



I.N.E.T.

OFFICERS ENTRY

Indian Navy Entrance Test

Part - 4

General Science



INDIAN NAVY ENTRANCE TEST

CONTENTS

Physics

1.	Quantity and Measurement	1
2.	Motion	4
3.	Force	11
4.	Work, Power and Energy	15
5.	Gravity	18
6.	Elasticity, Surface Tension, Bernoulli's Theorem and Pascal's law	19
7.	Viscosity	24
8.	Simple Harmonic Motion (SHM)	25
9.	Sound	27
10.	Heat and Temperature	30
11.	Light	32
12.	Electricity and Magnetism	46
13.	Modern Physics	52
14.	Radioactivity	54
15.	Communication Space Science	59
16.	Telecommunication	60

Chemistry

17.	Matter	64
18.	Mixture	65
19.	Gas Laws	68
20.	Atom	69
21.	Acid, Base and Salts	76
22.	Chemical reaction and Equation	83
23.	Batteries	85
24.	Chemical Bonding	88
25.	Elements, Metals and non-metals	91

26.	Synthetic Materials (Glass, Cement, Fertilizers)	106
27.	Polymerization	111
28.	Hydrocarbons	116
29.	Atmospheric pollution	123

Biology

30.	Classification of living organisms	129
31.	Nutrition	136
32.	Digestion	138
33.	Nutrition and Gaseous Exchange in Plants	149
34.	Human Circulatory System	154
35.	Excretion	161
36.	Respiration (Plant and Animal)	163
37.	Reproduction (Plant and Animal)	169
38.	Blood	185
39.	Cell and Animal Tissues	186
40.	Blood Group and Transfusion	201
41.	Nervous System	207
42.	Plant Tissue	211
43.	Endocrine System	213
44.	Plant Hormones	217
45.	Vitamin	218
46.	Diseases and Vaccines	220
47.	Important Facts - Virus, Root, Leaves, Algae, Fungi and Bacteria	225

Physics

PHYSICS

Quantity & Measurement :->

Quantity =>

Anything which is expressed in number is called quantity.

Physical Quantity

Scalars

↓
 Quantities which have magnitude only
Exp:- Mass, Temperature, Density, Volume, electric current, work etc.

Vectors

↓
 Quantities which have both magnitude and direction. and represented by (->) sign. and called vectors
Exp:- Displacement, linear momentum, angular velocity, torque, magnetic field intensity, electric displacement, current density etc.

measurement :->

To measure any quantity

Fundamental Units
 Units of ↓

Exp:- Length, Mass, time, Temperature, electric current, luminous intensity, Amount of substance.

Derived Units
 Units of

Exp:- Area, speed, density, volume, momentum, force, acceleration etc.

System of Units :->

Usually physical quantities are measured in 4 system of units -

- (i) CGS System (centimeters, gram, second)
- (ii) FPS System (Foot, pound, second)
- (iii) MKS System (Meter, kilogram, second)
- (iv) SI System (International System of Unit)

Supplementary Units of SI System :->

(i) Radian \Rightarrow All plane angles are measured in radian. Symbol = rad.

(ii) Steradian \Rightarrow All the solid angles are measured in 'steradian' Symbol = 'sr'

Fundamental Unit			Derived Units	
Physical Quantity	SI Units	Symbol	Physical Quantity	SI Units
Length	metre	m	Area	m^2
Mass	kilogram	kg	Volume	m^3
Time	second	s	Density	kg/m^3
Electric current	Ampere	A	Velocity	m/s
Temperature	Kelvin	θ or K	Force	kg/m^2 or Newton
Luminous intensity	Candela	cd	Momentum	$kg \cdot m/s$

Amount of substance	male	mal		
			Pressure	N/m^2 or Pascal
			work or Energy	N/m or Joule
			magnetic field intensity	$N\text{-amp}^{-1}m^{-1}$ or Tesla or Weber/ m^2
			Power	$kg\ m^2/s^3$ or Watt
			charge	amp-sec or Coulomb
			Resistance	Volt/ampere or ohm

Units of length or Distance :->

1 km = 1000m

1 fermi = $10^{-15}m$

1 light year = 9.46×10^{15} meters

1 Angstrom = $10^{-10}m$

Unit of Mass :->

10 ounce - oz = 28.35 gm

1 pound - lb = 16 oz

1 Quintal = 100 kg

1 metric ton = 1000 kg

Units of time :->

1 Lunar month = 28 days = 4 weeks

1 Solar month = 30 or 31 days

28 or 29 days (Feb)

1 Leap year = 366 days

Units of Area →

$$\begin{aligned} 1 \text{ acre} &= 4840 \text{ Sq. yard} \\ &= 48560 \text{ Sq. feet} \\ &= 4046.94 \text{ Sq. metre} \end{aligned}$$

$$1 \text{ hectare} = 2.5 \text{ acr}$$

Motion →

A body is said to be in Motion. If the position of body changes with time. But if the position of body does not change with time then it is said to be in rest.

