Bhanu's PPT

- Science & Technology

- PHYSICS
  - Part 1

Motion

1. Motion:
   We perceive an object to be in motion when its position changes with time. An object may appear to be moving for one person and stationary for some other. Ex. Passengers in a moving bus

   To describe the position of an object we need to specify a reference point called the origin.

2. Displacement:
   The shortest distance measured from the initial to the final position of an object is known as the displacement.

3. Distance:
   The total path length covered by the object is called distance.

Motion

4. Uniform Motion:
   If the object covers equal distances in equal intervals of time, it is said to be in uniform motion.

5. Non-Uniform Motion:
   When object covers unequal distances in equal interval of time, it is said to be non-uniform motion.

Speed

- The rate at which an object covers the distance is its speed.
  Speed = Distance/time
- The SI unit of speed is metre per second: m/s
  If an object travels a distance s in time t then its speed v is: v= s/t
  Average Speed = total distance travelled/ total time taken

ex. A car travels a distance of 100km in 2h.
Its average speed is 50km/h

ex. An object travels 16m in 4 sec and then 16 m in 2 sec
total distance covered= 32m
total time taken= 4+2=6sec
Average speed=32/6 =5.33 m/sec

Speed with direction

- If we specify the direction of motion of an object along with speed the information is more comprehensive.
- The quantity that specifies both speed and direction is called VELOCITY.
- Velocity is the speed of an object moving in a definite direction
- The velocity of an object can be uniform or variable. When an object is moving along a straight line at a variable speed, we can express the magnitude of its rate of motion in terms of average velocity.

Speed with direction

- In case the velocity of the object is changing at a uniform rate,
- then average velocity is given by the arithmetic mean of the initial velocity and the final velocity for a given period of time:
  Average velocity = initial velocity+ final velocity /2
  $v = u + v/_2$
- Speed and velocity have same units that is m/s

Rate of change of Velocity

- During uniform motion of an object along a straight line, the velocity remains constant with time.
  Change of velocity is zero.

- In a non-uniform motion, velocity varies with time.
  Acceleration is a measure of the change in the velocity of an object per unit time.
  that is:

  Acceleration = change in velocity/time taken

  If the velocity of an object changes from an initial value u to the final velocity v in time t
  the acceleration a is

  $$a = v-u/t$$

Rate of change of Velocity

- This time of motion is known as accelerated motion. The acceleration is taken to be positive if it is in the direction of velocity and negative when it is opposite to the direction of velocity.

  The SI unit of acceleration is m/s^2

- Ex. Starting from a stationary position. Rahul paddles his bicycle to attain a velocity of 6m/sec in 30 s. Then he applies brakes such that the velocity of the bicycle comes down to 4m/s in the next 5 s.

  Calculate the acceleration of the bicycle in both the cases.

Uniform Circular Motion

- If a athlete moves with a velocity of constant magnitude along the circular path, the only change in his velocity is due to the change in the direction of motion.
- The motion of the athlete moving along a circular path is therefore, an example of an accelerated motion.

  the circumference of a circle of radius r is given by $2\pi r$
  $v = 2\pi r/t$

  When an object moves in a circular path with uniform speed, its motion is called uniform circular motion

Uniform Circular Motion

Activity:

if we tie a small stone at one end of a piece of thread and move the stone to describe a circular path with constant speed by holding the thread at the other end.

When we release the thread, the stone will move along a straight line tangential to the circular path.

This is because once the stone is released, it continues to move along the direction it has been moving at that instant.

This shows that the direction of motion changed at every point when the stone was moving along the circular path.

Uniform Circular Motion

- When a athlete throws a hammer or a discus in a sports meet, he holds the hammer or the discus in his hand and gives it a circular motion by rotating his own body. Once released in the desired direction, the hammer or discus moves in the direction in which it was moving at the time it was released, just like the piece of stone in the activity described above. There are many more familiar examples of objects moving under uniform circular motion, such as the motion of the moon and the earth, a satellite in a circular orbit around the earth, a cyclist on a circular track at constant speed and so on.

Force and Laws of Motion

- In everyday life we observe that some effort is required to put a stationary object into motion or stop a moving object. Pushing, hitting and pulling of objects are all ways of bringing objects in motion. They move because we make a force act on them.
- Force can be used to change the magnitude of velocity of an object that is to make the object move faster or slower or to change its direction of motion. Force can change the shape and size of objects
- BALANCED AND UNBALANCED FORCES: When the forces, applied to any object, are balanced will not have any effect on the object. Balanced forces do not change the state of rest or of motion of an object.
- But if the forces applied are unbalanced the object would begin to move in the direction of the greater force.

Friction Force

- Friction force arises between two surfaces in contact. If the applied force is equal to force of friction the object will not move.
- Friction force balances the pushing force and therefore the object will not move.
- When the pushing force becomes bigger than the friction force there is unbalance in the forces and the object will start moving.
- When we ride a bicycle and we stop pedalling, the bicycle begins to slow down. This is again because of the friction forces acting opposite to the direction of motion. In order to keep the bicycle moving, we need to start pedalling again.

Laws of Motion

- An unbalanced external force is required to change the motion of the object but no net force is needed to sustain the uniform motion of the object.
  Newton's Laws of Motion:
  FIRST: An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force.
  All objects resist a change in their state of motion.
  The tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia.

Laws of Motion

- Sometimes the first law of motion is also known as the law of inertia.
- Ex. While travelling in a motor car we tend to remain at rest with respect to the seat until the driver applies a braking force to stop the car. With the application of brakes, the car slows down but our body tends to continue in the same state of motion because of its inertia.

