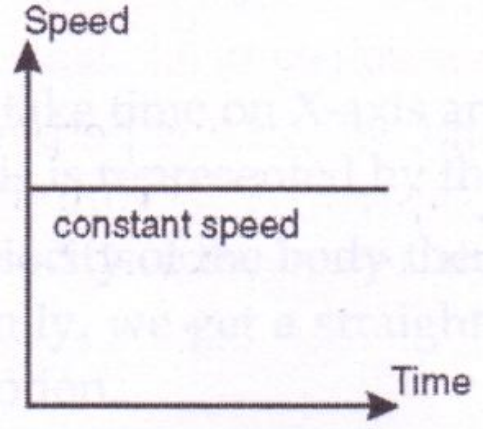


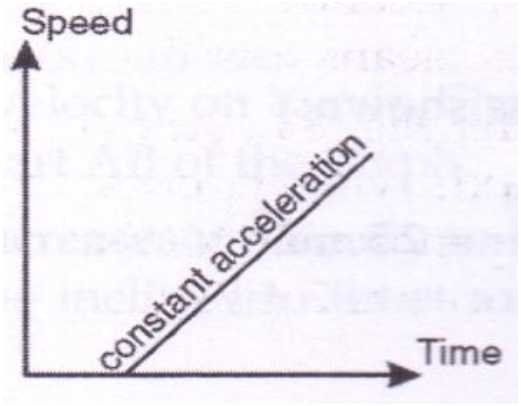


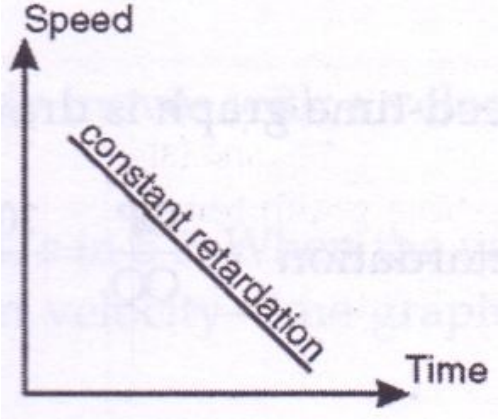

Displacement
Body at rest
Time


Displacement
constant velocity
Time


Displacement
variable velocity
Time

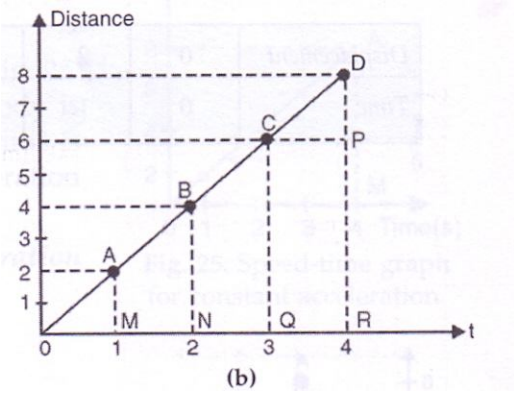

Speed
constant speed
Time


Speed
constant acceleration
Time

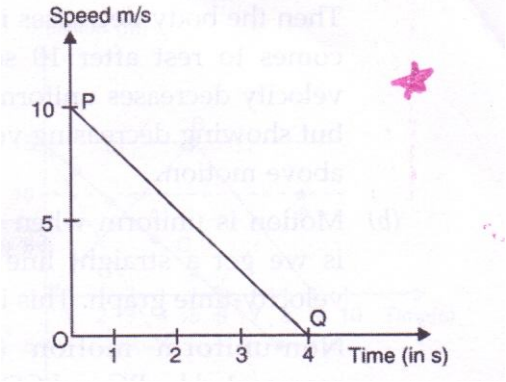

Speed
constant retardation
Time

ASSIGNMENT 8.10

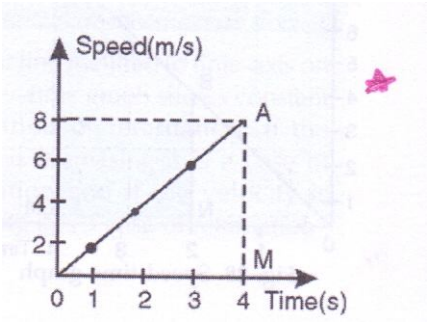
1. Calculate speed from the given distance-time graph.



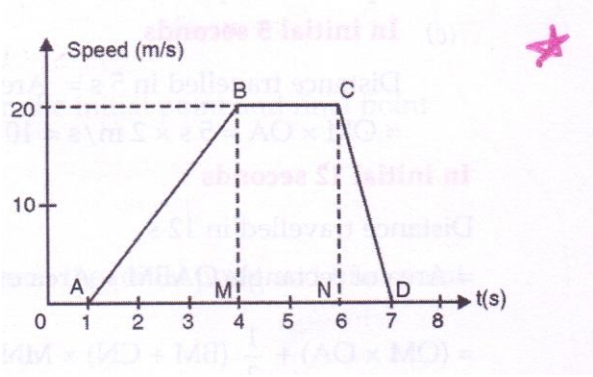
2. Calculate retardation between 0-4s from the given speed-time graph.

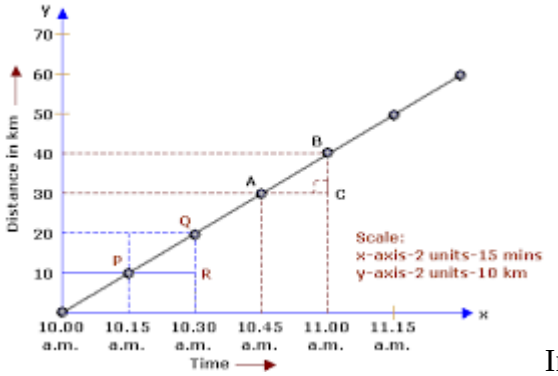


3. Calculate the acceleration and distance travelled between 0-4s from the given speed-time graph.

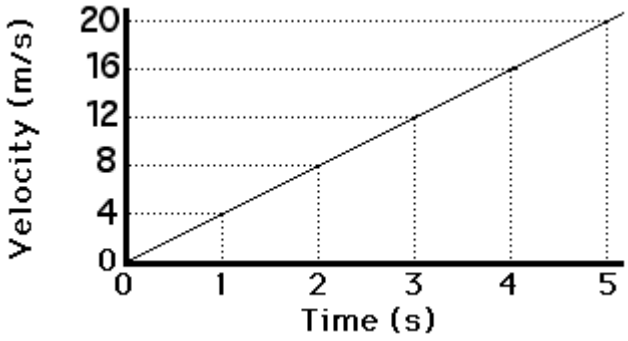


4. Calculate the acceleration during AB and the displacement between1s-6s from the given velocity-time graph.





5. In the given figure, find the speed between 10.30am and 11.00am.



6. In the given velocity-time graph, interprete the nature of the graph and calculate the acceleration and displacement between time interval 2 to 4s.

Assignment 8.11

1. What do the slopes of the following graphs give?

(a) distance-time graph - _____ (b) displacement-time graph - _____

(c) speed-time graph - _____ (d) velocity-time graph - _____

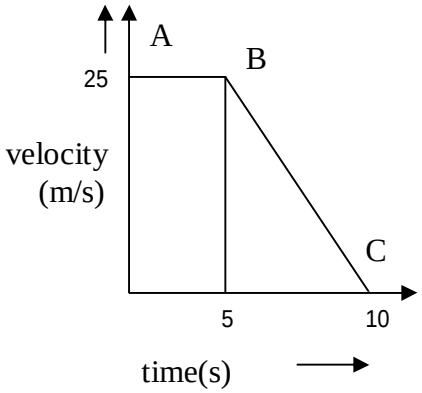
2. Name the physical quantity, the slope of whose graph against time gives

(a) speed - _____

(b) acceleration – _____

(c) velocity - _____

3.



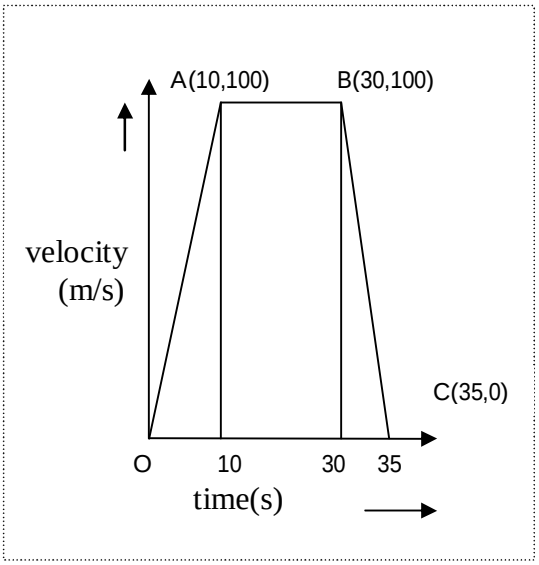
(a) What is the nature of graph in AB and BC?

(b) Calculate the acceleration and displacement between 5-10s.

4. A passenger lift starts from rest, accelerates uniformly and attains a speed of 4.6m/s in 2s. This speed is maintained for the next 6s. Then the lift undergoes uniform deceleration and stops in the next 2s. Draw the velocity-time graph of the lift and calculate the total distance covered by the lift in 10s.

ASSIGNMENT 8.12

TEST YOUR UNDERSTANDING [PRACTICE]



Observe the graph which shows how the speed of a marble changes when it rolls down an inclined plane, travels along a horizontal surface and then up an inclined plane till it stops and answer the following questions:-

1. What is the maximum velocity attained by the marble?

2. What is the time interval during which the marble maintains the maximum velocity?

3. Which part of the graph represents acceleration?

4. Which part of the graph represents deceleration?

5. Which part of the graph represents constant velocity?

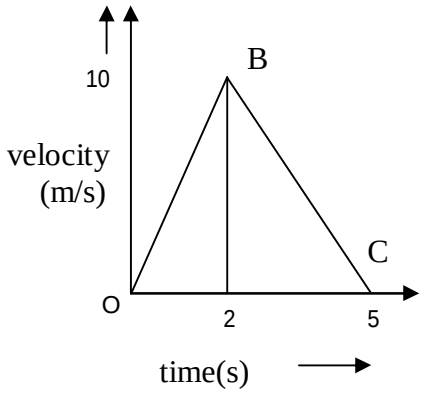
6. How long does the retardation last?

7. What is the time interval when the marble had zero acceleration?

ASSIGNMENT 8.12

PRACTICE QUESTIONS

1.



i. Interprete the nature of the graph.

ii. Which parts of the graph represents uniform acceleration and uniform retardation?

iii. Calculate acceleration and retardation.

iv. Calculate the total distance travelled.

2. On a highway with speed limit 80km/h, a car was stopped by applying brakes with a retardation of $5m/s^2$ in 5 seconds. What is the initial velocity of the car. Was it overspeeding?

3. A cycle travelling with a velocity of 20km/h, accelerates at the rate of $0.10m/s^2$. After what time will it achieve a velocity of 38km/h?

4. A truck moves with a velocity of 36km/h. How much distance will it cover in 1 minute if it moves with a uniform acceleration of $1m/s^2$?

5. A car starts and attains a velocity of 60m/s in 30s. If the acceleration is uniform, what is the distance travelled by the car to achieve this velocity?

6. A car travelleing with a velocity of 10m/s stops on application of brakes. It produces a uniform retardation of $1.25m/s^2$. Calculate the distance travelled by the car before it comes to rest. Also, find the time taken by the car to stop.

7. How much distance will a vehicle moving with uniform acceleration of $4 m/s^2$ cover in 5 seconds if the initial velocity of the vehicle is $5 m/s$.

8. Define acceleration. Derive its SI unit. Differentiate between uniform and non-uniform acceleration. Draw velocity-time graph to show both types of accelerations.

HIGH ORDER THINKING SKILLS

1. On a foggy day, two drivers spot each other when they are 80 m apart. They are travelling at 72 km/h and 60 km/h respectively. Both of them applied brakes and their cars retarded at the rate of $5 m/s^2$. Will they be able to avert collision or not?

2. Why is speed in general, greater than the magnitude of velocity?

3. Even when rain is falling vertically downwards, the front screen of a moving car gets wet whereas the back screen remains dry comparatively. Explain.

4. A ball hits a wall with a velocity of 30 m/s and rebounces with the same velocity. What is the change in its velocity?

NOTES

FACTOPAEDIA

- **The longest recorded flight of a chicken was 13 seconds**
- **The longest street in the world is Yonge street in Toronto Canada measuring 1,896 km (1,178 miles)**
- **The Great Wall of China is approximately 6,430 Km long (3,995 miles)**
- **If your DNA was stretched out it would reach to the moon 6,000 times**
- **The human body contains 96,000km(59,650miles) of blood vessels**
- **The average person walks the equivalent of twice around the world in a lifetime**
- **Sun light can penetrate clean ocean water up to a depth of 73m (240 feet)**
- **Your tongue is the fastest healing part of your body**
- **The first train reached a top speed of only 8 kmh (5 mph)**
- **A car travelling at 80kph (50mph) uses half its fuel to overcome wind resistance**
- **Squirrels can climb trees faster than they can run on the ground**
- **The greyhound is the fastest dog and can reach speeds of up to 72kph (45mph)**
- **The fastest fish in the sea is the swordfish and can reach up to speeds of 108kph (68mph, 59knots)**
- **Flies can react to an object it sees and change direction in less than 30 milliseconds**
- **A woodpecker can peck 20 times a second**
- **Fingernails grow faster than toenails**
- **Tachophobia is the fear of speed**

FORCE AND LAWS OFMOTION

In 1642, the year that Galileo Galilei died, Isaac Newton was born prematurely on Christmas Day.

Newton was born into a farming family. When he was 17, his mother insisted that he returned from school to run the family farm! Thankfully, Newton was a bad farmer and not long afterwards, his uncle successfully persuaded his mother to let him attend Trinity College in Cambridge instead.

- Newton's discoveries about light and movement of planets were used to make the first flights to the moon possible.
- Newton at only age 26 became a professor of math.
- Newton believed God was invisible but influenced every part of people's lives.
- Newton was an Arian, or a follower of a secret religion that didn't believe in the Holy Trinity.
- Newton practiced Alchemy. Alchemy is an ancient practice banned in England in 1404.
- Newton was elected as a member of parliament. His membership lasted only a year.
- Newton earned the title of Warden of the Royal Mint.
- Newton oversaw the recoinage of the whole country.
- Newton was knighted because of his political activities.
- Isaac was named after his father who died three months before Isaac was born.
- Isaac was born early. He was so small he could have put him in a quart jug.

- Isaac's father could hardly write his name.
- Isaac was one of the worst in his class until a bully at school kicked him. Isaac challenged him to a fight even though he was smaller. He won. That wasn't enough for him, he decided to be better than the bully at school as well.
- Isaac liked to draw, his room was even coloured on the ceilings and walls.

