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Physics for revision for

Competitive examinations such as CSE (Preliminary)

Ch 4 Motion in One Direction

Acceleration does not Determine direction, While Velocity determines Direction of the motion.

REST: A body is said to be at rest, if it does not change its position with respect to its surroundings.

MOTION: A body is said to be in motion, if it changes its position with respect to its immediate surroundings.

Speed, Velocity and Acceleration:

(c) Speed of a body is the rate of change of distance with time. It is the distance travelled in one second (1s) . Speed (V) = Distance (S) / Time (T)

(d) Velocity: of a body is the distance travelled per second in a specified direction See table on pge 43.

(e) Acceleration is the rate of change of velocity with time in one second.

Distance and Displacement:

(a) Distance is the length of the path traversed by a body. It may or may not be a straight path.

(b) Displacement: is the shortest distance from the initial position to the final position. The magnitude of displacement is the direction from the initial position of rest. See table on page 44.

A body is said to be in a 'One Direction Motion' when it moves along a straight line path. It is also called 'Rectilinear 'or a 'straight line ' motion

Speed and Graph of distance time and speed time

Displacement-time graph

- Time is on X axis, and displacement is on Y axis. The slope of displacement gives the Velocity.

Velocity –time graph

- Time is on X axis, and Velocity is on Y axis. As velocity is a vector quantity, positive velocity would indicate the body moving away from 0 representing the initial position of Rest. Negative velocity would indicate its movement in the opposite direction. Through the graph the displacement of the body in certain time intervals and the acceleration of the body can be determined.

Acceleration –time graph

- Time is on X axis, and acceleration is on Y axis. The area enclosed in the graph will give the change in speed of the body.

6. Pressure in Fluids and Atmospheric Pressure

Thrust is the force acting normally on a surface, when force is applied perpendicularly to the surface.

Thrust = weight of the body.

Thrust exerted by a body on the surface, is equal to the weight of the body.

Thrust is a vector quantity.

It is measured in units of force of newton (N), and S. I. Unit of its measure is 'dyne'.

The gravitational unit of thrust is kgf.

1 kgf = 9.8N and 1 gf = 980 dyne.

One Pascal is the pressure exerted on a surface of area 1 metre square by a force of 1 N acting normally on it.

Atmospheric pressure is measured as a height of mercury column. It is also expressed as the barometric height of 0.76m of Hg or 760 mm of Hg, at sea level.

Pressure is the thrust per unit area of surface . P = F/A.

Pressure is a scalar quantity, and is depended on two factors: (a) thrust (b) area on which thrust is applied.

The effect of a thrust is less on a large area, and it is more on a small area. Therefore, pressure on surface can be increased by making the surface smaller , and decreased by making is larger.

Fluid is a substance that can flow. All liquids and gases are fluids.

Solids exert pressure at the bottom of the surface on which they are placed.

Fluids exert pressure at the bottom as well as along the side walls of the container in which they are placed. Fluids therefore, exert pressure at all points and in all directions.

Pressure P = h p g = depth x density of liquid x acceleration due to gravity. Total pressure = Atmospheric pressure + pressure due to liquid column.

7. Up thrust or Buoyancy and Archimedes's Principle

The property of liquid to exert an upward force on a body immersed in it, is called buoyancy.

Properties of buoyancy: (a) Larger the volume of the body submerged, the greater is the buoyancy.

(b) Higher the density of the fluid, more is the buoyancy.

Archimedes's Principle states that when a body is immersed partially or completely in a liquid, it experiences an up thrust, which is equal to the weight of liquid displaced by it. This principle applies to gases also.

(c) The centre of gravity of the body is replaced by the centre of buoyancy , created by the up thrust of the fluid on the submerged body, to keep it afloat.

Buoyancy is the weight of the liquid displaced by the submerged part of the body

Factors affecting the magnitude of buoyancy are

(a) volume of body submerged in the liquid

(b) the density of the liquid.

Pressure increases with depth inside the liquid.

Solid bodies with density higher than the density of the fluid , sink.

Only those with density lower than the density of the fluid , floats

Factors affecting pressure in fluids

(1)Depth of the point below the free surface indicated by letter ‘h’.

Pressure is directly proportional to the depth h from the free surface.

(2) Acceleration due to gravity (g)

(3) Density of liquid is written as p. Pressure is directly proportional to the density of the liquid.

As the density of sea water is more than that of river water, the pressure at the same depth in the sea will be more than that in the river.

Five Laws of Liquid Pressure:

(1) A liquid seeks its own level

(2) Pressure at a point inside liquid increases with the depth from its free surface

(3) In a stationary liquid , pressure is same at all points on a horizontal plane.

(4) In liquid , pressure is same in all directions around a point.

(5) Pressure at same depth is different in different liquids . It increases and decreases with the density of liquid.

Due to these laws, the water supply tank is constructed at a height and walls of a dam are made thicker at the base.

Pascal’s law on transmission of pressure in liquids states that the pressure exerted anywhere in a confined liquid is transmitted equally and undiminished in all directions throughout the liquid .

This law is applied in hydraulic machines, such as hydraulic press for bale of cotton, hydraulic jack, hydraulic brakes.

8 Floatation and Relative Density

Principle of Floatation: (a) The weight of the body and its centre of gravity has the tendency to sink the body. The centre of gravity is therefore, displaced by the centre of buoyancy , to counter the sink thrust with an up thrust that keeps the body afloat.

(b) the up thrust buoyant force is equal in magnitude to the weight to the liquid displaced by the submerged part of the body.

- (c) As the weight of gravity that tries to sink the body, is counter balanced by the buoyant force that keeps it afloat, the apparent weight of the body is deemed to be zero.

There is no change in level of water after a piece of floating ice melts.

Density of the floating body divided by density of liquid gives the weight of liquid displaced by it.

In sum, the principle of floatation states that the weight of a floating body is equal to the weight of the liquid displaced by its submerged part.