  A sudden application of brakes may thus cause injury to us by impact of collision with the panels in front. Safety belts are worn to prevent such accidents. Safety belts exert a force on our body to make the forward motion slower.

Laws of Motion

- An opposite experience is encountered when we are standing in a bus and bus begins to move suddenly. Now we tend to fall backwards. This is because the sudden start of the bus brings motion to the bus as well as to our feet in contact with the floor of the bus. But the rest of our body opposes this motion because of inertia.

  When a motorcar makes a sharp turn at a high speed. We tend to get thrown to get thrown to one side. This is also due to inertia. We tend to continue in our straight-line motion. When an unbalanced force is applied by the engine to change the direction of motion of the motorcar, we slip to one side of the seat due to the inertia of our body.
  A groove is provided in a saucer for placing the tea cup. It prevents the cup from toppling over in case of sudden jerks.

Inertia and Mass

- There is a resistance offered by an object to change its state of motion. If it is at rest it tends to remain at rest; if it is moving it tends to keep moving. This property of an object is called its Inertia.

Heavier or more massive objects offer larger inertia. The Inertia of an object is measured by its mass. Inertia is the natural tendency of an object to resist a change in its state of motion or of rest. The mass of an object is a measure of its inertia.

Solution

- Sol: First case:
  initial velocity = 0
  final velocity = 6
  time = 30 s
  a= v-u/2. a= 6-0/30. = 0.2m/s^2

  Second case:
  initial velocity = 6
  final velocity = 4
  time = 5 s
  a= v-u/2. = 4-6/5. = -2/5. = -0.4 m/s^2

LI fi

- It is Light based Wi Fi
- Li-Fi is a bidirectional, high- speed and fully networked wireless communication technology similar to wi-fi.
- The term was coined by Harald Haas
- It is a form of optical wireless communication and uses visible spectrum as well as ultraviolet and infrared radiation
- Li-Fi could be a complement to RF communication (cellular networks)
- LED bulb can be used to send and receive data and can light a room

Aspect Ratio in TV Picture

- aspect ratio is the proportion between the width and height of an image, screen or video display. Aspect ratio is generally used to define graphic screen sizes for display resolutions.

Gravitational Waves

- These are ripples in the fabric of space-time that are produced, when black holes collide and stars explode.
- Gravitational waves were first proposed, 100 years ago by Albert Einstein as a part of Theory of Relatively
- Researchers analysing laser interferometer Gravitational Wave Observatory data have confirmed the second instance of gravitational waves recorded in Dec 2015.
- The faint ripple that eventually reached Earth was produced by the collision of two black holes at half the speed of light, 1.4 billion light years away.
- First detection was reported in February.

Pixel

- The pixel (a word invented from picture element) is the basic unit of programmable color on a computer display. Most monitors have hundreds or thousands or millions of pixels that are lit or dimmed to create an image.
- Pixel is a single point in a graphic image

The Laser Interferometer Gravitational Wave Observatory -LIGO

The proposal is to move one advanced LIGO detector from Hanford to India.

From India , Institute of Plasma Research Gandhinagar . Inter University Centre for Astronomy and Astrophysics IUCAA Pune and Raja Ramanna Centre for advanced Technology Indore are working for LIGO

LIGO

- The Laser Interferometer Gravitational Wave Observatory (LIGO) is a large scale physics experiment and observatory to detect cosmic gravitational waves and to develop gravitational wave observations as an astronomical tool.
- LIGO INDIA is a planned advanced gravitational wave observatory to be located in India as part of the worldwide network.
- LIGO India is planned as a collaborative project between a consortium of Indian research institutions and the LIGO laboratory in the USA , along with its International partners Australia, Germany and The UK.

Fish in Frozen Lake

- In cold winter months, lakes and rivers freeze over forming ice. Yet fish and other aquatic animals manage to survive. Animals like seals, penguins, walruses and a wide variety of sea birds are all fish eaters. The land is completely frozen. All liquids have a boiling point and freezing point. When water water boils at a certain temperature it turns in to steam. When it is cooled to a certain temperature it freezes and become ice. Water boils at 100 degree Celsius and freezes at 0 degree Celsius.

  However only the top layer of the lake or river freezes. Underneath the frozen upper layer the water remains in its liquid form and does not freeze.

ROBs Have Joints

- The purpose of the gap in the road on the bridge is to allow the road to expand and contract with temperature changes without causing damage or deformation to the road.

Red Eye in Photographs

- A red reflex is produced when the flash of a camera lights up the blood-rich retina.

Fuse

- A fuse is an electrical safety device that operates to provide safety to gadgets due to overcurrent.
- It melts when too much current flows through it.
- The circuit breaks and flow of current stops.
- So fuse wire need to be of low melting point.

Heavy Water

- Water is made up of hydrogen and oxygen. Normal hydrogen atom has one proton and one electron. Some hydrogen atoms have one neutron in addition to one electron and one proton.
- The addition neutron makes the atom of hydrogen heavier. Such hydrogen atoms are called Deuterium.
- The water with heavy hydrogen atoms is called heavy water. The density is about 11% higher.
- Heavy water is used in reactors of atomic power stations. It helps in moderating the nuclear reaction. The reaction does not go out of control.

Pressure Cooker

- As the pressure rises, the temperature of the water and staem inside the sealed cooker also rises above the normal 100 degrees boiling point temperature.
- At higher temperature cooking is faster.
- The higher the pressure the shorter the cooking time.
- The trapped steam increases the atmospheric pressure inside the cooker by 15 pounds per square inch (psi). It is 15 pounds above normal sea-level pressure.
- At this pressure, the boiling point of water is increases from 100 degree Celsius to 121 degree. The higher temperature is what cooks food faster.

- Thank You