CHAPTER – 9

FORCE AND NEWTON'S LAWS OF MOTION

Assignment 9.1

1. (a) **Force** [**F**]– It is a _____ or _____ which changes or tends to change the state of rest or of uniform motion, direction of motion or the shape and size of an object.

   (b) It is a _____ quantity.

   (c) The SI unit of force is _____ (**N**).

2. **Balanced forces** – When a number of forces acting on a body do not cause any change in its state of _____ or of _____ _____ in a straight line, then the forces are said to be balanced forces.

   i. They cannot set a stationary body into motion.

   ii. They cannot change the speed or velocity of a moving body.

   iii. They may change the shape and size of a soft object

   iv. The resultant force acting on the body is zero.

3. **Unbalanced forces** – When the resultant of all the forces acting on a body is _____ _____, the forces are called unbalanced forces.

   i. They can set a stationary body into motion.

   ii. They can bring a moving body to rest.

   iii. They can change the direction of motion.

4. **Newton's first law of motion** [Law of _____] – It states that "An object continues to remain in its position of rest or of uniform motion in a straight line unless an external unbalanced force acts on it".

5. **Inertia** – It is the tendency of undisturbed objects to stay _____ or to keep moving with _____ velocity.

OR

It is the property of an object to resist any change in its state of rest or of uniform motion.

6. **Mass is the measure of inertia**. Or in other words Inertia is _____ to mass of an object. The larger is the mass, larger is the inertia and vice-versa.

7. **Types of inertia** –

i. **Inertia of rest** – It is the tendency of an object to oppose any change in its state of _____.

Eg 1. When a bus starts stars suddenly, passengers tend to fall backward.
2. When a carpet is shaken, dust particles get separated from the carpet.

ii. **Inertia of motion** – It is the tendency of an object to oppose any change in its state of _____.

Eg 1. When a moving bus stops suddenly, passengers tend to fall forward.
2. An athlete runs a certain distance beyond the finishing line before stopping.

iii. **Inertia of direction** – It is the tendency of an object to oppose any change in its _____ of motion.

Eg 1. When a moving bus takes a sudden turn, passengers tend to fall sideways.
2. When a vehicle moves on wet road, the water and dust particles fly off tangentially to the moving wheels.

Explain giving scientific reason :-

1. When a bus starts suddenly, a standing passenger tends to fall backwards.

2. A man jumping out of a moving bus runs in the direction of bus for some time.
3. A luggage is usually tied with a rope on the roof of buses.
4. When the striker hits the lowest coin of the pile of carom coins, the pile remains intact although that coin moves from its place.

ASSIGNMENT 9.2

1. **Momentum** [p] – The _____ possessed by a moving body is known as the momentum of the body.

    i. It is equal to the product of mass [m] and velocity[v] of the body.

    ii. Hence, $p = m v$

    iii. It is a _____ quantity.

    iv. The SI unit of momentum is kilogram metre per second [_____]

2. **Newton's second law of motion** – It states that " the rate of change of momentum of an object is directly proportional to the applied unbalanced force in the direction of force".

Derivation of mathematical form of Newton's second law

We consider an object of mass m moving with initial velocity u. A force F is applied on the object for time t so that the velocity of the object after time t is v [final velocity].

Diagram

Initial momentum of the object, p_i =

Final momentum of the object,p_f =

Change in momentum =

Rate of change in momentum =

By Newton's second law, Rate of change in momentum _____ Force applied

Hence, force acting on an object is directly proportional to its mass and its acceleration.

Explain giving scientific reason :-

1. A karate player breaks a pile of tiles in a single blow.
2. A cricket player lowers his hands while catching a ball.
3. After taking a high jump, the athlete lands on a cushioned surface.

NUMERICALS

1. Find the acceleration produced by a force of 20 N acting on a body of mass 5kg.

2. Find the magnitude of net force on a 20kg mass if it accelerates uniformly from 2.5m/s to 5.8 m/s in 3s.

3. A body A of mass 1kg has acceleration $2m/s^2$. Another body B of mass 0.5kg has acceleration $5m/s^2$. On which body greater force acts.

4. Calculate the momentum of a ball of mass of mass 450g moving with a velocity of 120 km/h.

5. Which would require a greater force – accelerating a 10g mass at $5m/s^2$ or a 20g mass at $2m/s^2$?
17.

6. A drum weighing 20kg rolls down at a velocity of 2m/s. After 30s, its velocity becomes 17m/s. Calculate

i. its initial momentum
ii. its final momentum
iii. change in momentum
iv. rate of change of momentum

3. **Newton's third law of motion** – It states that "To every action there is an equal and opposite reaction".

Eg. When a player kicks a football, the football moves forward and the foot of the player moves backward.

Action – Force with which the football is kicked by the player

Effect of action force – football moves forward

Action force acts on the football.

Reaction – Force exerted by the football on the foot of the player.

Effect of reaction force – foot of the player moves backward.

Reaction force acts on the foot of the player.

Hence we see that action and reaction forces are equal in magnitude and opposite in direction. Yet they are not balanced forces as they act on two different objects.

Explain giving scientific reason :-

1. We are able to swim.
2. When an inflated balloon is untied, the balloon rises up.
3. Before a person jumps out of a boat in the shore, the boat is tied with a hook on the shore.
4. Glass or bone china crockery is wrapped in newspaper or straw during transportation.
5. A fireman struggles to hold a hose pipe.

ASSIGNMENT 9.3

1. **Law of conservation of momentum** – According to the law of conservation of momentum, the total momentum of a system [or an object] remains constant if no net external unbalanced force acts on the system.

Proof:

2. Recoil velocity of a gun

Let the mass and velocity [after firing] of the bullet be m_b and v_b

And the mass and velocity [after firing] of the gun be m_g and v_g respectively.

Total momentum of gun and bullet before firing =

Total momentum of the gun and bullet after firing =

According to law of conservation of momentum,

Explain giving scientific reason :-

1. Propulsion of a rocket as it it is launched.
2. Recoiling of a gun when a bullet is fired.

NUMERICALS

1. A bullet of mass 10g is fired at a speed of 400m/s. from a gun of mass 4kg. What is the recoil velocity of the gun?
2. A shell of mass 100kg is fired with a velocity of 300m/s. If the cannon has a mass 1000kg, what is the velocity of recoil of cannon?
3. Two small glass spheres of masses 10g and 20g are moving in a straight line in the same direction with velocities of 3m/s and 2m/s respectively. They collide with each other and after collision, glass sphere of mass 10g moves with a velocity of 2.5m/s. Find the velocity of the second ball after collision.
4. A bullet of mass 5g travelling with a velocity of 18km/h penetrates a wooden block and comes to rest in 0.01s. Find

   (a) the distance it penetrates in the wooden block
   (b) the retarding force of the block

ASSIGNMENT 9.4 [PRACTICE]

1. When a branch of a tree is shaken, dried leaves and ripe fruits leaves from the branches fall down.

2. A standing passenger in a bus falls forward when sudden brakes are applied.

3. When a bus takes a sharp turn, passengers tend to fall sideways / in the outward direction.

4. A boxer moves his head backward to minimize the effect of the coming punch.

5. A passenger jumping out of a fast moving bus runs forward after he steps on ground.

6. A rubber ball bounces off after hitting a concrete floor.

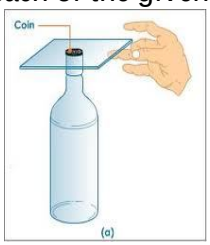
7. When a dog chases a hare, the hare takes a zigzag path.

8. A book can be easily pulled out from the bottom of a pile without disturbing the pile.

9. A stone tied to a string if whirled around, the stone flies off tangentially if the string breaks.

Assignment 9.5

For each of the given identify the law / theory applicable for explanation:-

1. 

2. 

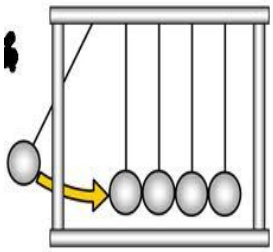
_____ _____

3. 

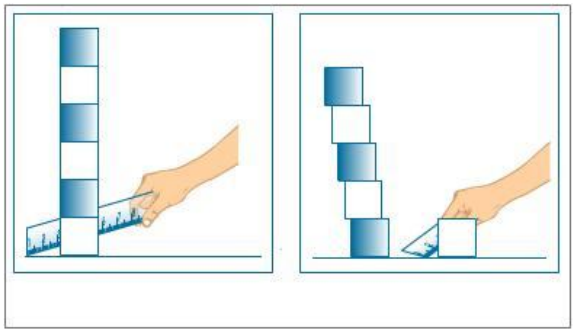
4. 

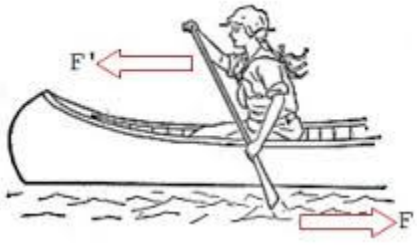
_____ _____

5. 

6. 

_____ _____

7. 

8. 

_____ _____

Assignment 9.6

MULTIPLE CHOICE QUESTIONS

1. If A and B are two objects with masses 6kg and 34kg respectively

    i. A has more inertia than B
    ii. B has more inertia than A
    iii. A and B have the same inertia
    iv. None have inertia

2. Unbalanced forces act on a body. The body

    i. must remain at rest
    ii. must be accelerated / decelerated
    iii. must move with uniform velocity
    iv. moves in a zigzag manner

3. Balanced forces act on a body. The body

    i. must remain at rest
    ii. must be accelerated
    iii. must move with uniform velocity
    iv. moves in a zigzag manner

4. Force measures rate of change of

    i. mass
    ii. momentum
    iii. velocity
    iv. acceleration

5. Acceleration measures rate of change of

    i. mass
    ii. momentum
    iii. velocity
    iv. acceleration

6. Inertia of an object tends to cause the object to

    i. resist any change in its state of motion
    ii. decrease its speed
    iii. increase its speed
    iv. decelerate due to friction

7. Relation between force, mass and acceleration is given by

i. Newton's first law of motion
ii. Newton's second law of motion
iii. Newton's third law of motion
iv. Newton's universal law of gravitation

8. Four iron balls A, B, C and D have mass 1kg, 3kg, 2kg and 5kg respectively. They move with same velocity. Which of them will have largest momentum?

i. A
ii. B
iii. C
iv. D

9. Same force acts on four objects P,Q,R and S of masses 4kg, 3kg, 2kg and 1kg respectively. Which object will have least acceleration?

i. P
ii. Q
iii. R
iv. S

10. A father and the son have masses 60kg and 30kg respectively. The ratio of inertia of the father to inertia of the son is

i. 1:1
ii. 1:2
iii. 2:1
iv. 1:3

11. The earth attracts a stone towards itself with a force of 10N. The force with which the stone attracts the earth is

i. 20N
ii. Infinite
iii. Zero
iv. 10N

12. Statement 1 – An object can move with constant velocity if no net force acts on it.
Statement 2 – No net force is needed to move an object with constant velocity.

i. Only statement 1 is correct
ii. Only statement 2 is correct
iii. Statement 1 is correct and statement 2 explains it.
iv. Statement 1 is correct but statement 2 does not explain it.

Assignment 9.7

SHORT ANSWER QUESTIONS

1. Can balanced forces stop a moving body? Can it change the shape and size of a body?

2. Name the physical quantity whose SI unit is $kgms^{-1}$.

3. A ball is thrown vertically upwards. What is its momentum at the highest point?

4. What is the relationship between acceleration and mass of a body?

5. A force acting on a body does not produce motion in it but causes a change in its shape. What kind of force is it?

6. Which has more inertia – a cricket ball or a sponge ball of the same size?

7. A ball is moving over a horizontal smooth surface with a constant velocity. Name the type of force acting on the ball.

8. On what factor does inertia of an object depend?

9. A fast moving truck loses momentum of 2 kgm/s after colliding with a stationary car. Will the car lose or gain momentum? What is the magnitude of momentum of car after the truck comes to rest?

10. A ball is suspended by a cord from the ceiling of a car. What will be the effect on the position of the ball when

(a) the car is moving with constant velocity.

(b) The car is in accelerated motion.

(c) The car turns towards right.

(d) The brakes of the car are applied

11. On what principle , the propulsion of rocket works?

12. A force of 20N towards east is balanced by an unknown force . What will be the magnitude and direction of the unknown force?

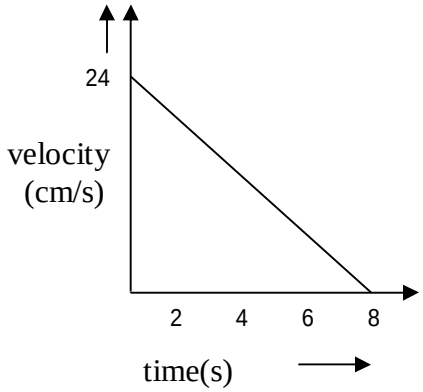
Assignment 9.8

NUMERICALS

1. Two balls identical in shape and size are acted upon by equal forces which cause them to move on a horizontal surface. The acceleration of the second ball is thrice of that of the first. What is the ratio of the mass of the second to the first.

2. A motorcycle of mass 200kg moves with uniform velocity. Brakes are applied so that the motorcycle undergoes retardation of $1.5 m/s^2$. What is the force of friction between the tyres of the motorcycle and the road?

3.



The velocity –time graph of a coin rolling on a table is shown. If the coin weighs 10g, then how much force does the table exert on the coin to bring it to rest?

4. Two blocks of different metals identical in shape and size are acted upon by equal forces. The acceleration of the second block is 5 times of that of the first. What is the ratio of the mass of the first to the second?

Assignment 9.9

PRACTICE QUESTIONS

1. What is the SI and CGS unit of momentum?

2. What is the momentum of a boy of mass 40kg when he walks with a uniform velocity of 2m/s?

3. How is Newton's second law different from the first law?

4. A truck of mass 2000 kg moving with a velocity of 36km/h hits against a hill and comes to rest in 2s. What is the force exerted by the hill in the truck?

5. A gun of mass 5kg fires a 50g bullet with a velocity of 200m/s. What is the recoil velocity of the gun?

6. A force of 400N produced an acceleration of $5m/s^2$ on a body. Calculate the mass of the body.

7. State the action and reaction in the following cases:-
   i. A book lying on the table
   ii. Hammering a nail into the wall
   iii. A man walking on floor
   iv. A ball hitting the ground

8. A 1500kg car is moving with a speed of 50m/s. When brakes are applied, it stops with uniform retardation at a distance of 150m. Calculate the force applied by the brakes of the car.

9. Derive the SI unit of force and define it.

10. Why does a rider fall backwards when his horse starts running suddenly?

11. Derive the mathematical form of force from Newton's second law.

12. A constant retarding force of 100N is applied to a body of mass 60kgmoving initially with a speed of 18km/h. How long does the body take to come to halt?