Types of Motion →

1. Rectilinear and Translatory Motion →

If a body (particle) moves along a straight line then the motion is called translatory motion.

for exp → Motion of a train.

2. Circular and Rotatory Motion →

If a body move along a circular path it is called circular motion. But if a body rotates ~~circular~~ about a line (axis) passing through it is called rotatory motion.

3. Oscillatory and Vibratory motion :->

In motion in which a body (particle) moves to and fro/back and forth repeatedly about a fixed point is called oscillatory motion.

If in oscillatory motion the amplitude is very small then the motion of the body is called vibratory motion.

Distance \Rightarrow Speed \times Time

SI Unit \Rightarrow meter

Displacement :->

The least distance travelled by a body between the initial and final points of a straight line motion in a definite direction is called displacement.

It is a vector quantity and can be (-ve), (+ve) or zero, its SI unit is meter.

Velocity :->

Velocity of a body is the rate of change of its position in a fixed direction. It is a vector quantity, its value may be +ve, -ve or zero and its SI unit is ms

Speed :->

Total distance covered by a body between the initial and final points of a straight line in unit time is called speed of the body.

It is a scalar quantity and its SI Unit is ms^{-1}

$$\text{Average Speed} = \frac{\text{Total distance travelled}}{\text{Total time elapsed}}$$

$$V_{av} = \frac{d}{t} \text{ m/sec}$$

∴ $d = \text{distance}$
 $t = \text{change in time}$

$$\text{Average Velocity} = \frac{\text{Total displacement}}{\text{Total time}}$$

$$V_{av} = \frac{\Delta x}{\Delta t} \frac{\text{m}}{\text{sec}}$$

∴ change in position

$$\therefore \Delta x = x_2 - x_1$$

change in time

$$\Delta t = t_2 - t_1$$

Instantaneous Velocity ⇒

Velocity of a body at a particular instant or moment of time is called instantaneous velocity.

$$\vec{v} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t}$$

Acceleration :->

The rate of change of the body is called acceleration of the body. Acceleration is a vector quantity and its SI unit is ms^{-2}

$$\left[\frac{d\vec{v}}{dt} = \frac{d^2\vec{x}}{dt^2} \right]$$

Positive Acceleration :->

If the velocity of an object increases in the same direction the object has a positive acceleration.

Negative Acceleration :->

If the velocity of a body decreases in the same direction the body has a negative acceleration.

Ex:- A train slows down

Relative Motion and Relative Velocity :->

The motion of an object B with respect to object A which is a moving or stationary is called as relative motion.

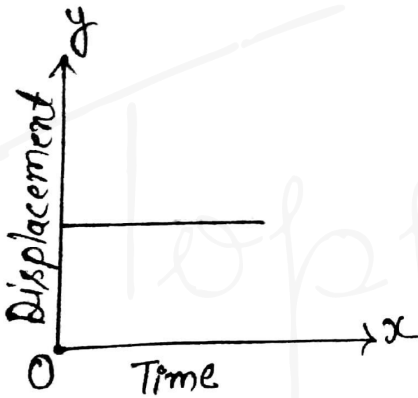
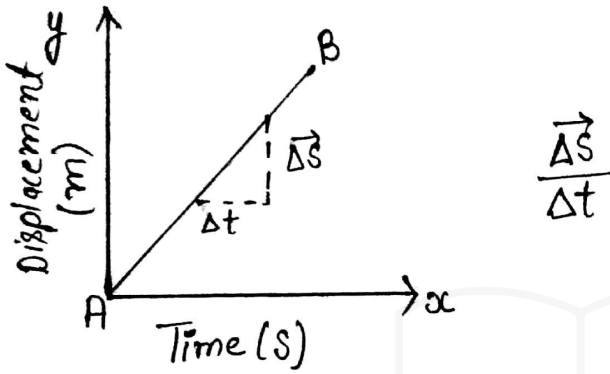
Relative velocity of an object B with respect to object A when both are in motion is the rate of change of position of object B with respect to A.

