



PHYSICS

SESSION-I

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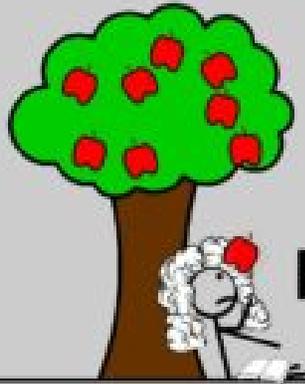


Today's Topic

BASIC PHYSICS

Issues of Discussion

1. Introduction to Basic Physics.
2. What is vectors and scalars ?
3. Discussion on Displacement Velocity , Acceleration.
4. Forces and Newton's laws of motion
5. Discussion on Work ,Power & Energy
6. Question & Answer



WHAT IS PHYSICS?

- Physics is one of the broader subjects that fall under the category of Science. It is concerned with every aspect of Universe.
- It is a scientific study that governs the physical world and natural phenomenon around us.

The several branches of Physics are –

- **Classical Mechanics** : This branch deals majorly with motions under the influence of forces. Under this branch, we look into details the aspects of linear, circular and oscillatory motions as well as motion of fluids.
- **Thermodynamics** : This branch looks at how heat as a form of energy is transformed to/from other forms of energy.
- **Electromagnetism** : This branch looks at the interaction between electric fields and magnetic fields and the applications of such interactions.
- **Geometrical Optics** : This branch takes a keen look at the behavior of light in various media.
- **Atomic Physics** : This area of study is targeted at the behavior of particles of the nucleus and the accompanying energy changes.
- **Waves** : It deals with the study of the propagation of energy through space.