13. The CGS unit of force is 'dyne'. Find the relation between the SI and CGS unit of force.

14. A mechanic strikes a nail with a hammer of mass 500g moving with velocity of 20m/s. The hammer comes to rest in 0.02s after striking the nail. Calculate the force exerted by the nail on the hammer.

15. How much force acts on a body when momentum is constant?

16. Why does a boatman pushes the bank of the river with a pole to take his boat into the river?

17. A gun recoils backward with small speed while the bullet moves forward with a high speed. Why?

18. Action and reaction are equal and opposite even then they do not cancel each other. Why?

TIME TO THINK [H.O.T.S.]

1. A bullet fired from a gun is more dangerous than an air molecule hitting a person, though both bullet and air molecule are moving with same velocity. Why?

2. A ball of certain mass is thrown vertically upward . Its speed decreases continuously till it becomes zero. Thereafter, the ball begins to fall downward and attains a speed v before striking the ground. It implies that the magnitude of initial and final momentums of the ball are same. Yet, it is not an example of conservation of momentum. Explain, why?

3. If a body is not at rest, the net external force acting on it cannot be zero. Is it true or false?

4. If a body is thrown up in a moving train, it comes back to the person's hand. Why?

5. A bird is sitting on the floor of a wire cage and the cage is in the hand of a boy. The bird starts flying in the cage. Will the boy experience any change in the weight of the cage?

6. A soda water bottle is falling freely. Will the bubbles of the gas rise in the water of the bottle?

NOTES

FACTOPAEDIA

- **The wheelbarrow is invented in China**
- **The electric toothbrush was invented in 1939**
- **Isaac Newton invented the cat door**
- **The doorbell was invented in 1831**
- **The revolving door was invented in 1888**
- **Leonardo Da Vinci invented scissors**
- **Bulletproof vests, fire escapes, windshield wipers, and laser printers were all all invented by women**
- **The elevator was invented in 1850**
- **The corkscrew was invented in 1890**
- **The typewriter was invented in 1829**
- **The wristwatch was invented in 1904**

NOTES

GRAVITATION
PART I

Assignment 10.1

1. Newton's law of gravitation [Universal law of gravitation]

"Every object in the universe attracts every other object with a force which is _____ to the product of their masses and _____ to the square of the distance between them. The direction of force is along the line joining the two objects."

If we consider two objects of masses m_1 and m_2 separated by a distance r, then the force of gravitation F between them is given by

F

F

F

$F = G \frac{m_1 m_2}{r^2}$ where G = universal gravitational constant

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

Note : Gravitational force - It is action-at-a-distance force. i.e. the gravitational force always exists between two objects irrespective of the medium which separates them.

So, SI unit of G = $\frac{\text{SI unit of F x SI unit of } r^2}{\text{SI unit of } m_1m_2}$

= $\frac{\text{newton x metre}^2}{\text{kilogram}^2}$

= $\frac{\text{N m}^2}{\text{kg}^2}$

Definition of G

If m_1 = 1kg , m_2 = 1kg and r = 1m

Then F = G

Universal gravitational constant G is equal to the gravitational force which acts between two bodies of _____ separated by a distance of _____.

G = 6.67×10^{-11} Nm^2kg^{-2}

Note : The value of G was measured by Sir Henry Cavendish in 1798.

2. Importance of universal law of gravitation

i. All planets revolve around the sun due to gravitational force between planets and the sun.

ii. Tides in oceans are formed due to gravitational force between the moon and water in oceans.

iii. Existence of moon around any planet depends on the gravitational force between the planet and its satellite. [gravitational force of Mercury and Venus are too small and so they do not have planets]

iv. Aritificial satellites revolve around the earth .

v. Presence of the atmosphere around the earth.

vi. We are able to stay on the earth's surface.

vii. Rainfall and snowfall are possible.

viii. Water in oceans and rivers are held onto surface of earth.

3. Why is Newton's law of gravitation known as universal law of gravitation?

Newton's law of gravitation holds good

i. For all bodies of any size and shape

ii. At all places in the universe
iii. At all times

3. Acceleration due to gravity –

1. It is the acceleration produced in a freely falling body due to the gravitational force of the earth.

2. It is denoted by _____.

3. The SI unit of 'g' is _____.

4. Estimating value of 'g'

If Me is mass of the earth, Re is radius of the earth and m is the mass of the object near the surface of the earth falling freely towards the earth,

Then by Newton's law of gravitation

$$F = G \frac{mM_e}{R_e^2} \text{ ---------- (1)}$$

Also by Newton's second law of motion, $F = mg$ ---------- (2)

From (1) and (2), $mg =$

$g =$ where, $G = = 6.67 \times 10^{-11} Nm^2/kg^2$; $M_e = 6 \times 10^{24} kg$; $R_e = 6.4 \times 10^6 m$

$g =$

$g = \quad m/s^2$

Interpretation – The acceleration of an object falling freely towards earth is 9.8 m/s^2. This means that when an object falls freely towards earth, its velocity increases by 9.8 m/s every one second during its motion.

5. Difference between acceleration due to gravity (g) and universal gravitational constant (G)

Acceleration due to gravity(g)	Universal gravitational constant(G)
1. It is the acceleration produced in a freely falling object under the action of the earth's gravitational force.	1. It is the gravitational force of attraction between two objects of unit masses separated by a unit distance.
2. The value of g is different at different places on the earth as well as other planets.	2. The value of G remains same everywhere in the universe.

6. How does g vary as one goes from equator to the poles?

7. How does g vary with altitude above the surface of the earth?

8. Differences between mass and weight

Mass	**Weight**
It is the amount of matter contained in an object	Weight of an object is the force of attraction exerted by the earth on an object.
Mass of an object remains constant everywhere and can never be zero.	The weight of an object changes on different planets and also on the earth with the latitude, altitude and the depth and becomes zero at the centre of the earth.
Mass is a scalar quantity	Weight is a vector quantity
Mass is measured using a beam balance and its SI unit is kg.	It is measured using a spring balance and its SI unit is Newton (N).

- **Due to gravitational effects, you weigh slightly less when the moon is directly overhead.**

Assignment 10.2 [HOME WORK]

$G = 6.67 \times 10^{-11}\ Nm^2 / kg^2$

Mass of earth, $M_e = 6 \times 10^{24}$ kg

Mass of the sun, $M_{sun} = 2 \times 10^{30}$ kg

Radius of earth, $R_e = 6.4 \times 10^{6}$ m

Mass of moon, $M_{moon} = 7.4 \times 10^{22}$kg

Distance between moon and earth, $R_{moon\ \&\ earth} = 3.84 \times 10^{8}$m

Distance between sun and earth , $R_{sun\&earth} = 1.5 \times 10^{11}$m

Calculate

1. Gravitational force between sun and earth.

2. Gravitational force between moon and the earth.

3. Gravitational force between a body of mass 1kg and the earth .

4. Gravitational force between a man of mass 60 kg and the earth

5. Gravitational force between two objects of mass 1 kg each separated by 1 m distance.

Comparison between the forces

S No	Objects considered	Force acting between 2 objects
1.	Sun and earth	
2.	Moon and earth	
3.	Object of mass 1 kg and earth	
4.	Object of mass 60 kg and earth	
5.	Both objects of masses 1 kg	

- **Because of differences in gravity, a 100kg (220 pound) person would only weigh 38kg (84 pounds) on Mars.**

Assignment 10.3

Short answer questions

1. Where is the acceleration due to gravity maximum – on or above the earth?

2. You buy a bag of sugar of weight W at a place on the equator. You take it to Antarctica. Would it weigh more or less or same? Why?

3. What is the acceleration of (a) a free falling body (b) a body thrown vertically upwards?

4. Name the force responsible for the tides in the sea.

5. Which of these is a scalar quantity – mass or weight?

6. A body has mass m kg.

   (a) What is its weight on the earth?

   (b) What is its mass on moon?

   (c) What is its weight on moon?

Assignment 10.4

Multiple Choice Questions [CLASS ASSIGNMENT]

1. When a stone falls from the roof of a house,

   (a) Only stone attracts the earth
   (b) Only earth attracts the stone
   (c) Both earth and stone attract each other
   (d) They do not attract each other

2. The ratio of the value of ‘g’ on the earth’s surface to that on the moon ‘s surface is

(a) 1 / 6
(b) 6
(c) $\sqrt{6}$
(d) 1 / $\sqrt{6}$

3. The force of gravitation between two bodies does not depend upon

(a) Their separation
(b) The product of their masses
(c) The sum of their masses
(d) The gravitational constant

4. If the distance between two objects is doubled, the gravitational force between them

(a) Remains the same
(b) Gets doubled
(c) Gets halved
(d) Becomes one fourth

5. Acceleration due to gravity

(a) has the same value everywhere in space
(b) has the same value everywhere on earth
(c) is greater on moon than on earth
(d) varies with the latitude of the earth

6. The weight of an object

(a) is the mass of the matter it contains
(b) refers to its inertia
(c) is same as the mass but expressed in different units
(d) is the force with which it is attracted to the earth

7. In free fall, when a heavy object and a light object are dropped simultaneously,

(a) The lighter object accelerates more
(b) The heavier object accelerates more
(c) Both move with same velocity
(d) Both undergo same acceleration

8. An object weighs 5 kg. Its weight and mass at the centre of earth are

(a) 5 kg and 5 kg
(b) 0 and 5 kg
(c) 5 kg and 0
(d) Both zero

9. If masses of two objects are halved without changing the distance, the gravitational force, F between two objects would become

(a) F / 4
(b) F / 2
(c) F
(d) 2F

10. The force of attraction between two unit point masses separated by a unit distance is called
(a) Gravitational potential
(b) Acceleration due to gravity
(c) Gravitational field
(d) Universal gravitational constant

- **Water can work against gravity, moving up narrow tubes in a process called capillary action**

Assignment 10.5 [HOME ASSIGNMENT]

Equations of motion for objects under free fall

a → g, acceleration due to gravity

s → h, vertical distance covered

$$v=u+gt$$

$$h=ut+1/2gt^2$$

$$v^2=u^2+2gh$$

1. A boy drops a coin from a height of 1.6m. With what speed will the coin strike the ground ?

2. An object is released from a height. Find the distance travelled by the object after (i) 1s (ii) 2s.

3. Find the speed of an object 2s after its release from a certain height.

4. An object is thrown up with a speed of 19.6m/s. What is its speed after 2s ?

5. An object is thrown up with a speed of 40m/s. Find the time for which it goes in the upward direction and the maximum height attained. [Take g = 10m/s^2]

Assignment 10.6

Practice questions

1. Calculate the acceleration due to gravity on a planet whose mass is double and radius is three times that of the earth.[take $g = 9.8 m/s^2$]

2. Compare the gravitational forces exerted by the sun and the moon on the earth and find their ratio.

3. A body has a mass m kg on the earth.

   (a) What will be its weight on earth?

   (b) What will be its mass on the moon?

   (c) What will be its weight on the moon?

4. Two bodies of masses m and M are dropped from two different heights x and y. Calculate the ratio of times taken by two bodies to travel through the respective distances.

5. A ball is dropped from a cliff 78.4 m high. One second later, another ball was thrown from the same place with some velocity. Both the balls reach the ground at the same time. Find the velocity with which the second ball was thrown.

6. Estimate the force of gravitation between two friends of masses 60 kg and 50 kg sitting 1 m away from each other.

TIME TO THINK !! [H.O.T.S.]

1. We cannot even move a finger without disturbing all stars. Explain.

2. What is the ratio of the force of attraction between two bodies kept in air and tthe same two bodies kept in water ?

3. A clock fitted with a pendulum and another with a spring indicate correct time on earth. Which one will show correct time on moon ?

4. Moon travellers tie heavy weight at their backs before landing on the moon. Why ?

5. An artificial satellite revolves around the earth without using any fuel but an aeroplane requires fuel to fly. Why ?

NOTES

FACTOPAEDIA

- **Switzerland eats the most chocolate equating to 10 kilos per person per year**
- **The human body of a 70 kg person contains 0.2mg of gold**
- **Crocodiles swallow rocks to help them dive deeper**
- **The bones of a pigeon weigh less than its feathers**
- **Your brain weights 2% of your body weight though uses 20% of all oxygen you breathe and 15% of the body's blood supply**
- **8.5 million tons of water evaporates from the Dead Sea every day**
- **The Statue of Liberty weighs over 225 tons**
- **The average person sheds .7kg (1.5 pounds) of skin each year**
- **Due to gravitational effects you weigh is slightly less when the moon is directly overhead**

GRAVITATION PART II

Assignment 10.7

1. Thrust – The total force acting in _____ direction [perpendicular to] over a given surface area is called thrust.

2. Pressure - _____ acting per unit _____ of a surface is called pressure.

3. Pressure = Force / Area

4. SI unit of pressure =

5. Definition of SI unit of pressure – Pressure exerted on an object is _____ when a thrust of _____ acts on a surface area of _____.

REASONING QUESTIONS

(a) Cutting tools are sharp and pointed.

(b) School bags are provided with wide straps.

(c) Tractors have broad tyres.

NUMERICALS

1. The pressure exerted by the weight of a cubical block of side 3 cm on the surface is 5 Pa. Calculate the weight of the block.

2. A drawing pin is pushed against a wooden table with a force of 10 N. Calculate the pressure exerted by the pin at a point on the table if the area of the point is 0.01 mm^2.

3. A man weighs 600 N. The total area of his shoes is 200 cm^2. What is the pressure exerted by him on the ground in SI units?

4. A force of 12 N is uniformly distributed over an area of 120cm^2. Find the pressure in pascal.

5. A block of cuboidal wood is kept on a table top. The mass of the block is 5kg and its dimensions are 40cm x 20cm x 10cm. With which face kept on the table top will it exert minimum and maximum pressure? Calculate the minimum and maximum pressure.

ASSIGNMENT 10.8

1. Buoyant force / _____ - It is the upward force experienced by an object when it is _____ or _____ immersed in a fluid.

2. Buoyant force =

3. Density [ρ/D] –

4. SI unit of density =

5. CGS unit of density =

6. Archimedes' Principle –

7. Relative density –

8. Conditions of floatation –

(a) With respect to density of a substance

(i) If density of a substance is _____ than the density of water, it _____

(ii) If density of a substance is _____ than the density of water, it _____

(iii) If density of a substance is _____ than the density of water, it _____

(b) With respect to weight of a substance

(i) If weight of a substance is _____ than the weight of the displaced liquid, it _____

(ii) If weight of a substance is _____ than the weight of the displaced liquid, it _____

(iii) If weight of a substance is _____ than the weight of the displaced liquid, it _____

REASONING QUESTIONS

(a) It is easier to swim in sea water than in river water.

(b) A mug full of water appears lighter inside water.

(c) Base of the dams are thick and broad.