$$\text{relative velocity } \vec{v}_{BA} = \vec{v}_B - \vec{v}_A$$

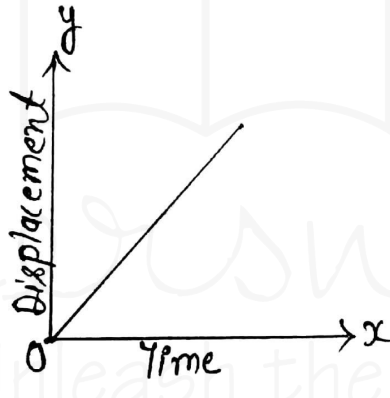
$$\text{and } \vec{v}_{AB} = \vec{v}_A - \vec{v}_B$$

Graphical representation of Motion is A straight line:

1) Displacement - time Graphs →



a) Constant Velocity

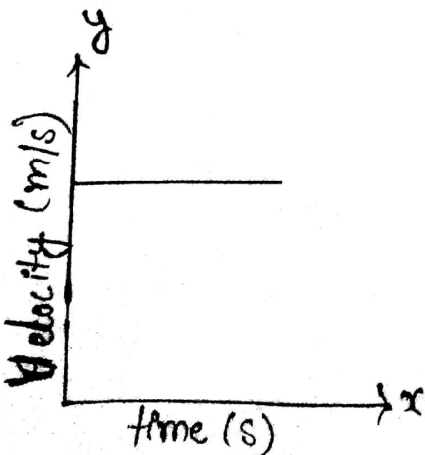


(b) Uniformly Accelerated motion

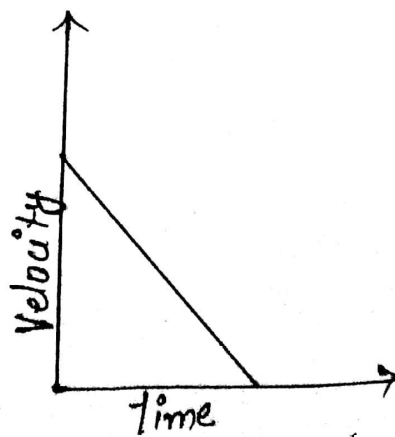


(c) Constant Accelerated motion

2) Velocity - time Graphs →

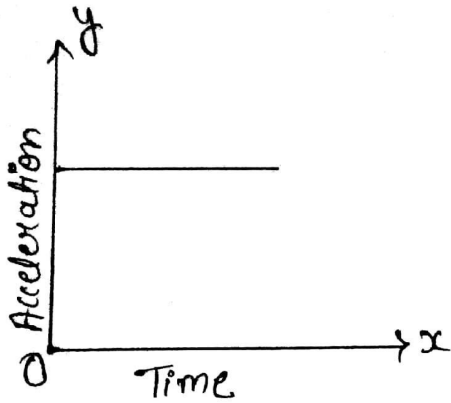


(zero) constant acceleration

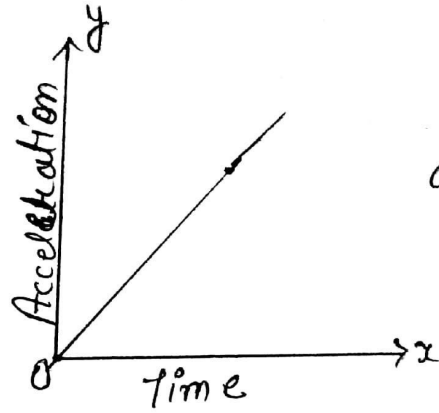


-ve acceleration

3). Acceleration - Time Graph →



Constant acceleration



Rate of change of acceleration with time

$$a = \frac{\Delta v}{\Delta t}$$

Equation of motion are -

1. $v = u + at$

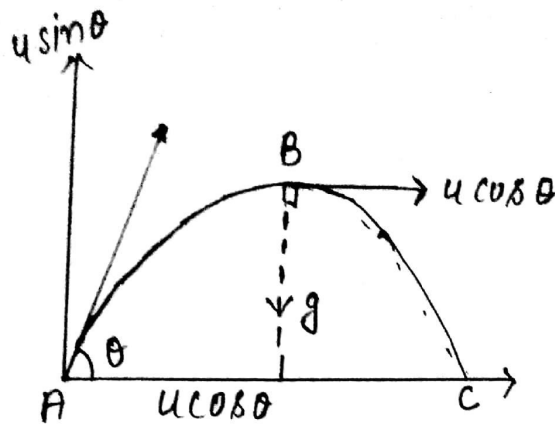
2. $s = ut + \frac{1}{2}at^2$

3. $v^2 = u^2 + 2as$

u = initial velocity
 v = final velocity
 a = acceleration
 t = time interval
 s = Displacement

Projectile Motion →

Projectile refers to an object that is in flight after being thrown or projected. The motion of a projectile is called projectile motion.



eg. • Throwing a Ball

• The motion of the earth around the sun
 time of Ascent

$$t_a = \frac{u \sin \theta}{g}$$

time of flight

$$t_f = \frac{2u \sin \theta}{g}$$

$$\text{maximum height } H = \frac{u^2 \sin^2 \theta}{2g}$$

Laws of Motion :->

In 1687 Sir Issac Newton propounded the 3 laws of motion.

