# 9th Class 2015

| Physics | Group-II | Paper-I |
|---|---|---|
| Time: 15 Minutes | (Objective Type) | Marks: 12 |

**Note:** Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

**1-1- The least count of Vernier Calliper is:**

(a) 0.1 mm √ (b) 0.01 cm

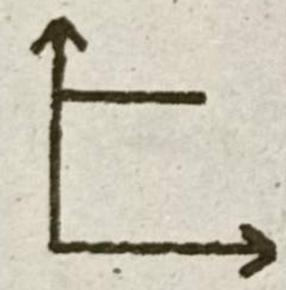
(c) 0.1 cm (d) 0.01 mm

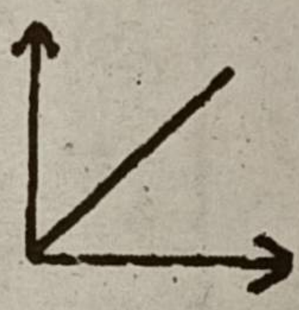
**2- The motion of body in straight line is:**

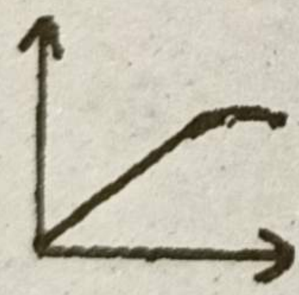
(a) Random motion (b) Circular motion

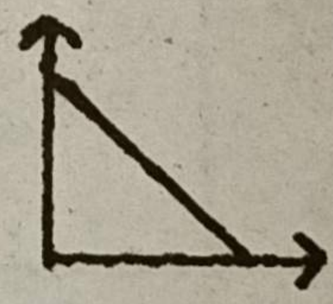
(c) Linear motion √ (d) Translatory motion

**3- The graph of uniform acceleration is:**

(a) 

(b)  √

(c) 

(d) 

**4- The unit of momentum is:**

(a) Nm (b) $Ns^{-1}$

(c) $kg\ ms^{-2}$ (d) $kg\ ms^{-1}$ √

**5- In isolated system the momentum after collision of two bodies is:**

(a) Increases (b) Constant √

(c) Decreases (d) Zero

**6- The number of forces that can be added by head to tail rule are:**

(a) 2 (b) 3

(c) 4 (d) Any number √

7- **A body is in equilibrium when its:**

(a) Acceleration is uniform

(b) Speed and acceleration are uniform

(c) Speed is uniform √

(d) Acceleration is non-uniform

8- **The value of 'g' at moon is:**

(a) 1.7 $ms^{-2}$ (b) 1.6 $ms^{-2}$ √

(c) 10 $ms^{-2}$ (d) 9.8 $ms^{-2}$

9- **In Einstein's mass-energy equation, c is the:**

(a) Speed of sound (b) Speed of light √

(c) Speed of earth (d) Speed of electron

10- **In which of the following state molecules do not leave their position:**

(a) Liquid (b) Solid √

(c) Gas (d) Plasma

11- **Which one part affects evaporation:**

(a) Surface area of the liquid

(b) Temperature

(c) Air (d) All of these √

12- **In solids heat is transferred by:**

(a) Radiation (b) Convection

(c) Conduction √ (d) Convection and radiation

# 9th Class 2015

| Physics | Group-II | Paper-I |
|---|---|---|
| Time: 2.45 Hours | (Subjective Type) | Marks: 63 |

## (Part-I)

**2. Write short answers to any Five (5) questions: 10**

**(i) Change 16 years age into seconds.**

**Ans** Age = 16 year

Days in one year = 365

Hours in one day = 24

Second in one hour = $60 \times 60$

$16 \times 365 \times 24 \times 60 \times 60 = 504576000$ Seconds

**(ii) What is meant by Vernier Constant?**

**Ans** Vernier constant or least count is the minimum distance that can be measured with the help of vernier callipers.

**(iii) Define the terms velocity and acceleration.**

**Ans** The rate of displacement of a body is called its velocity.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{time}}$$

$$v = \frac{S}{t}$$

Acceleration is defined as the rate of change of velocity of a body.

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

$$\text{Acceleration} = \frac{\text{final velocity - initial velocity}}{\text{time taken}}$$