(d) A ship made of iron can float in water whereas a nail made of iron sinks.

PRACTICE QUESTIONS OF REASONING:-

(a) When a plastic block is released under water, it bounces back to the surface of water.

(b) War tanks can move on soft ground.

(c) Eskimos use sledges to travel on snow.

(d) Skiers do not sink in snow.

(e) Camels can easily walk in deserts.

Assignment 10.9

Multiple Choice Questions

1. A rectangular brick is placed on a table with different faces in contact. The block exerts
   (i) same thrust and same pressure
   (ii) same thrust and different pressure
   (iii) different thrust and different pressure
   (iv) different thrust and same pressure

2. If a solid copper ball of radius 1cm is placed in water, the upthrust acting on it will be
   (i) more than the weight of the sphere
   (ii) equal to the weight of the sphere
   (iii) less than the weight of the sphere
   (iv) none of these

3. The SI unit of pressure is
   (i) Newton
   (ii) newton metre
   (iii) newton per square metre
   (iv) newton per metre

4. The density of water is 1000 kg/m^3 and relative density of silver is 10.5. The density of silver is
   (i) 105 kg/m^3
   (ii) 1050 kg/m^3
   (iii) 10500 kg/m^3
   (iv) 10.5 kg/m^3

5. If the density of iron is 7900 kg/m^3, its relative density is
   (i) 7900
   (ii) 790
   (iii) 79
   (iv) 7.9

6. By doubling the mass of a solid object, its density becomes
   (i) twice
   (ii) thrice
   (iii) half
   (iv) remains same

7. On immersing a body fully in a liquid, the apparent loss in weight of the object is
   (i) more in denser liquid
   (ii) less in denser liquid
   (iii) more in less dense liquid
   (iv) independent of the density of the liquid

8. When an object is weighed in a liquid, the loss in its weight depends upon

   (i) volume of the object
   (ii) mass of the object
   (iii) shape of the object
   (iv) centre of gravity of the object

9. The upthrust acting on a body completely immersed in a liquid is equal to

   (i) weight of the liquid displaced
   (ii) mass of the liquid displaced
   (iii) volume of the liquid displaced
   (iv) volume of the solid immersed

10. A heavy cylinder of length l is slowly taken out of a dense liquid. The weight felt as it is taken out of the liquid

    (i) will remain the same
    (ii) will increase
    (iii) will decrease
    (iv) will increase till it attains the weight in air

The Dead Sea is so dense with salt, you can easily float on it without drowning

Assignment 10.10

Short answer questions

1. When a floating body is pressed down a little, which of the two will increase – weight or upthrust?

2. Which of the two will double the pressure – doubling area and force or making area half?

3. Name the force experienced by an object when immersed in a liquid. What is the direction of this force?

4. What are the factors on which density of a solid depend?

5. What are the factors on which buoyant force acting on an object depend?

6. What are the factors on which weight of an object depend?

7. What are the factors on which pressure exerted by a liquid depend?

8. An object weighs 400 N in air. Will it weigh more or less or equal to 400 N in water?

9. An object weighs 400 N in air and 200 N in water. What is the weight of the water displaced by the object?

10. Where will a body weigh maximum – in air, in vacuum or in water?

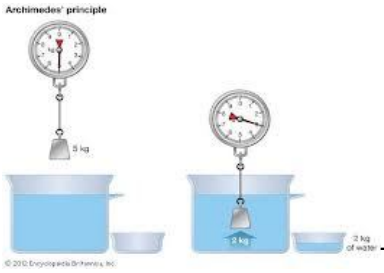
11. What is the term for 'thrust per unit area'?

12. Name the force which makes heavy objects appear light when immersed in a liquid?

- The world's densest wood, the Black Ironwood (Olea laurifolia), does not float on water and therefore sinks.

- **You can convert graphite into diamond by applying a temperature of 3000 Celsius and pressure of 100,000 atm.**

Assignment 10.11

1. 

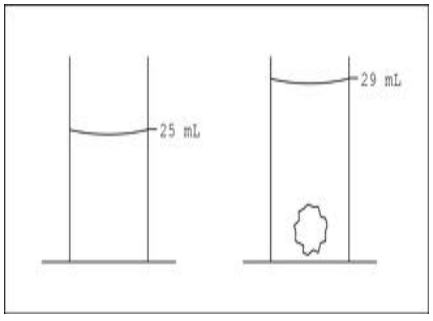
The reading in the spring in the first figure is 5kgf, that in the second figure is 3 kgf and the water collected in the second figure is 2 kg.

(a) What is the weight of the object in air?

(b)What is the loss in weight of the object immersed in water?

(c) What is the weight of the water displaced by the object?

(d) Which scientific principle is verified by this activity?

2. 

What is the volume of the object immersed in water?

- **The bark of the redwood tree is fireproof.**

Assignment 10.12

Numericals

1. A solid object of mass 150g and volume 250cm^3 is placed in water. Will it float or sink in water? [density of water is 1 g/cm^3]

2. A ball weighing 2 kg of density 2000 kg/m^3 is completely immersed in water of density 1000 kg/m^3. What is the buoyant force acting on it?

3. A 400g sealed container has a volume 200 cm^3. What is the density of the container? Will it float or sink in water?

4. If the density of gold is 19320 kg/m^3, what is its relative density?

5. If the density of turpentine is 840 kg/m^3, what will be its relative density?

6. A rectangular block of dimension 5 x 4 x 6 [in cm] is immersed in a liquid of density 1.2g/cm^3. What is the upthrust acting on it?

7. A body of volume 50 cm^3 is completely immersed in water. What is the buoyant force on the body?

- **If Mount Everest were placed at the bottom of the deepest part of the ocean, its peak would still be a mile underwater**

TIME TO THINK !! [H.O.T.S.]

1. Why two holes are made to empty an oil tin?

2. A man is sitting in a boat which is floating on a pond. If the man drinks some water from the pond, will the level of the water in the pond fall?

3. A boy is carrying a fish in one hand and a bucket full of water in the other hand. He then places the fish in the bucket. Is he now carrying more or less weight?

4. The velocity of water in a river is less on the bank and large in the middle. Explain.

5. Why does a flag flutter when strong winds are blowing?

6. Which property makes antiseptics more effective in terms of physics? Explain.

7. A piece of ice with a stone frozen in it floats on water in a beaker. When the ice melts completely, will there be a change in the level of water? Explain.

NOTES

WORK, POWER AND ENERGY

Assignment 11.1

1. The word 'work' means any kind of physical or mental activity. Eg. Reading a book, cooking food, pushing a wall, carrying a heavy bag, etc.
   But in physics 'work' has an entirely different meaning.

2. (a) **Work** is said to be done by an object when a force acting on the object produces displacement in it.

   (b) Work is a _____ quantity.

   (c) The SI unit of work is newton metre (Nm) which is also known as joule(J) in memory of famous physicist Joule.

   (d) If W denotes work, F denotes force applied and s denotes displacement,

   Then, work = force x displacement

   W = F x s

3. (a) **Work done by a force on an object is positive** when the object is displaced in the _____ of the applied force
   W = F x s

   (b) **Work done by a force on an object is negative** when an object is displaced in a direction _____ to the direction of the applied force.
   W = - F x s

(c) **Work done is zero** or no work is done when the force is acting at _____ to the displacement of the object.

$W = 0$

i.e. Work done is zero if displacement is perpendicular to direction of force.

Eg. 1. When a person carries a load in hand or on head and walks, no work is done.

2. When a man pushes a wall without displacing it from its position, [s=0], no work is done.

4. **SI unit of work** - work = force x displacement

So, SI unit of work = SI unit of force x SI unit of displacement

= newton x metre [N x m]

= joule [J]

1 J = 1 N x 1 m

Definition of SI unit of work – Work done is said to be 1 joule when a force of 1 newton acting on an object displaces the object by 1 metre.

NUMERICALS

(a) Calculate the work done when a force of 20N displaces a body through 8m in the direction of the applied force.

(b) An object of mass 2kg thrown up reaches a maximum height of 5m. Calculate the work done by the force of gravity on the object.

(c) A porter lifts a 20kg bag and puts it on his head at a height of 1.5m above the ground. Calculate the work done by the porter on the bag.

(d) A person holds a 30kg suitcase and walks on the platform upto50m. Calculate the work done by the person.

5. **Energy** – The capacity of doing work by an object is known as the energy of the object

Some of the forms of energy –

(i) Mechanical energy – Sum of kinetic and potential energy.

(ii) Thermal [heat] energy – Energy possessed by an object due to its temperature.

(iii) Chemical energy – Energy released in chemical reactions.

(iv) Sound energy – Energy of a vibrating object producing sound.

(v) Electrical energy – Energy of moving electrons in a conductor connected with a battery.

(vi) Nuclear energy – Energy released when two or more light nuclei combine to form a heavy nucleus or when a heavy nucleus breaks down into two or more light nuclei.

(vii) Solar energy – Energy radiated by the sun.

6. **SI unit of energy** – The SI unit of energy is **joule (J)** i.e. same as that of work.

7. **Kinetic energy** – Energy possessed by an object by virtue of its _____.

Eg. A moving car, moving bullet, released arrow, flowing water, moving ball, etc have kinetic energy.

In other words, anything which moves has kinetic energy.

8. Derivation of expression for kinetic energy

We consider an object of mass **m** lying on smooth horizontal surface. Let a force **F** is applied on the object so that the object starts moving, attains velocity v after travelling a distance **s.** As the object start from rest the velocity changes from 0 to v, it undergoes acceleration a.

Work done, $W = F\ s$ [from definition of work]

$W =$ [$F = m\ a$ {from newton's second law of motion}] ---------- (1)

From 3rd equation of motion, $v^2 - u^2 = 2\ a\ s$

---------- (2)

Using (2) in (1),

$W =$

$W =$

This work done is the kinetic energy of the body.

Kinetic energy, $E_k = W = \frac{1}{2} mv^2$

9. **Special case** – If an object is moving with initial velocity u which undergoes an acceleration a due to an applied force F and attains a final velocity v, then

$W = F\ s$

$W = m\ a\ s$

$W = m\ a\ [v^2 - u^2 / 2a]$

$W = \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

W = final kinetic energy - initial kinetic energy

W = change in kinetic energy of the body

10. **Potential energy** - Energy possessed by an object by virtue of its _____ or _____ or _____.

Examples of objects having potential energy due to position –

(i) Water stored in a dam
(ii) Stone held at a height above the ground
(iii) Hammer which is lifted to a height by hand

Examples of objects having potential energy due to shape / configuration –

(i) A stretched or compressed spring
(ii) A stretched bow and arrow
(iii) A wound spring of a watch

11. Derivation of expression for potential energy of an object at a height

The work done in lifting an object of mass m against force of gravity through a height h is the potential energy of the object at that height.

We consider an object of mass m which is raised to height h. For lifting it to h,

force applied, F = weight of the object =

work done, W =

W =

This work done against gravity is stored in the object as its potential energy or gravitational potential energy.

Hence, **Potential energy, E_p = W = m g h**

NUMERICALS

1. A magnetic crane lifts a mass of mass 2000 kg through a vertical height of 50 m. Calculate the work done by the crane. [g=10m/s2]

2. A body of mass 10kg is moving with a speed of 50m/s. What is its kinetic energy?

3. In Q 3. Calculate the K.E. if (i) velocity is doubled (ii) mass is doubled.

4. A body of mass 100g slows down from a speed of 5m/s to 3m/s. Find the change in the kinetic energy of the body.

5. A body of mass 5 kg is raised to a height of 50m. Calculate the potential energy of the body.

6. 60000 J of energy is utilized in lifting a mass of 50kg. Calculate the height to which the mass is lifted.

12. Law of conservation of energy

Statement 1 – Energy can neither be created nor destroyed, but can be changed from one form to another.

Statement 2 – When one form of energy is changed or transformed into other forms of energy, the total energy of an isolated system remains the same.

13. (1) **Power** – It is defined as rate of doing work or work done per unit time by an object.

$$\text{Power, } P = \frac{\text{work done, } W}{\text{time taken, } t}$$

(2) **SI unit of power** = SI unit of W / SI unit of t

= joule, J / second, s

= watt, W

1 W = 1 J / 1 s

Definition of SI unit of power – Power of an object or agent is said to be 1 watt when it does 1 joule of work in 1 second.

14. Some other **expressions of power**

$$P = W / t$$

$P = F s / t \quad [W = F s]$

$P = F (s / t)$

$P = F v \quad [v = s / t]$

15. Some other **units of power**

horse power :- 1 h.p. = 746 W

kilowatt :- 1 kW = 1000 W

megawatt :- 1 MW = 10^6 W

16. **Commercial unit of energy**: kilowatt – hour (kWh)

Electric energy is required to operate all electrical gadgets such as lamps, heaters, refrigerators, etc.

The department of electricity sells the electric energy to consumers in units called kilowatt hour (kWh).

1 unit = 1 kWh

Definition of 1 kWh – A kilowatt hour is the amount of electric energy used by 1000 W electric appliance when it operates for 1 hour.

17. Relationship between SI unit and commercial unit of power

Relationship between joule (J) and kilowatt-hour (kWh)

1 kWh =

1 kWh = 3.6 x 10^6 J

NUMERICALS

1. An engine supplies 36000 J of energy in one minute. Calculate its power.

2. A woman weighing 60kg climbs up 15 steps of stairs in half a minute. If each step is 20cm high, calculate the power used in climbing the stairs.

3. A 1000 W electric heater is switched on for 2 hours. Calculate the electric energy consumed by the heater.

4. A 100 W bulb is lit for 6 hours everyday. Calculate the energy consumed in a month of 30 days and cost of electricity consumed at a rate of Rs. 5 per unit.

