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GENERAL PHYSICS

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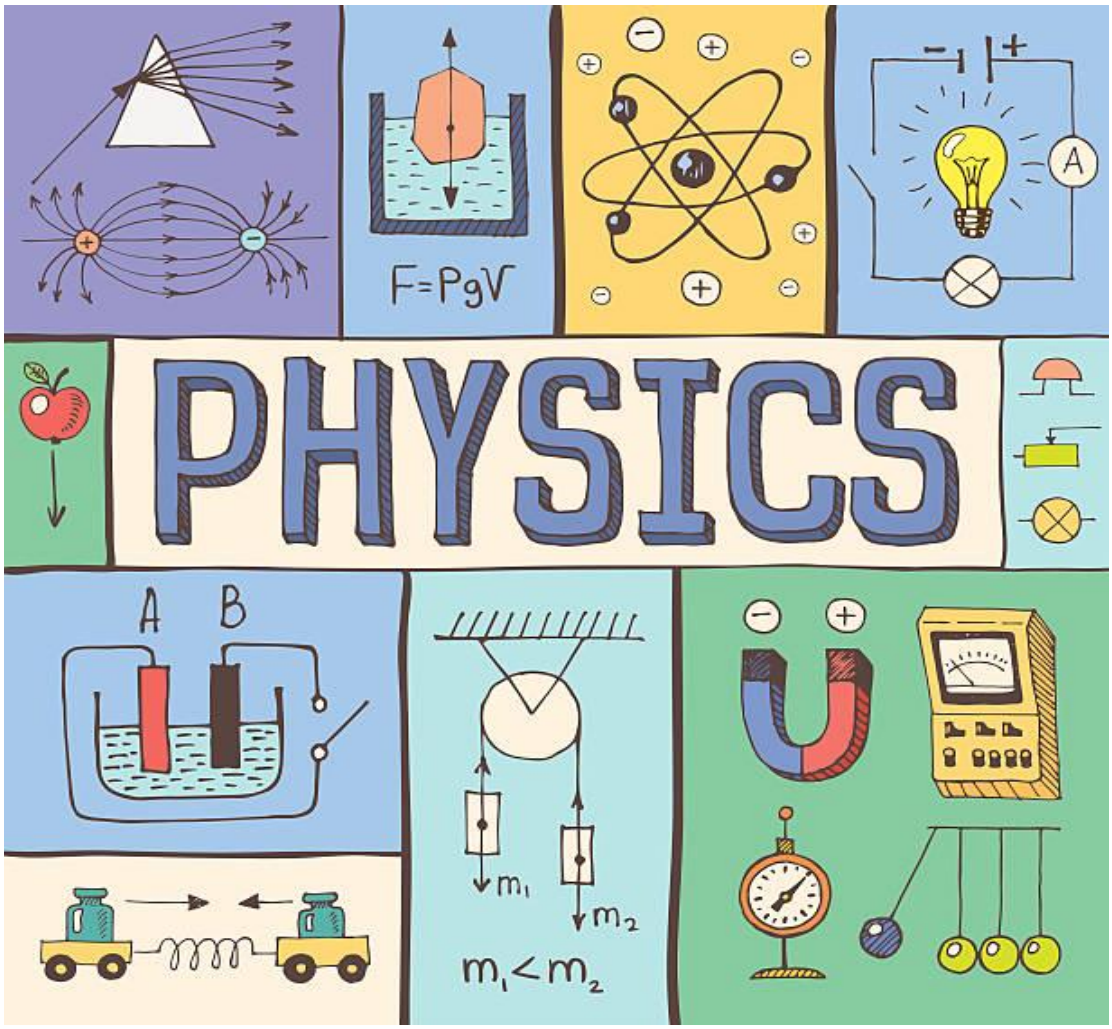
LECTURE (2)



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NEWTON'S LAWS OF MOTION / THE VELOCITY /ACCELERATION

Newton's laws of motion, three statements describing the relations between the forces acting on a body and the motion of the body, first formulated by English physicist and mathematician Isaac Newton, which are the foundation of classical mechanics.

Newton's first law (Inertia)

If a body is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force.

A bicycle or car will keep moving unless the rider or driver applies a frictional force through the brakes to stop it. A driver or passenger in a moving car who is not wearing a seat belt will be thrown forward when the car suddenly stops because he remains in motion. A fastened seat belt provides a restraining force on the passenger's or driver's motion.