1. First law (Law of Inertia) =>

An object continues in a state of rest or a state of motion unless some external force is applied to it

$$\boxed{\Sigma F = 0 \Leftrightarrow \frac{dV}{dt} = 0}$$

Eg. leaning in the opposite direction when train suddenly starts.

2. Second law (law of measurement of force) :->

The rate of change of linear momentum (P)

$$F = \frac{dP}{dt} = \frac{d(mv)}{dt} = m \frac{dv}{dt} = ma$$

of a body is directly proportional to the force applied.

3. Third law (law of the Action and Reaction) :->

The third law states that to every action, there is an equal and opposite reaction.

Exp:-

- During firing of a bullet the gun recoils back with a great force.
- Motion of rocket
- Swimming in a pond

Force :->

A force is that physical quantity which tries to change the state of rest of a body.

Units of force :->

SI Unit = Newton

CGS System = dyne

MKS System = kilogramme force

1 Newton = 10^5 dyne

Momentum :->

momentum = product of mass and velocity

$$\vec{p} = m\vec{v}$$

SI Unit = kg m/s

- Example :->
- To hit nail in depth, a heavy hammer is used
 - To avoid injuries in cricket players taking a catch move their hands in the direction of the motion of the ball.

Elastic and Inelastic Collision :->

A collision in which there is no loss of kinetic energy is called elastic collision and in an inelastic collision kinetic energy is lost during collision

Gravitational Force :->

Everybody in our universe interacts (attracts) with each other which is called Gravitation. The gravitational force is the weakest among all existing forces.

Frictional Force →

Friction is a resistance to the relative motion between two objects in contact.

An opposing force retards its motion and this force is called frictional force.

Types of frictional force →

- (a) Static frictional force
- (b) Kinetic or sliding frictional force

Centripetal force (Real force) →

If m be the mass of object then it experiences a force which directs towards the centre of the circular path and has a magnitude given by

$$F_c = ma = \frac{mv^2}{r}$$

Ex: - planetary motion of sun and planets.

Centrifugal force / Pseudo force / fictitious force →

The virtual force which balances the centripetal force in uniform circular motion is called as centrifugal force. It is not a real force.

- Eq: -
- Cream separator
 - Washing machine drum
 - Merry-go-round.

Moment of Inertia :->

The opposition that the body exhibits to having its speed of rotation about an axis altered by the application of a torque

$$I = Mr^2$$

SI Unit = kg m^2

Radius of Gyration :->

The Radius of gyration can be mathematically expressed as

$$I = MK^2$$

Radius of Gyration $K = \sqrt{\left(\frac{I}{m}\right)}$

Moment of Inertia of Bodies :-

- | | |
|-----------------------|------------------------|
| 1. Circular ring | $I = MR^2$ |
| 2. Thin circular ring | $I = \frac{MR^2}{2}$ |
| 3. Thin rod | $I = \frac{ML^2}{12}$ |
| 4. Circular disc | $I = \frac{MR^2}{2}$ |
| 5. Circular disc | $I = \frac{MR^2}{4}$ |
| 6. Solid cylinder | $I = \frac{MR^2}{2}$ |
| 7. Hollow cylinder | $I = MR^2$ |
| 8. Solid sphere | $I = \frac{2}{5} MR^2$ |

Work →

Work is defined as the product of the force and displacement in the direction of the applied force.

$$W = F \cdot x = Fx \cos \theta$$

SI Unit = newton-metre or Joule

Energy / Power →

Energy is Capacity to do work.

$$\text{power (P)} = \frac{\text{work done (W)}}{\text{time Interval (t)}}$$

The power of machines are expressed in Horse power (H.P)

$$1 \text{ HP} = 746 \text{ watt}$$

Unit for electrical-energy = kilowatt-hour (KWh)

$$1 \text{ Kwh} = 1 \text{ kw} \times 1 \text{ hour}$$

$$= (1000 \text{ watt}) \times (3600 \text{ s})$$

$$= 1000 \text{ J/s} \times 3600 \text{ s}$$

$$= 3600000 \text{ Joules} = 3.6 \times 10^6 \text{ Joule}$$

Kinetic Energy	potential Energy
Kinetic Energy of an object is the energy that it possessed due to its motion.	potential energy is that energy which an object has because of its position
$KE = \frac{1}{2} mv^2$	$U = PE = mgh$