5. The electric meter shows that a household consumes 500 units in a month. How much is this energy in joules?

6. A cart is pushed along the road with a force of 500N through a distance of 50m in I minute. Calculate its power.

7. The power output of an engine is 5kW. How much work does the engine do in 50 s?

8. Five electric fans of 120 W each are used for 6 hours. Calculate the electrical energy consumed in kWh.

9. An electric iron uses 500kJ in 5 minutes. What is its power rating?

- **The only rock that floats in water is pumice.**

Assignment 11.2

Multiple Choice Questions

1. A stone is tied to a string and whirled around in a circle. The Work done on it by the string is –

(a) positive
(b) negative
(c) undefined
(d) zero

2. When brakes are applied to a moving vehicle, the work done is-

(a) positive
(b) negative
(c) undefined
(d) zero

3. Potential energy of a person is minimum when he is –

(a) lying down
(b) standing on the floor
(c) sitting on a chair
(d) standing on a chair

4. When a stone falls through a height "h" the decrease in potential energy is –

(a) mg/h
(b) mg^2/h
(c) mgh
(d) $mg^2/2$

5. One of the following is a vector quantity-

(a) potential energy
(b) kinetic energy
(c) muscular force
(d) work

6. A wound spring possesses

(a) kinetic energy
(b) potential energy
(c) electric energy
(d) no energy

7. When an object falls freely towards the earth, its total energy

(a) increases
(b) decreases
(c) remains same
(d) first increases and then decreases

8. Which one of the following is not the unit of energy?

(a) joule
(b) kilowatt
(c) kilowatt-hour
(d) newton metre

9. This is a device which converts electric energy into mechanical energy.

(a) electric kettle
(b) electric fan
(c) electric toaster
(d) electric tandoor

10. Which of the following is not a scalar quantity?

(a) force
(b) energy
(c) pressure
(d) work

- **The temperature in fahrenheit can be determined by counting the number of cricket chirps in 14 seconds and adding 40.**

Assignment 11.3

Short answer questions

1. A person holding a suitcase is at rest. Is he doing any work?

2. In what form is energy stored in a clock?

3. A car and a bike, both have same kinetic energy. Which one is running faster?

4. Name the two types of mechanical energy.

5. Can a body have energy without momentum?

6. What are the practical unit and SI unit of power?

7. Name the type of energy stored in a dam.

8. Name and define the type of energy possessed by a ball , just before it is caught by a fielder?

9. What is SI unit of work?

10. What is the work done on a body moving in a circular path?

11. Which physical quantity does watt-second represent?

12. Flowing water can rotate a turbine. Which type of energy is used by the turbine?

13. By how much will the kinetic energy of a bicycle change if its speed is doubled?

14. What change would be affected in the velocity of a given body to maintain the same kinetic energy if its mass is increased 4 times?

15. A heavy and a light body have the same momentum. Which one will have more kinetic energy?

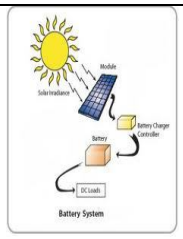
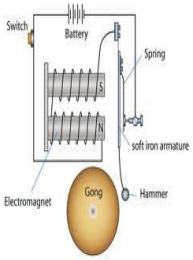
16. Can kinetic energy of an object be negative? Justify.

- The word energy comes from the Greek word energeia.

Assignment 11.4

Energy Transformation

Mention the energy transformations in the following:-

S.No	Figure	Name [object / instrument]	Energy transformation
1.			
2.			
3.			
4.			
5.			

The mass of our entire atmosphere is estimated to be some 5.5 quadrillion tons (55 followed by 14 zeros).

Assignment 11.5

Check your understanding [PRACTICE]

1. A force of 100 N acts on a body of mass 5kg at rest for 5 seconds. Find

   (a) initial kinetic energy of the body.

   (b) Acceleration produced in the body

   (c) Final kinetic energy of the body

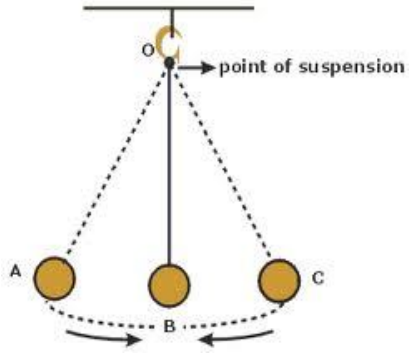
   (d) Velocity before the force is applied

   (e) Velocity after 5 seconds.

   (f) Distance moved by the body in 5 seconds

   (g) Work done by the force

   (h) Power developed by the body

2. 

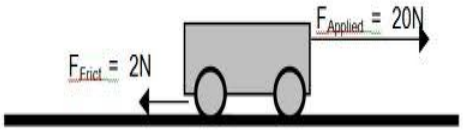
In the figure of simple pendulum, mention the position where the bob

   (a) minimum potential energy

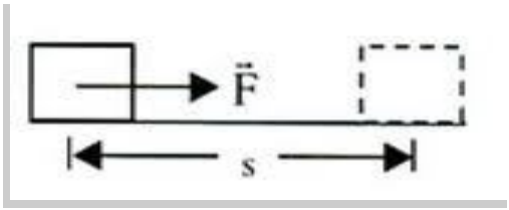
   (b) minimum kinetic energy

   (c) maximum potential energy

   (d) maximum kinetic energy

4. 

What is the net force?

5. What is the work done? Is it positive or negative? 

2. What is the work done by the man on the buckets while walking?

Assignment 11.8

Practice questions

1. Under what conditions is Work done on an object considered to be zero?

2. Find the work done by a player in giving a speed of 10m / s to a ball of mass 250g?

3. Define the commercial unit in which electrical energy is measured and obtain its value in terms of the S.I unit of energy?

4. Name the commercial unit of energy.

5. Define kilowatt hour

6. What is the power of a body which is doing work at the rate of one joule per second?

7. A boy and a girl do the same work in 5 minutes and 10 minutes respectively. Who has more power and why?

8. Two boys X and Y whose masses are same climb a rope upto a height of 20m. X takes 20s and Y takes 15 s to climb. Calculate the work done by each of them and find out who has more power?

9. In a game of tug of war between teams A and B, A loses and B wins. Which team does positive work and which team does negative work?

10. State the law of Conservation of Energy and mention the series of energy transformations that take place while riding a bicycle, in the form of a schematic figure?

11. Calculate the energy lost by a ball of mass 55g on hitting the ground, when it is released from a height of 250 cm assuming 'g'=9.8m / s^2?

12. A lift is designed to carry a load of 4000kg through 10 floors of a building averaging 6m per floor in 10 s. Calculate the power of the lift?

13. Compare the kinetic energies of a truck weighing 5000 Kg and a cart weighing 500Kg moving at the same speed?

14. A player throws a ball of mass 250g at the centre of the field and the ball moves at the rateof 10m / s. Calculate the work done by the player?

TIME TO THINK !! [H.O.T.S.]

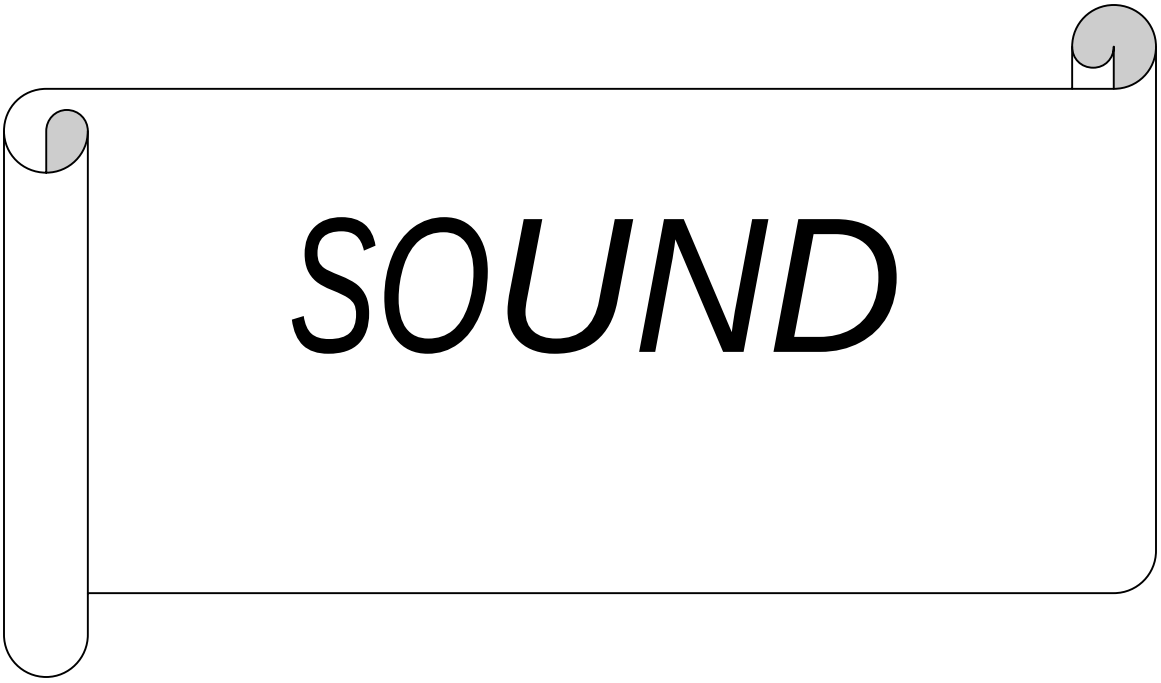
1. Mountain roads rarely go straight up but wind up gradually. Why?

2. When water falls in a water fall , is there any difference in temperature of water at the top and at the foot of the fall? Explain.

3. A rocket explodes in mid air. How does this affect its (a) total momentum and (b) total kinetic energy?

4. A trolley of mass 200 kg carries a sandbag of mass 25 kg. After sometime, sand starts leaking out of a hole on the trolley's floor at the rate of 0.05 kg/s. What would be the speed of the trolley after the sandbag is empty?

NOTES



Assignment 12.1

1. **Sound** – It is a form of _____ which produces the sensation of hearing in our ears.

2. (i) **Wave** – The movement of the _____ through a medium due to the repeated periodic motion of the particles of the medium about their mean position is known as wave.

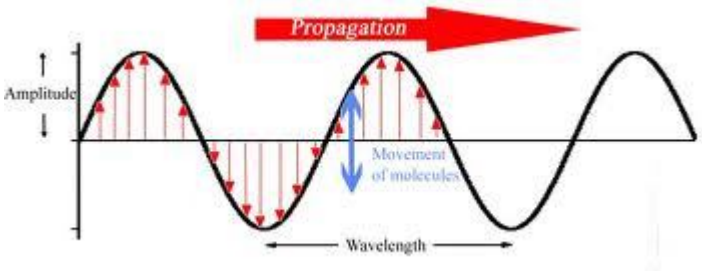
(ii) Wave transfers energy and not matter.

3. **Mechanical wave** – It is a periodic disturbance which requires a _____ [solid, liquid or gas] for its propagation

Sound waves, waves produced in water, waves produced due to earthquake, etc are some mechanical waves.

4. Types of mechanical waves - (i) _____ (ii) _____

5. (i) **Transverse waves** – If the particles of a medium vibrate or oscillate about their mean position at right angles to the _____, then the waves are transverse waves.



(ii) When transverse waves travel through the medium, the particles of the medium either rise above the mean position or go down below the mean position.

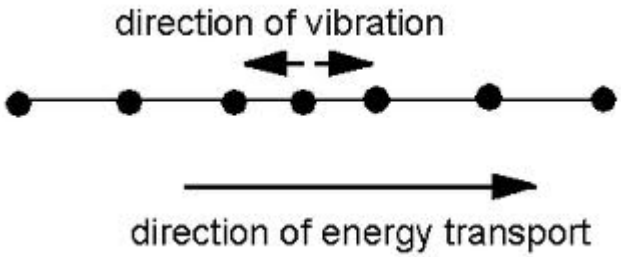
(iii) **Crest** – The point on the elevation of the medium whose distance is maximum from the mean position is called crest.

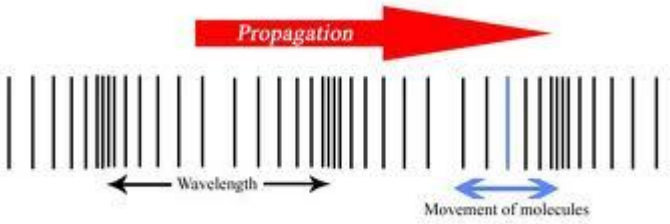
(iv) **Trough** – The point on the depressed part of the medium whose distance is maximum from the mean position is called trough.

(v) The distance between two successive crests or troughs is known as _____. It is represented by λ (lambda).

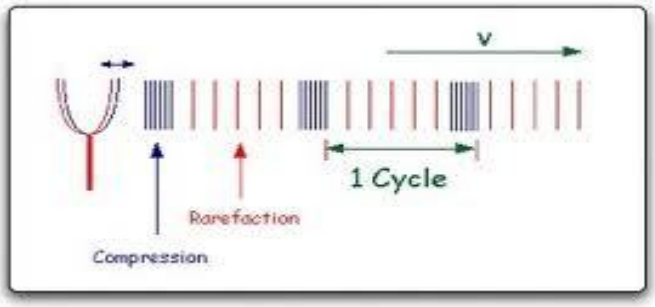
Diagram to represent crest, trough and wavelength for a transverse wave

6. (i) **Longitudinal waves** – If the particles of the medium vibrate or oscillate to and fro about their mean position _____ the direction of the propagation of the disturbance, then the wave is called longitudinal wave.





(ii) When longitudinal waves passes through a medium, the medium is divided into regions of _____ and _____.



(iii) **Compression** – It is the region of the medium where the density of the medium is _____ i.e. the particles of the medium are very close to each other.

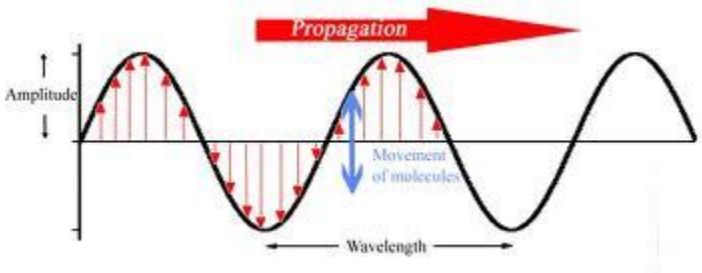
(iv) **Rarefaction** – It is the region of the medium where the density of the medium is _____ i.e. the particles of the medium are far apart from each other.

(v) The distance between two successive compressions or rarefactions is called _____ (λ).

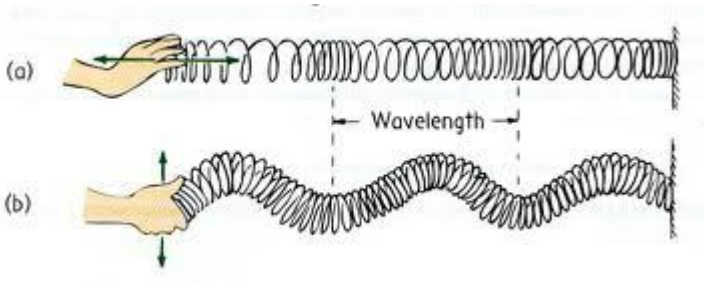
7. Sound waves are longitudinal waves.