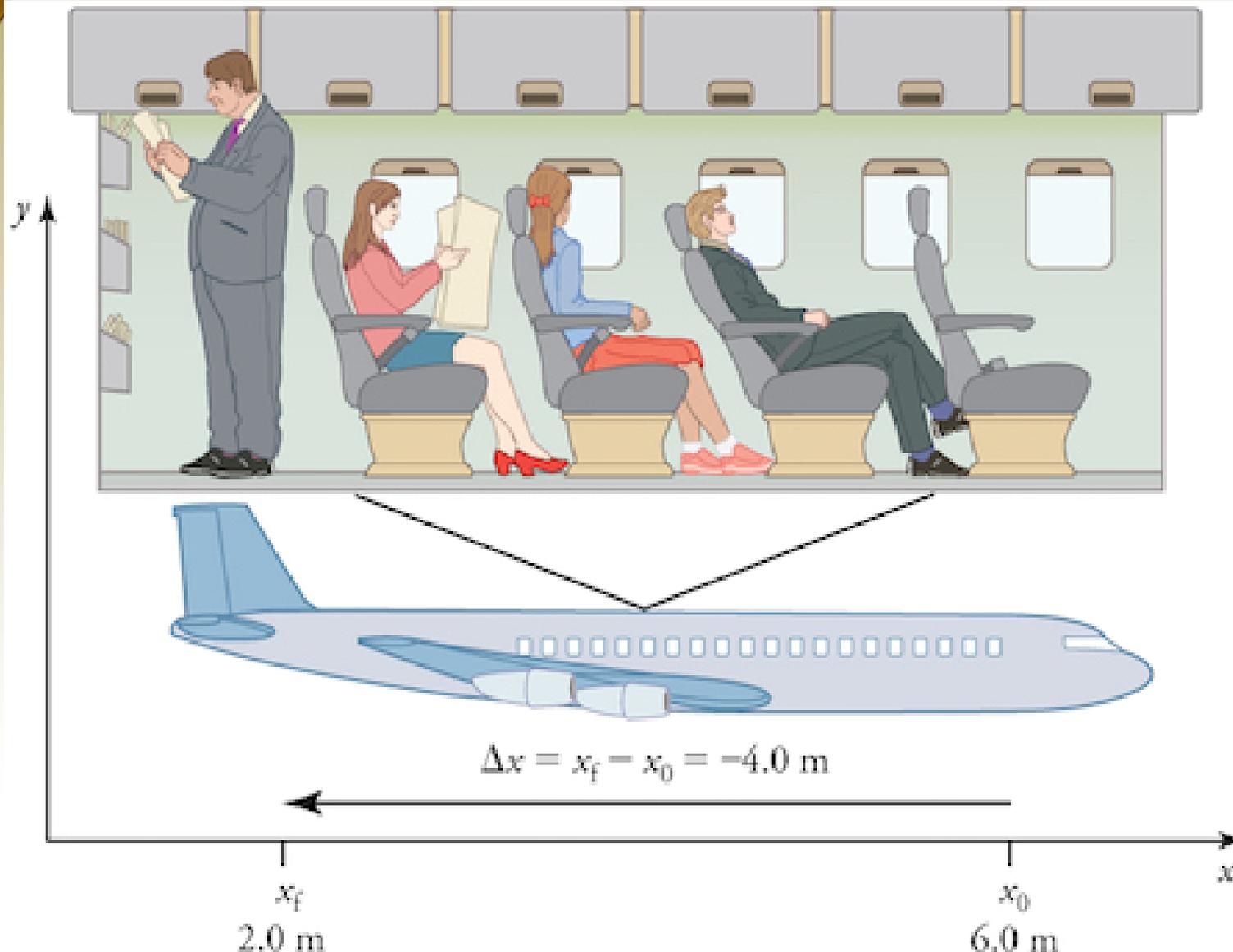


Scalar & Vector

The quantity is either a **vector** or a **scalar**. These two categories can be distinguished from one another by their distinct definitions: **Scalars** are quantities that are fully described by a magnitude (or numerical value) alone. **Vectors** are quantities that are fully described by both a magnitude and a direction.

What does displacement mean?

Example, if a passenger's position changes. The word displaced.





What is velocity?

Velocity is defined as a vector measurement of the rate and direction of motion. Put simply, velocity is the speed at which something moves in a particular direction, such as the speed of a car traveling north on a major freeway, or the speed a rocket travels as it launches into space.

Velocity Formula

The most common way to calculate the constant velocity of an object moving in a straight line is with the formula:

$$r = d / t$$

where

r is the rate, or speed (sometimes denoted as v , for velocity)

d is the distance moved

t is the time it takes to complete the movement

Units of Velocity

The SI (international) units for velocity are m/s (meters per second).

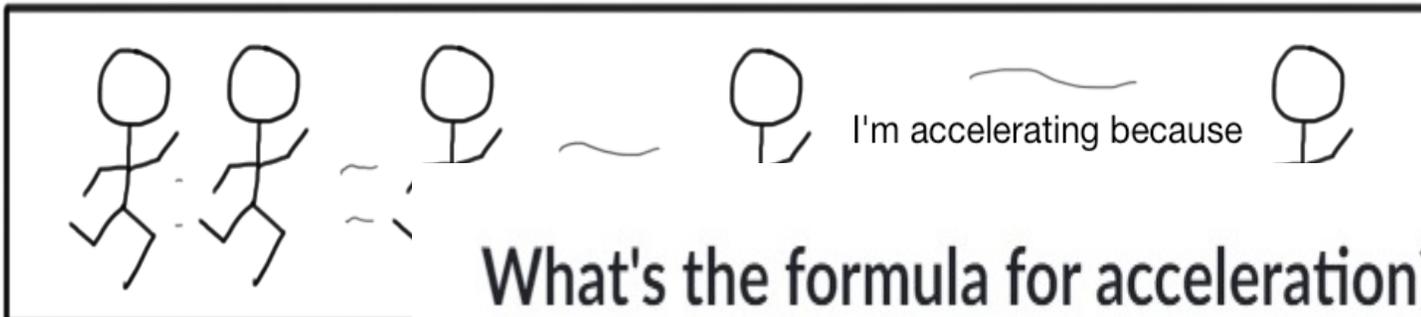
But velocity may be expressed in any units of distance per time.

Other units include miles per hour (mph), kilometers per hour (kph), and kilometers per second (km/s).



What is acceleration?

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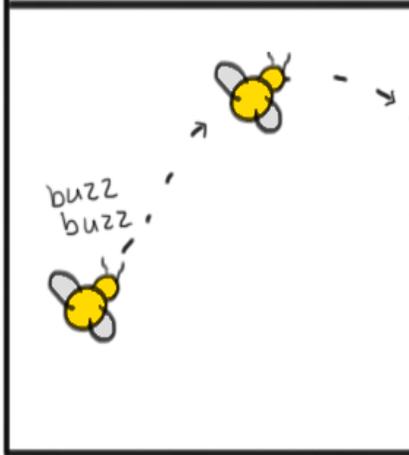


What's the formula for acceleration?

To be specific, acceleration is defined to be the rate of change of the velocity.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t}$$

The above equation says that the acceleration, a , is equal to the difference between the initial and final velocities, $v_f - v_i$, divided by the time, Δt , it took for the velocity to change from v_i to v_f .





Forces and Newton's laws of motion

- **Newton's first law:** An object at rest remains at rest, or if in motion, remains in motion at a constant velocity unless acted on by a net external force.
- **Newton's Second Law of Motion** states that force is equal to the change in momentum per change in time. For a constant mass, force equals mass times acceleration, i.e. $F = m \cdot a$.
- **Newton's third law:** If an object A exerts a force on object B, then object B must exert a force of equal magnitude and opposite direction back on object A.