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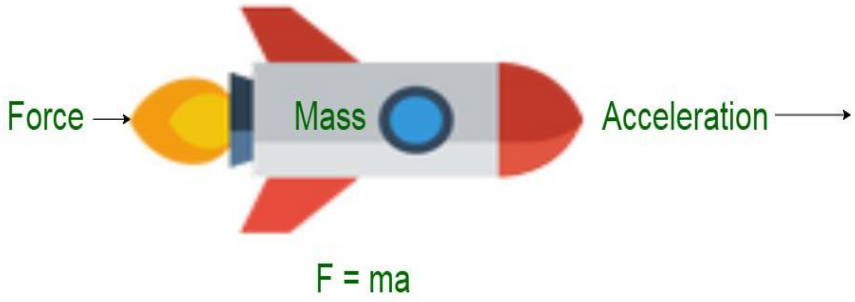
Second Law: Force and Acceleration : F = ma

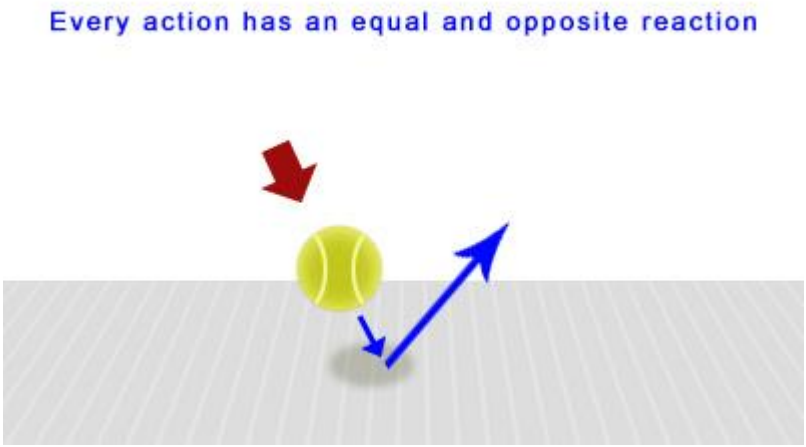
Newton's second law defines the relationship between the change in the speed of a moving object -- its acceleration -- and the force acting upon it. This force equals the object's mass multiplied by its acceleration. It takes a smaller extra force to propel a small yacht at sea than to propel a supertanker because the latter has a greater mass than the former.



Third Law: Action and Reaction

Newton's third law states that there are no isolated forces. For each force that exists, one of equal magnitude and opposite direction acts against it: action and reaction. For example, a ball thrown onto the ground exerts a downward force; in response, the ground exerts an upward force on the ball and it bounces. A person is unable to walk on the ground without the ground's frictional force. When he takes one step forward, he exerts a backward force on the ground. The ground responds by exerting a frictional

force in the opposite direction allowing the walker to move forward as he takes a further step with his other leg.



Acceleration: is the rate of change of an object's speed; in other words, it's how fast velocity changes. According to Newton's second law, acceleration is directly proportional to the summation of all forces that act on an object and inversely proportional to its mass.

It's all common sense – if several different forces are pushing an object, you need to work out what they add up to (they may be working in different directions) and then divide the resulting net force by your object's mass.

At rest thus measures the acceleration of gravity, which on the Earth's surface is about (9.80665 m/s^2). In other words, this is the acceleration due to gravity that any object gains in free fall when in a vacuum.

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$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$a = \Delta v / t$$

Velocity:

The terms velocity and speed give us an idea of how fast or slow an object is moving. Quite often, we come across situations where we need to identify which of the two or more objects is moving faster. One can easily tell the faster of the two if they are moving in the same direction on the same road.

According to the velocity meaning, it can be defined as the rate of change of the object's position with respect to a frame of reference and time. It might sound complicated, but velocity is basically speeding in a specific direction. It is a vector quantity, which means we need both magnitude (speed) and direction to define velocity. The SI unit of it is metre per second (ms^{-1}). If there is a change in magnitude or the direction of the velocity of a body, then it is said to be accelerating.

Velocity Formula $= (xf - xi)/t = \Delta x/t$ Where,

v = Velocity (m/s)

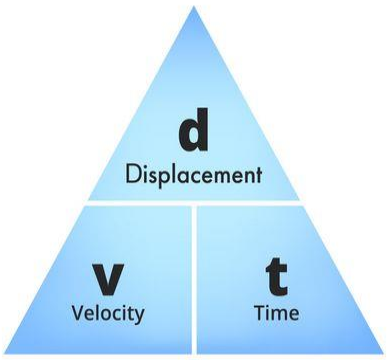
xf = The final position (m)

xi = The initial position (m)

t = The time required

Δx = "The change in" position (m)

VELOCITY FORMULA



$v = d / t$

$t = d / v$

$d = v \cdot t$

Difference Between Speed and Velocity	
Velocity	Speed
It refers to the displacement of a given object over a time interval.	It refers to the distance moved by an object over a time interval.
It has a specific direction	It does not have any direction.
Velocity = $\frac{\text{displacement}}{\text{time}}$	Speed = $\frac{\text{distance}}{\text{time}}$
Velocity can hold a negative value	Speed cannot hold a negative value.