8. **Characteristics of sound wave**

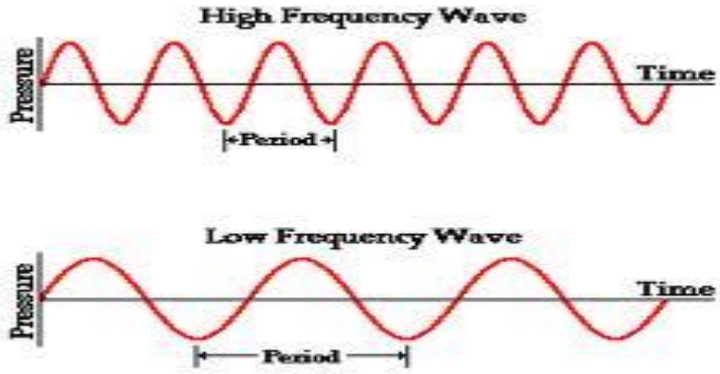
(i) **Amplitude** – It is the maximum displacement of a vibrating body from its _____. It SI unit is **metre (m).**



(ii) **Wavelength** – The distance between two successive regions of _____ or rarefactions is called the wavelength of the sound wave. It is denoted by λ. Its SI unit is **metre (m).**



(iii) **Frequency** – It is the total number of vibrations made by a vibrating body in _____. It is denoted by f or ν (nu). Its SI unit is **hertz (Hz).**



9. **Time period (T)** – It is the time taken by a vibrating body to complete _____. Its SI unit is **second (s).**

10. **Relationship between frequency and time period**

f = 1 / T

11. **Pitch** – It is the characteristic property of a sound which depends on _____of the sound wave.

More is the frequency, more is the pitch and vice versa. High pitch is characterized by a shrill voice.

Eg. A woman's voice has high pitch [high frequency and more shrill].

A man's voice has low pitch [low frequency and less shrill]

Graphical representation of high frequency sound wave

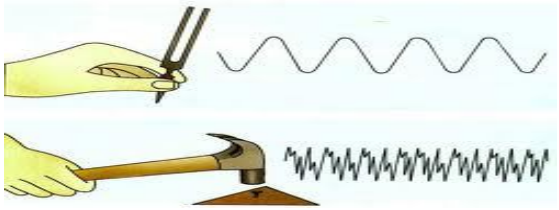
Graphical representation of low frequency sound wave

12. **Loudness** – The loudness of a sound depends upon the _____ of the vibrating body producing sound. More is the amplitude, more is the loudness and vice versa. It is a subjective quantity i.e. it depends on the sensitivity of our ears. Same sound can be loud for one person and feeble for another standing at the same position.

Graphical representation of large amplitude sound wave

Graphical representation of small amplitude sound wave

13. **Quality / Timbre** – It is a characteristic feature of sound which enables us to distinguish between the sounds of same _____ and _____. This is so because different sources of sound produce different wave patterns.



14. **Intensity** – Intensity of a sound is the sound energy transferred per unit time through a unit area placed perpendicular to the direction of the propagation of sound.

$$\text{Intensity} = \frac{\text{sound energy}}{\text{time} \times \text{area}}$$

SI unit of intensity = joule second^{-1} metre^{-2} = watt / metre^2

Hence, intensity of sound is an objective physical quantity which does not depend upon the sensitivity of our ears.

15. **Relationship between speed of wave (v), frequency (f) and wavelength (λ)**

$$\text{Speed of wave} = \frac{\text{distance travelled by the wave}}{\text{time taken}}$$

$$= \frac{\text{wavelength}}{\text{time period}}$$

$$= \text{wavelength} \times \text{frequency} \quad [\text{frequency} = 1 / \text{time period}]$$

i.e. $\mathbf{v = \lambda f}$

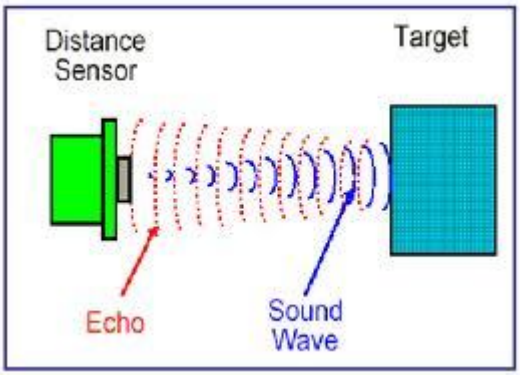
16. Reflection of sound – When a sound wave travelling in a medium bounces back to the same medium after striking the second medium (a solid), reflection of sound wave is said to take place.

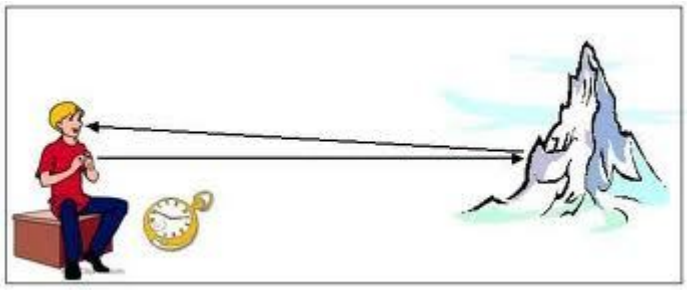
Laws of reflection

(1) The angle of incidence of sound wave is equal to the angle of incidence of the sound wave.

(2) The incident direction of sound, reflected direction of sound and the normal to the point of incidence, all lie in the same plane.

17. Echo – It is the repetition of sound due to the _____ of original sound by a large and hard obstacle.





Conditions for production of echo

(i) Time gap between the original and reflected sound should be more than 0.1 s.

This is because we can hear two sounds distinctly when the time gap between two sound is more than 0.1 s as our persistence of hearing is $1/10^{th}$ of a second i.e. 0.1 s. It means that the impression of a sound remains for 0.1 s in our brain.

(ii) Minimum distance between the source of sound and obstacle should be 17 m.

As the speed of sound in air is 344 m/s approx.,

distance travelled by sound in 0.1 s is = speed x time

=

=

So, the minimum distance between the source and obstacle should be half of this distance i.e.

……

(iii) The nature of the obstacle should be a rigid object like a building, hill or cliff.

(iv) The size of the obstacle reflecting the sound should be quite large.

18. Reverberation – It is the repeated reflection of sound which results in persistence of sound for a long time after the source of sound has stopped producing sound and its gradual fading away until it is no longer audible.

Reverberation time – The time during which the audible sound persists after the production of sound.

A certain amount of reverberation improves the quality of sound.

Excessive reverberation is undesirable as it interferes with the original sound and sound becomes unclear.

Ways of decreasing reverberation time –

Reverberation time can be reduced by using sound absorbing materials in big halls and auditorium like

(i) Covering the walls and ceilings with _____ materials such as fiber board, rough plaster, draperies, perforated cardboard sheets, etc.

(ii) Windows are covered with _____.

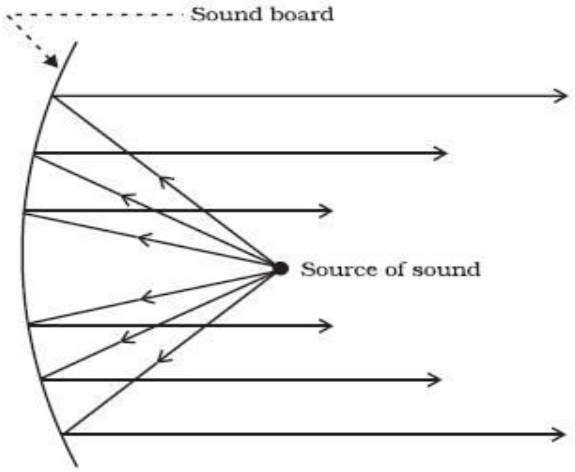
(iii) Special tiles are used for flooring or floors are _____.

(iv) Seats are _____.

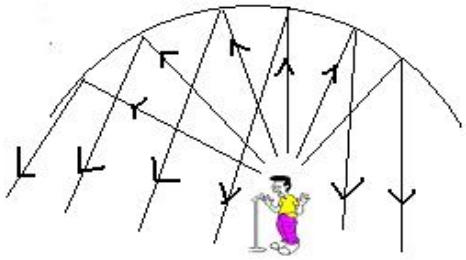
(v) Some potted plants are arranged in the hall.

19. Applications of reflection / multiple reflection of sound

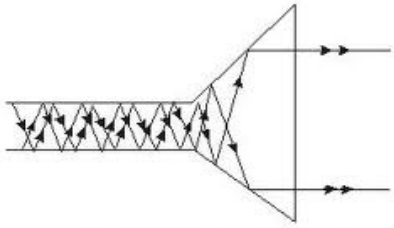
(i) Sound board – These are curved (concave) surfaces used at the back of the stage which directs the sound waves towards the people sitting in a hall / auditorium.



(ii) Curved ceilings – This is done so that sound reaches all parts of the hall after reflecting from the ceiling as shown in the figure.

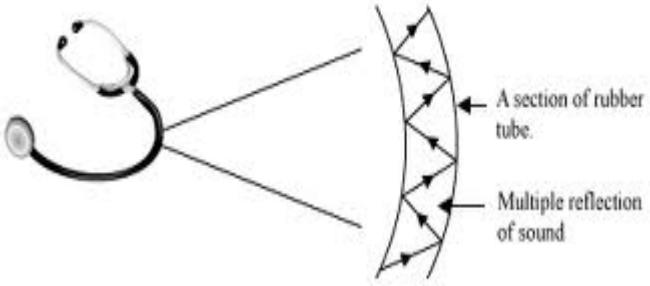


(iii) Megaphone, horns, trumpets, shehnais, etc.



Multiple reflection of sound in a megaphone

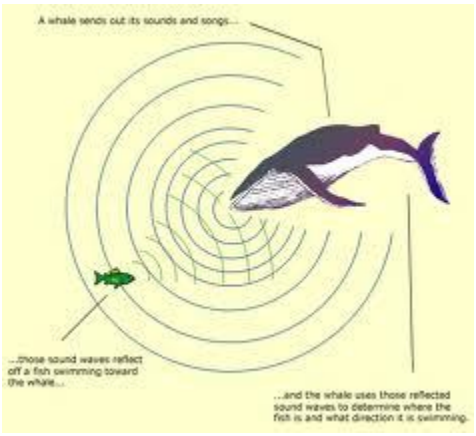
(iv) Stethoscope



(v) Hearing aid

20. Range of hearing - The audible range of frequency for human beings is _____.

Waves of frequency _____ 20 Hz are called infrasonic waves or infrasound. Infrasonic waves are produced by earthquakes, elephants, rhinoceros, whales, etc.

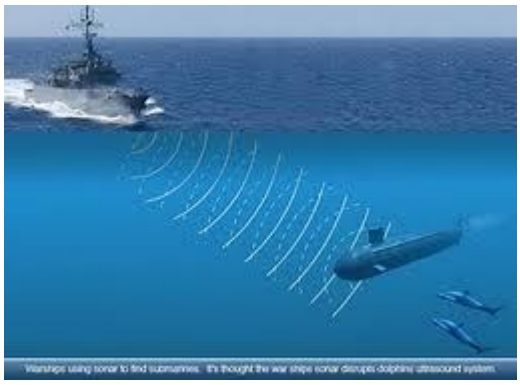


Waves of frequency _____ 20,000 Hz are called ultrasonic waves or ultrasound.

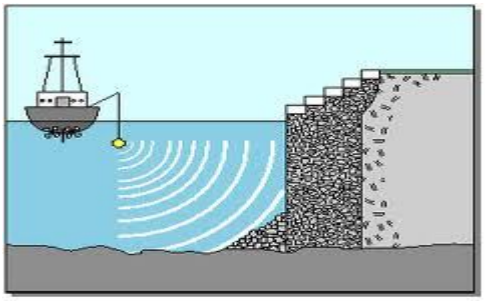
Bats, dogs and dolphins can produce ultrasonic waves.

21. Applications of ultrasound –

(i) To establish ship to ship / submarine communication or location.



(ii) To determine depth of a sea [SONAR]



(iii) For cleaning hidden parts of certain devices

(iv) For welding plastic

(v) For diagnosing diseases in human body

(vi) To kill bacteria in liquids like milk.

(vii) To detect faults and cracks in metals.

(viii) To study the growth of foetus.

22. Uses of Sound Navigation And Ranging [SONAR]

(i) To determine the depth of sea

(ii) To locate underwater hills, valleys, submarine, icebergs, sunken ships, etc.

23. Applications of ultrasound in medicine

(i) Echocardiography – Ultrasonic waves are made to reflect from the parts of heart to form its image.

(ii) Ultrasonography – Ultrasound scanner uses these waves to form images of various internal organs [liver, gall bladder, kidney, etc] of human body and to detect congenial defects and growth abnormalities in foetus during pregnanacy.

(iii) Lithotripsy – The waves are used to break stones formed in the kidney into fine grains which gets flushed out of the body with urine.

- **If you yelled for 8 years, 7 months and 6 days, you would have produced just enough sound energy to heat up one cup of coffee.**

Assignment 12.2

Multiple choice questions

1. Ultrasound waves are those waves which are-
   (a) Audible to man
   (b) Inaudible to man
   (c) Having low frequencies
   (d) Having low amplitudes.

2. When a sound wave goes from air to water, its characteristic property that remains unchanged is-
   (a) velocity
   (b) amplitude
   (c) frequency
   (d) wavelength.

3. Supersonic jets fly with a speed
   (a) less than the speed of sound
   (b) greater than the speed of sound
   (c) equal to that of sound
   (d) equal to that of light

4. A bomb explodes on the moon. How long will it take for the sound of the explosion to reach the earth?
   (a) 10s
   (b) 1day
   (c) 1000s
   (d) None of these

5. The persistence of sound in an auditorium is due to the phenomenon of -
   (a) absorption
   (b) reflection
   (c) reverberation
   (d) interference

6. Air in a room is warmed up. The speed of sound in this room will
   (a) increase
   (b) decrease
   (c) remain unaffected
   (d) fluctuates.

7. When a sound wave moves in a medium,
   (a) density of the medium changes
   (b) pressure of the medium changes
   (c) medium remains unaffected
   (d) Both density and pressure changes.

8. Sound waves can be
   (a) reflected
   (b) absorbed
   (c) reflected multiple times
   (d) all of the above

9. When the source of sound moves towards the listener
   (a) frequency of sound is increased
   (b) velocity of sound is decreased
   (c) wavelength of sound is decreased
   (d) amplitude of sound is increased

10. Which of the following is carried by the waves from one place to another?
   (a) mass
   (b) velocity
   (c) energy
   (d) all the above

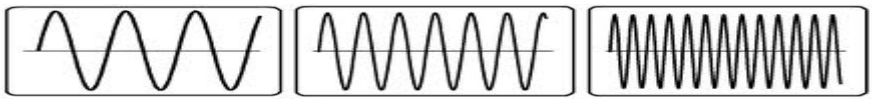
11. 