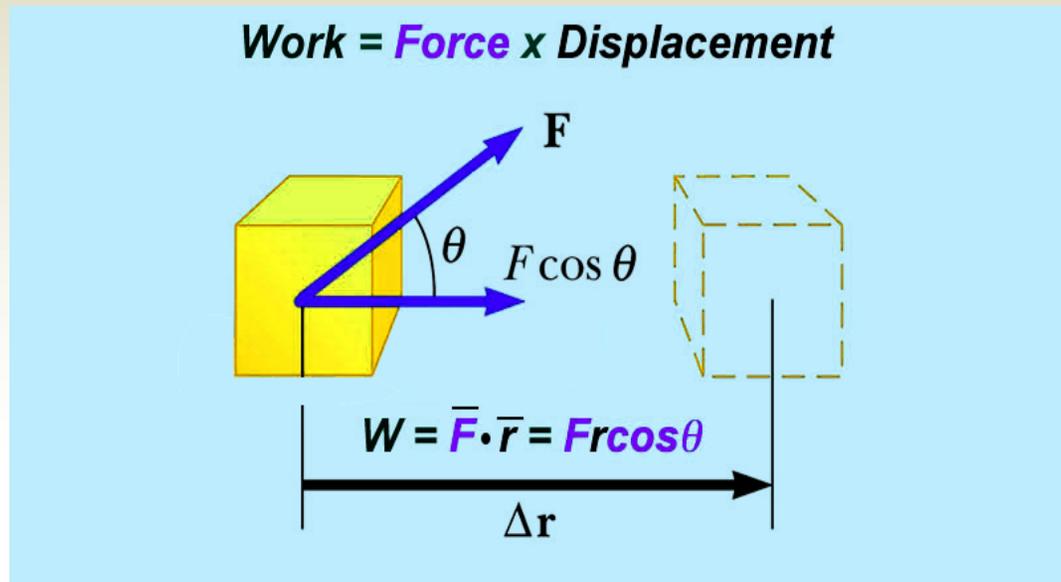


Work

- **Definition: Work** is said to be done when a force applied to an object moves that object.
- **Formula: We** can calculate work by multiplying the force by the movement of the object.

$$W = F \times d$$

- **Unit: The** SI unit of work is the joule (J)





Energy

- **Definition:** We can define energy as the capacity to do work. The law of conservation of energy states that energy can neither be created nor be destroyed. It can only be transferred from one form to another.
- **Formula:** For the potential energy the formula is
P.E. = mgh , for kinetic energy the formula is $KE = \frac{1}{2} mv^2$
- **Unit:** The SI unit of energy is joules (J), which is named in honour of James Prescott Joule.

The Equivalence of Mass and Energy

An equation given by Einstein explains the relationship equivalence of mass and energy. According to it, the energy of a body is equal to the products of the mass of the body and the square of the speed of light. The famous equation is $E = mc^2$

Where E is the energy, m is the mass of the body and c is the speed of light in a vacuum which is approximately equal to 3×10^8 m/sec.



What is Power?

- We can define power as the rate of doing work, it is the work done in unit time. The SI unit of power is Watt (W) which is joules per second (J/s). Sometimes the power of motor vehicles and other machines are given in terms of Horsepower (hp) which is approximately equal to 745.7 watts.

Power Formula

Power is defined as the rate at which work is done upon an object. Power is a time-based quantity, which is related to how fast a job is done. The formula for power is mentioned below.

Power = Work / time

$P = W / t$

Unit of Power

The unit for standard metric work is the Joule and the standard metric unit for time is the second, so the standard metric unit for power is a Joule / second, defined as a Watt and abbreviated W.



Solved Example for You

Q: Which of the following is/are true about force:

- A. Force will always change the magnitude of velocity
- B. Force will always change the direction of the velocity
- C. S.I unit of force is Newton
- D. All of the above

Sol.: Force does not always change the magnitude of the velocity.

Example: Centripetal force, It changes the only direction of motion but not the magnitude of the velocity. Force does not always change the direction of motion. Example: Linear motion, the friction only reduces the velocity of the body but does not change the direction. SI unit of force is Newton.



Question

1. A car starts from rest and speeds up uniformly to 12 meters per second in a time of 3 seconds. What was the magnitude of the average acceleration of the car?
2. A 60-watt bulb is switched on 24 hours a day and there is another 60-watt bulb which is turned on for only 12 hours. Find the energy consumed by both the bulbs in one day. Find the total electricity charge?(Rs 10/unit)
3. An object is horizontally dragged across the surface by a 100 N force acting parallel to the surface. Find out the amount of work done by the force in moving the object through a distance of 8 m
4. A garage hoist lifts a truck up 2 meters above the ground in 15 seconds. Find the power delivered to the truck. [Given: 1000 kg as the mass of the truck]
5. A 70N force is applied horizontally to a 10kg block at rest for a displacement of 200m across a frictionless surface
 - a) How much work done by the force?
 - b) What is the final kinetic energy?
 - c) How fast is the block moving?
 - d) What is the acceleration of the block horizontal in the direction?
 - e) Use kinematics to calculate the final speed of work?