Fig A Fig B Fig C

For the three figures, with respect to their amplitude and frequency, which of the following statement is correct?
   (a) A, B and C have same amplitude and same frequency
   (b) A, B and C have same amplitude and decreasing frequency from A to C
   (c) A, B and C have different amplitude and different frequency
   (d) A, B and C have same amplitude and increasing frequency from A to C

12. Sound absorbing materials are used in the interiors of an auditorium to
   (a) enhance the appearance of auditorium
   (b) decrease the echo
   (c) decrease the reverberation
   (d) decrease the amount of reflection

13. The instruments such as megaphone, hearing aid, stethoscope and sound board have something in common. What is that?
   (a) all are made of metals
   (b) all cause echo of sound which is inaudible
   (c) all work on the principle of reflection
   (d) None of these

- **If Mount Everest were placed at the bottom of the deepest part of the ocean, its peak would still be a mile underwater.**

Assignment 12.3

Short answer questions [CLASS ASSIGNMENT]

1. Name the wave property that determines (a) loudness and (b) pitch

2. What is the nature of sound waves?

3. A sound wave travels from east to west. What is the direction of motion of the particles of the medium?

4. Why is a woman's voice shriller than a man's voice?

5. What is the audible range of frequency of hearing in human beings?

6. Why do astronauts use radios to talk with each other in space?

7. Which characteristic of a sound wave helps us in identifying our friend's voice in a group without seeing them?

8. Name the type of wave produced when

   (a) a stone is dropped in a pond - _____

   (b) a tuning fork is struck on rubber pad - _____

(c) a slinky kept horizontally is pushed to give a jerk - _____

9. What is the persistence of hearing for a human being?

10. What is the relationship between speed, frequency and wavelength of a wave?

11. Where is the density of particles of medium more for longitudinal waves?

12. What is the distance between two consecutive compressions or rarefactions called?

- **The bark of the redwood tree is fireproof.**

Assignment 12.4

Reasoning questions [HOME WORK]

1. An approaching train can be felt easily by putting one's ear to the rails.

2. Bats can detect the position of their prey with great accuracy.

3. Carpets and curtains are used in auditoriums.

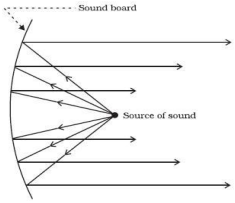
4. The 

figure shows the reflection of sound from a curved sound board in a big hall.

(a) Why are the sound boards curved?

(b) Where should the speaker stand and speak so that all in the hall can hear him clearly?

5. The sound of supernova explosions in space cannot be heard on the surface of the earth.

- **Chewing gum was invented by a dentist, named William Semple - as a way to exercise your jaws.**

Assignment 12.5

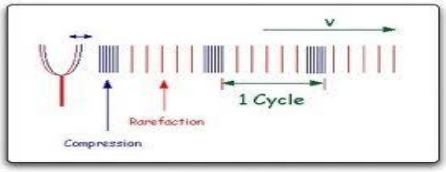
Check your concepts [PRACTICE]

1. A violin and a sitar may have the same pitch, yet we can distinguish their notes. Why?

2. How is a note different from tone?

3. How is an echo different from reverberation?

4. Does the sound of a bomb explosion travel faster than that produced by a humming bee?

5. 

A vibrating tuning fork has a frequency of 250 Hz. The distance between two consecutive compressions is 25cm. What is the velocity with which the wave is travelling forward? Name the type of waves produced.

6. 
Fig A

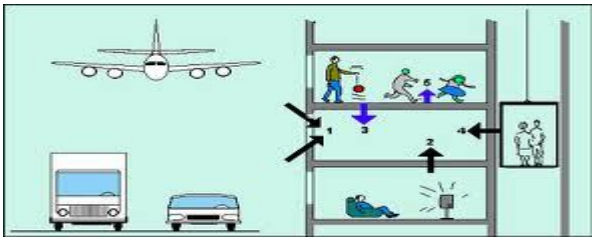
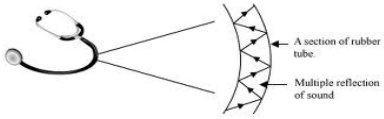



Fig B
The two figures A and B show two different sets of things which produce sound. What is the difference between the two?

7. 

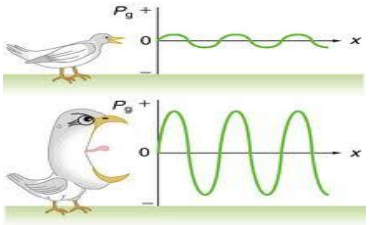
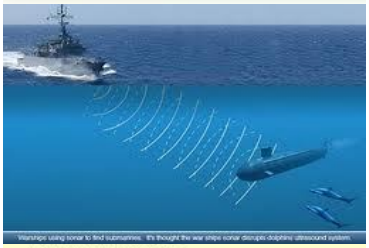
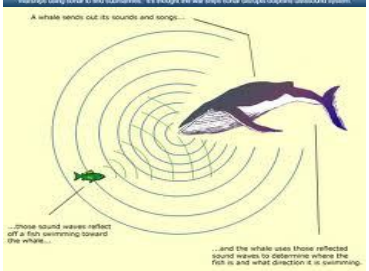
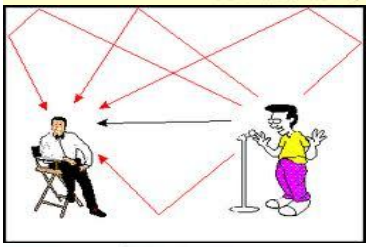
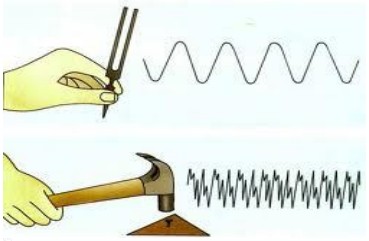
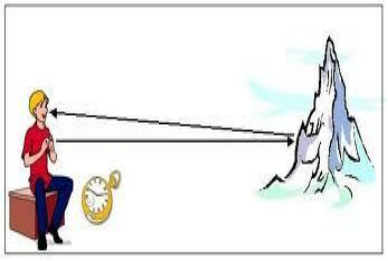
Name the first figure. What is the relation between the first and the second figure?

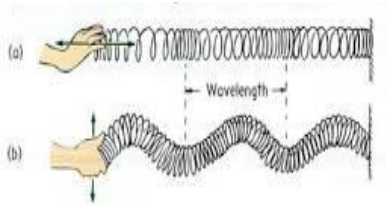
8. If we hit a wooden table hard, what type of sound wave is produced and what kind of sound is heard?

- **The world's densest wood, the Black Ironwood (Olea laurifolia), does not float on water and therefore sinks.**

Assignment 12.6

Diagram based questions

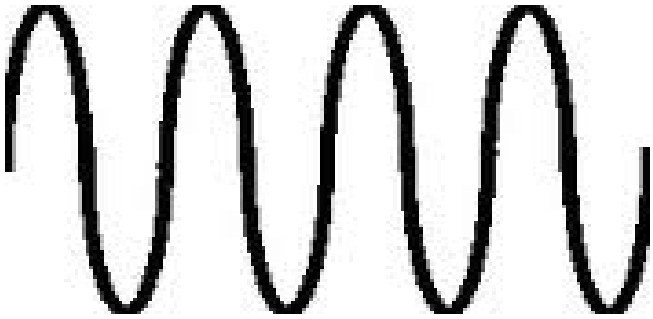
QNo	Figure	Question
1.		The wave pattern produced by the bird at two different times is shown. Which characteristic of sound wave is shown and what type of sound is produced in each case? Ans.
2.		What is the technique used to find the position of the submarine? Ans.
3.		Name the sound waves used by the whale to locate its prey, the fish. Ans.
4.		How can this room be designed to ensure clarity of the sound produced by the boy and that heard by the man sitting? Ans.
5.		What is the difference in the sound produced by the tuning fork and the hammer? Ans.
6.		What can the boy do / verify / find with the stop watch in the given situation? Ans.

7. 

What is the difference between the two slinky on the basis of how the waves are produced?

Ans.

8. Label the figure as per the instructions:-
   (a) Draw the x and y axis for the wave.
   (b) Mark displacement (m) on x axis and time (s) on y axis.
   (c) Show amplitude, 2 crests, 2 troughs and wavelength
   (d) How many waves are drawn in the figure?



- **The loud noise you create by cracking a whip occurs because the tip is moving so fast it breaks the speed of sound!**

Assignment 12.7

NUMERICALS [CLASS ASSIGNMENT]

1. A tuning fork has a frequency of 256 Hz. What is the wavelength of the sound wave produced in air if the speed of the sound in air is 340m/s?

2. A boy hears an echo from a cliff 4s after the sound from a powerful cracker is produced. How far is the cliff from the boy?

3. Calculate the wavelength of a sound wave whose frequency is 220Hz and speed is 440m/s in a given medium.

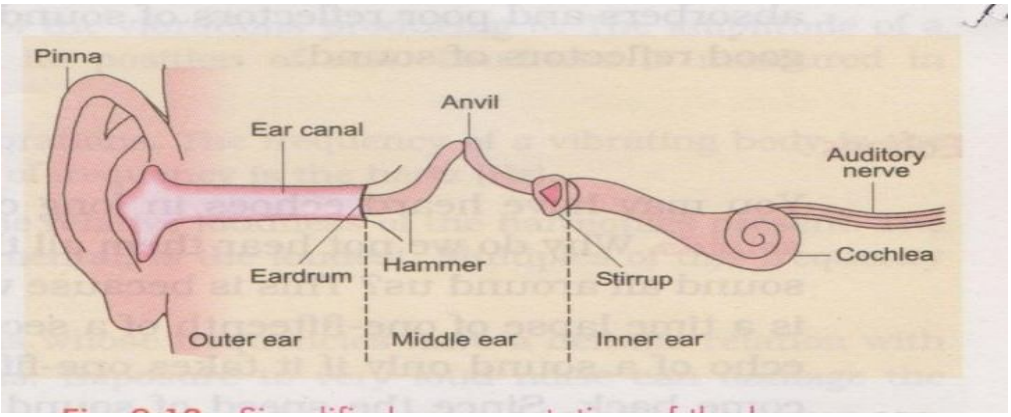
4. A submarine emits a SONAR pulse, which returns from an underwater cliff in 1.02 s. How far is the cliff from the source if the speed of sound in water is 1531m/s?

- **The scientific study of sound waves is known as acoustics.**

Assignment 12.8 [HOME WORK]

Structure of ear and its working

1. Schematic diagram of human ear.



2. How do we hear sound through our ears?

Assignment 12.9

Practice questions

1. Name the type of waves produced when a bell rings in air.

2. State the factors on which velocity of sound depends.

3. Name the sound wave below and above the audible range of human beings.

4. What are the condition(s) necessary for an echo to be heard distinctly?

5. Why are sound waves called mechanical waves?

6. In which form does transverse and longitudinal waves propagate?

7. Mention two medical uses of ultrasonography?

8. Why is the reverberation time larger for an empty hall than a crowded hall?

9. Why do we prefer to use ultrasound instead of X-rays for medical applications?

TIME TO THINK !! [[H.O.T.S.]

1. What causes the rolling sound of thunder?

2. When we keep our ears on one end of a long metallic pipe we hear two distinct sound if the other end is hammered. Why?

3. If we set our watch by the sound of a distant siren, will it go slow or fast?

4. A tuning fork has two prongs. Would the tuning fork be of any use if one of its prongs is cut off?

NOTES

FACTOPAEDIA

- **If you try to say the alphabet without moving your lips or tongue every letter will sound the same**

- **To crack a whip the tip must be travelling faster than the speed of sound**

- **Dolphins can hear underwater sounds from 24km (15miles) away**

- **Sound travels 10 times faster through granite than air**

- **Dolphin's can detect underwater sounds from 24 km (15 miles) away**

- **When baby polar bear cubs are born they cannot see or hear for their first month**

- **Akousticophobia is the fear of noises**

- **Melophobia is the fear of music**

EXPERIMENTS

PRACTICALS

INSTRUCTIONS FOR WRITING PRACTICAL IN FILE

- The sequence as given here must be followed.
- Diagram has to be drawn with pencil.
- What is given in smart skills has to be copied from here to the file and the rest in the given sequence is to be noted down from the laboratory manual.

1. **AIM**
2. **APPARATUS**
3. **THEORY**
4. **DIAGRAM [Left hand side of the file / Blank page]**
5. **OBSERVATION [Left hand side of the file / Blank page]**
6. **OBSERAVTION TABLE [Left hand side of the file / Blank page]**
7. **CALCULATION [If any]**
8. **RESULT**
9. **PRECAUTION**
10. **SOURCES OF ERROR**

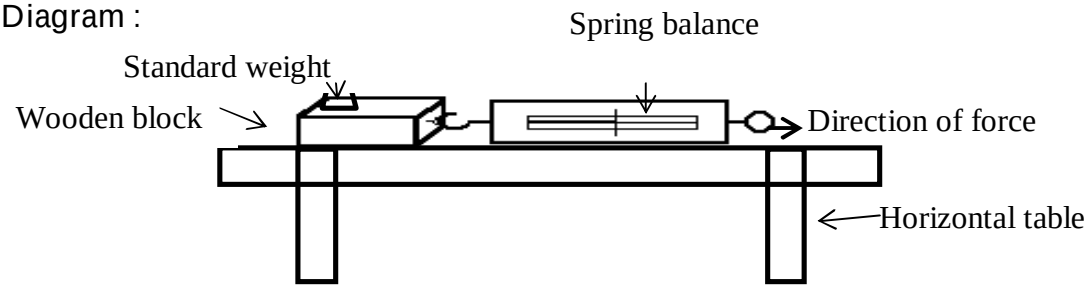
PHYSICS PRACTICAL – TERM I

Aim : To establish relationship between weight of a rectangular wooden block on a horizontal table and the minimum force required to just move it using a spring balance

Materials required : Known standard weights,, wooden block, spring balance, smooth horizontal table

Theory : Any object placed on a horizontal table, in a state of rest, possesses inertia of rest. The inertia of an object depends on its mass. Higher the mass of an object, greater is its inertia, greater is the force required to move it.

Diagram :



Procedure :

1. Take a spring balance and note its least count and zero error (if any).
2. Take a smooth rectangular block and measure its weight, W.
3. Place the wooden block and the spring balance on the table as shown in the diagram.
4. Place a known standard weight on the wooden block.
5. Now gently pull the ring of the spring balance using your fingers, gradually increasing the force with which it is pulled till the wooden block just starts moving on the table.
6. When the wooden block just starts moving, note down the reading on the spring balance which is the force, F required to just move the block.
7. Repeat step 4-6 for different weights [at least three readings]

Observations: Least count of the spring balance = …… gf

Observation Table:

S No	Weight of wooden block, X (gf)	Standard weight Y (gf)	Total weight of the block, W = X+Y (gf)	Force required to move the block, F (gf)
1.				
2.				
3.				

Result : We observe that as the weight of the wooden block, W increases, the force, F required to just move the weight also increases.

Precautions:

TERM 2

EXPERIMENT 1

Aim : To observe and compare the pressure exerted by a glass slab on refined flour while resting on its three different faces and to calculate the pressure exerted in the three different cases.

Observation :

Length of the glass slab, **l** = _____ cm

Breadth of the glass slab, **b** = _____ cm

Height of the glass slab, **h** = _____ cm

Weight of the glass slab, **F** = _____ gwt

Observation table:

S No	Faces	Area, **A (cm^2)**	Depression measured **(cm)**	Pressure, **P = $\frac{F}{A}$ (gwt/cm^2)**
1.	l x b			
2.	b x h			
3.	l x h			

Result :

1. When _____ face is kept on refined flour, depression measured is maximum.

2. When _____ face is kept on refined flour, depression measured is minimum.

3. Pressure exerted by the glass slab on refined flour is maximum when it is placed with _____ face and minimum when it is placed with _____ face.

EXPERIMENT 2

Aim : To determine the density of a solid by using spring balance and a measuring cylinder.

Observation :

Range of the spring balance –

Zero error of the spring balance –

Least count of the spring balance –

Range of the measuring cylinder –

Least count of the measuring cylinder –

1 ml = 1 cm^3 (cc)

Observation Table :

S No	Mass of object in air, **M** **(g)**	Initial volume of water, V_i **(cm^3)**	Final volume of water, V_f **(cm^3)**	Volume of solid $V = V_f - V_i$ **(cm^3)**	Average volume of object, $V_{av} = \frac{V_1+V_2+V_3}{3}$ **(cm^3)**
1.					
2.					
3.					

Calculation : Density = $\frac{\text{mass}}{\text{volume}}$

$= \frac{M}{V_{av}}$

= g / cm^3

= g / cm^3

EXPERIMENT 3

Aim : To establish a relation between the loss in weight of a solid when fully immersed in (i) tap water and (ii) saturated salt solution, with the weight of the water displaced by it.

Observation:

Zero error of spring balance = _____ g

Range of the spring balance = _____ g

Least count of the spring balance = _____ g

Weight of the empty beaker, $\mathbf{W_3}$ = _____ gwt

Observation table 1:

S No	Weight of solid in air, $\mathbf{W_1}$ **(gwt)**	Weight of solid in tap water, $\mathbf{W_2}$ **(gwt)**	Loss inweight of solid **W'= W_1 -W_2 (gwt)**	Weight of beaker with displaced water $\mathbf{W_4}$ **(gwt)**	Weight of water displaced **W" = W_4 - W_3 (gwt)**
1.					
2.					

Observation table 2:

S No	Weight of solid in air, $\mathbf{W_1}$ **(gwt)**	Weight of solid in salt solution, $\mathbf{W_2}$ **(gwt)**	Loss inweight of solid **W'= W_1 -W_2 (gwt)**	Weight of beaker with displaced water $\mathbf{W_4}$ **(gwt)**	Weight of water displaced **W" = W_4 - W_3 (gwt)**
1.					
2.					

Result :

1. In both observation tables, W' = W"
   That is, loss in weight of the body is equal to the weight of the water displaced.

2. Weight of the water displaced in tap water [for the same solid] is greater than the weight of the water displaced in salt water [for the same solid]

EXPERIMENT 4

Aim : To determine the velocity of a pulse propagated through a stretched slinky.

Observation :

S No	Length between A & B L (cm)	2L ,(cm)	Time taken, t (s)	Average time, T (s)	Velocity of pulse V = 2L / T (cm/s)
1.					
2.					
3.					
4.					
5.					

EXPERIMENT 5

Aim : To verify the laws of reflection of sound

MULTIPLE CHOICE QUESTIONS

BASED ON PRACTICAL – TERM I

1. The spring balance used for the experiment has 4 divisions between the markings 1 and 2. Its least count is
    (a) 2 gf
    (b) 0.2 gf
    (c) 1 gf
    (d) 5 gf
2. While doing the experiment to find the relationship between the weight of a rectangular wooden block lying on a horizontal table and the minimum force required to just move it using a spring balance, it is observed that
    (a) Inertia and force are not related to each other
    (b) More is inertia, more is the force
    (c) Less is inertia, more is the force
    (d) More is inertia, less is the force
3. A rectangular wooden box open from one side is lying on a horizontal table. Different weights are kept in the box one by one. The force required to just move the wooden box is maximum when we put a weight of
    (a) 30 gf
    (b) 35 gf
    (c) 50 gf
    (d) 45 gf
4. A student applied force on a rectangular wooden block placed on a horizontal surface. He gradually increased the force on the block till it just starts sliding on the surface. He measured this force as F_1. The same experiment was performed with the same set of apparatus by his two classmates, but they applied force from different directions to slide the block on the surface and the force recorded by them were F_2 and F_3. On analysing the magnitude of these forces, it was found that
    (a) $F_1 < F_2 < F_3$
    (b) $F_3 < F_2 < F_1$
    (c) $F_1 = F_2 = F_3$
    (d) $F_2 < F_1 = F_3$
5. A student measured the minimum force to pull a wooden block as F_1 when it was placed on wooden table, F_2 when placed on glass surface and F_3 when placed on cardboard. The relationship between the three forces would be
    (a) $F_1 < F_2 < F_3$
    (b) $F_3 < F_2 < F_1$
    (c) $F_1 = F_2 = F_3$
    (d) $F_2 < F_1 = F_3$

6. The term inertia means which of the following? The tendency of an object to
    (a) maintain its mass.
    (b) remain in motion.
    (c) remain in rest or motion
    (d) stop the motion of other objects
7. In a spring balance, there are 25 divisions between 0 and 50 gf. Its least count is
    (a) 10 gf
    (b) 5 gf
    (c) 0.2 gf
    (d) 2 gf
8. For pulling the wooden block placed on a table with a spring balance, ideally the surface of
    (a) Only table should be smooth
    (b) Only wooden block should be smooth
    (c) Table and wooden block need not be smooth
    (d) Both table and wooden block should be smooth
9. In the experiment, to establish relationship between weight of a rectangular wooden block on a horizontal table and the minimum force required to just move it using a spring balance, the force required depends upon
    (a) Weight of the block with weights
    (b) Nature of surfaces of table and block in contact
    (c) The least count of spring balance
    (d) Weight of the block with weights and nature of surfaces of table and block in contact
    18.
10. To establish relationship between weight of a rectangular wooden block on a horizontal table and the minimum force required to just move it, a student did the experiment with weights W, 2W and W / 2. He found that the ratio of force F required to just move the block and the weight taken
    (a) Was always a constant
    (b) Was always less than one
    (c) Was always greater than one
    (d) Cannot be calculated

MULTIPLE CHOICE QUESTIONS

BASED ON PRACTICALS – TERM II

1. Sound waves can travel
   (a) in vacuum only
   (b) in vacuum and material medium
   (c) in material medium only
   (d) neither in vacuum nor in material medium

2. While determining the density of a copper cylinder using a spring balance and measuring cylinder, Sharon followed the given procedure—The wrong step in the procedure is
   (a) Noted the water level in the measuring cylinder without the copper piece
   (b) Immersed the copper piece in water
   (c) Noted the water level in the measuring cylinder with the copper piece inside it
   (d) Removed the copper piece from the water and immediately weighed it using a spring balance

3. Before using the spring balance, its pointer should be
   (a) at zero mark
   (b) at any mark
   (c) below zero mark
   (d) above zero mark

4. The density of which of the following cannot be measured accurately using a spring balance and a measuring cylinder
   (a) a sponge ball
   (b) a block of ice at 0^{o} C
   (c) a balloon filled with water but leaking from a small hole
   (d) all of these

5. Four measuring cylinders with least count 2.5 ml. 1.0ml, 0.5ml and 0.2ml are present. Which one should be preferred to find the density of a solid accurately? The spring balance with least count
   (a) 2.5 ml
   (b) 1.0 ml
   (c) 0.5 ml
   (d) 0.2 ml

6. A given solid is weighed in air using a spring balance. It is weighed by immersing fully in tap water first and then in salt solution. The reading of the spring balance would be
   (a) least in air
   (b) least in water
   (c) least in salt solution

(d) equal in all the three cases

7. The weight of an object felt in tap water and salt solution are W_T and W_S respectively, then
   (a) $W_T = W_S$
   (b) $W_T < W_S$
   (c) $W_T > W_S$
   (d) $W_T = W_S$

8. A cylinder and a cone having radius r_1 and r_2 respectively, ($r_1 > r_2$) are having the same mass. Then pressure exerted by the cylinder is
   (a) greater than cone
   (b) less than cone
   (c) equal to cone
   (d) cannot be decided

9. To observe and compare the pressure exerted by a solid iron cuboid in its upright position, Ravi placed the cuboid gently on loose sand and Raj placed it on the table top. Who will observe the pressure exerted by cuboid easily?
   (a) Ravi
   (b) Raj
   (c) both Ravi and Raj
   (d) neither Ravi nor Raj

10. A periodic wave is characterized by
   (a) wavelength
   (b) frequency
   (c) phase
   (d) none of these

11. Which of these do not need any medium to travel?
   (a) transverse waves
   (b) longitudinal waves
   (c) electromagnetic waves
   (d) all the options, (a), (b) and (c)

12. In an experiment on determining the velocity of a pulse, as it propagates through a stretched wire, a student uses four different lengths of the same wire, in increasing order. The velocity og propagation of the pulse, observed by him, would
   (a) show random variations depending on the strengths of the jerk given to the wire
   (b) increase with increase in length
   (c) be the same for all lengths of the wire
   (d) decrease with increase in length

13. To show the effect of force depends upon area of contact, a student holds both the ends of a sharpened pencil between the index fingers of both the hands and presses it from both sides. The finger which has a deeper mark of pencil is
   (a) towards the pointed end of the pencil
   (b) towards the flat end of the pencil
   (c) on index fingers of both hands

(d) none of the index fingers

14. A student is given an iron cube of side 1 cm, a measuring cylinder of range 100ml and least count 1 ml and a spring balance of range 100 gwt and least count 1 gwt. He can use these to measure
    (a) both the mass and the volume of the given iron cube
    (b) neither the mass nor the volume of the given iron cube
    (c) only the mass of the iron cube but not its volume
    (d) only the volume of the iron cube but not its mass

15. The number of pulses created in a slinky depends on
    (a) the length of the slinky
    (b) the number of turns of slinky
    (c) nature of material of slinky
    (d) none of the above

16. Pressure has
    (a) magnitude
    (b) direction
    (c) magnitude as well as direction
    (d) neither magnitude nor direction

17. A body of mass 300g is floating in water. The results recorded for the apparent weight by four students are as follows. Which one is correct?
    (a) zero
    (b) 300 g wt
    (c) less than 300 g wt
    (d) more than 300 g wt

18. The same iron block is immersed in two liquids A and B one after another. The extent to which the body sinks in liquid B is less than in liquid A. Which of the following conclusions can be drawn from the observation?
    (a) No definite conclusion can be made
    (b) density of the iron block is less than any one liquid
    (c) density of liquid A is more than that of B
    (d) density of liquid B is more than that of A

19. The radius of sphere, the side of a cube and the length of a cylindrical rod made of copper is 3 cm. These are successively immersed in a liquid to find the density of the liquid. The area of cross-section of the rod is 6 sq cm. Which of the three will displace minimum volume of water?
    (a) the sphere
    (b) the rod
    (c) the cube
    (d) cannot be decided

20. A student took solid objects of different shapes, sizes and materials and noted down the apparent loss in weight on partially or fully immersing the objects in different liquids.

Based on the observations, he concluded the following statements. Which one of them is not correct?

(a) Upthrust depends on the density of the liquid
(b) Upthrust depends on the volume of the object immersed
(c) Upthrust increases as the object is taken deeper in a liquid
(d) Upthrust depends on the shape of the container containing liquid

21. Adding salt to water will
    (a) initially increase and the decrease its density
    (b) increase its density
    (c) decrease its density
    (d) not change its density

22. Two slinky A and B of the same length are made up of two different materials. The times taken by 20 pulses to travel in both of them are 50 s and 70 s respectively.
    (a) the pulse travels faster in A than B
    (b) the pulse travels faster in B and A
    (c) speed of the pulse cannot be decided
    (d) there is no relation between speed of pulse and material of slinky

23. In a slinky, one can produce
    (a) transverse waves
    (b) longitudinal waves
    (c) both transverse and longitudinal waves
    (d) neither transverse nor longitudinal waves

24. The SI unit for speed of pulse is
    (a) second
    (b) kilogram
    (c) metre
    (d) metre per second

25. A student sets up a slinky on a smooth table top with one end fixed and other end free. How can one produce transverse wave in the slinky by moving its free end?
    (a) backward and forward along the length of the slinky
    (b) up and down
    (c) left and right
    (d) at an angle of 45^0 with the table top

26. Wooden sleepers are laid below rail tracks. This ensures
    (a) more pressure on the ground by increasing area of contact
    (b) less pressure on the ground by increasing area of contact
    (c) smooth movement of the train
    (d) less cost

27. A car weighs 9000N. For this car, the recommended pressure is 18 N / cm^2. What is the area of contact of each tyre with the ground?
    (a) 500 cm^2
    (b) 250 cm^2

(c) 125 cm^2
(d) 1.62 x 10^5 cm^2

28. Before making use of spring balance, the pointer should be
(a) below zero mark
(b) above zero mark
(c) at zero mark
(d) at any mark

29. The density of which of the following cannot be measured accurately using a spring balance and a measuring cylinder?
(a) a bag filled with a liquid having a leakage
(b) a block of ice at 0^0C
(c) a small porous solid
(d) all of these

30. An iron cuboid of weight 120N has dimensions 40cm x 30cm x 10cm. The maximum pressure exerted by the iron cuboid is
(a) 10^3 Pa
(b) 3 x 10^3 Pa
(c) 4 x 10^3 Pa
(d) 12 x 10^3 Pa

31. While performing an experiment on verifying the laws of reflection of sound, the 'reflected sound' can be detected better by keeping one ear
(a) near the end of the tube and keeping the other ear closed
(b) near the end of the tube and keeping the other ear open
(c) at about 5cm from the end of he tube and keeping the other ear closed
(d) at about 5cm from the end of the tube and keeping the other ear open

32. A student while verifying the law of reflection of sound measured the angle between the incident sound wave and reflected sound wave as 110^0. The angle of reflection is
(a) 110^0
(b) 55^0
(c) 27^0
(d) none of these

33. Curved sound board may be placed behind the stage because
(a) after reflection, sound waves spread evenly across the width of the hall
(b) sound waves may be absorbed
(c) it makes the stage look beautiful
(d) it reflects the sound to a particular point in the hall

34. While verifying the laws of reflection of sound, the incident sound is directed along

(a) axis of the tube
(b) normal to the axis of the tube
(c) at an angle of 30^0 from the axis of the tube
(d) at an angle of 45^0 from the axis of the tube

35. While performing the experiment to verify the laws of reflection of sound, which of the following precautions need not be followed?
(a) the table top should be horizontal
(b) length of pipes should be sufficiently long
(c) the reflecting surface should be smooth and hard
(d) ear should not be placed close to the pipe