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

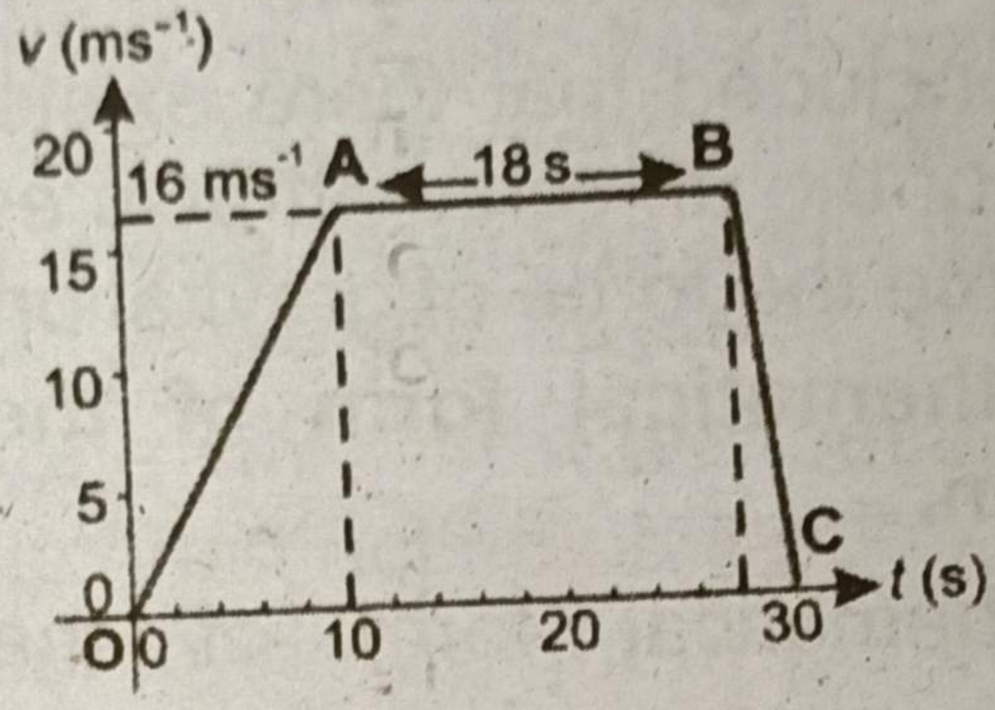
**(iv) Define Scalars and Vectors.**

**Ans** A physical quantity which can be completely described by its magnitude and unit is called a scalar. A

vector can be described completely by magnitude, unit and along with its direction.

**(v) What would be the shape of a speed-time graph of a moving body with variable speed?**

**Ans** The shape of a speed-time graph of a moving body with variable speed is given below:




**(vi) Define Inertia.**

**Ans** Inertia of a body is its property due to which it resists any change in its state of rest or motion.

**(vii) Differentiate between mass and weight.**

**Ans**

1. Mass is scalar but weight is vector.
2. Mass is a fixed quantity at any place whereas weight of a body will be different at different places due to different values of g.

**(viii) The weight of a body is 147N. What will be its mass? (Value of g is 10 $ms^{-2}$)**

**Ans**

Weight of a body = 147 N

Value of g = 10 $ms^{-2}$

$$\text{Mass} = \frac{147\ \text{N}}{10\ ms^{-2}}$$

$$\boxed{\text{Mass} = 14.7\ \text{kg}}$$

## 3. Write short answers to any Six (6) questions: 12

**(i) Define like and unlike parallel forces.**

**Ans** Like parallel forces are the forces that are parallel to each other and have the same direction. Unlike parallel

forces are the forces that are parallel but have directions opposite to each other.

**(ii) Define centre of mass.**

**Ans** Centre of mass of a system is such a point where an applied force causes the system to move without rotation.

**(iii) Define force of gravitation.**

**Ans** Newton concluded that there exists a force due to which everybody of the universe attracts every other body. He named this force the force of gravitation.

**(iv) Write mathematical form of the condition of equilibrium.**

**Ans** The mathematical form of the condition of equilibrium is:

First condition for equilibrium : $\Sigma F = 0$

Second condition for equilibrium : $\Sigma \tau = 0$

**(v) Define gravitational field strength.**

**Ans** In the gravitational field of the Earth, the gravitational force per unit mass is called the gravitational field strength of the Earth. At any place its value is equal to the value of g at that point. Near the surface of the Earth, the gravitational field strength is 10 N $kg^{-1}$.

**(vi) Define the power and write its unit.**

**Ans** Power is defined as the rate of doing work. SI unit of power is watt (W).

**(vii) Define mechanical energy.**

**Ans** The energy possessed by a body both due to its motion or position is called mechanical energy.

**(viii) Define work and write its unit.**

**Ans** Work is done when a force acting on a body displaces it in the direction of a force. SI unit of work is joule (J).

**(ix) Define Kinetic energy and write its equation.**

**Ans** The energy possessed by a body due to its motion is called its kinetic energy.

$$K.E. = \frac{1}{2} m v^2$$

**4. Write short answers to any Five (5) questions: 10**

**(i) Write down any two examples of application of Pascal's Law.**

**Ans** Pascal's Law finds numerous applications in our daily life such as automobiles, hydraulic brake system, hydraulic jack, hydraulic press and other hydraulic machine.

**(ii) Why does a piece of stone sink in water but a ship with a huge weight floats?**

**Ans** A piece of stone sinks in water because its weight is greater than the upthrust acting on it but a ship floats if it displaces water equal to the weight of the body when it is partially or completely immersed in water.

**(iii) How does heating affect the motion of molecules of a gas?**

**Ans** When a body is heated, the kinetic energy of its molecules increases, the average distances between the molecules increase. Thus, the motion of molecules of gas increases on heating.

**(iv) Change 300 Kelvin into Celsius scale.**

**Ans**

$$T = 300 \text{ K}$$

Since $C = T(K) - 273$

$\therefore \quad C = (300 - 273)\,^{\circ}C$

or $\quad C = 27\,^{\circ}C$

**(v) What is the effect of temperature on evaporation?**

**Ans** At higher temperature, more molecules of a liquid are moving with high velocities. Thus, more molecules escape from its surface. Thus, evaporation is faster at high temperature than at low temperature.

**(vi) How many types are of Latent Heat? Write their names.**

**Ans** There are two types of latent heat:

(a) Latent heat of fusion.

(b) Latent heat of vaporization.

**(vii) On what factors radiation depends?**

**Ans** Radiation depends upon various factors such as:

- Colour and texture of the surface
- Surface temperature
- Surface area

**(viii) What is the effect of length of the solid on thermal conductivity?**

**Ans** Larger is the length between the hot and cold ends of the solid, more time it will take to conduct heat to the colder end and smaller will be the rate of flow of heat. Thus

$$\text{Rate of flow of heat } \frac{Q}{t} \propto \frac{1}{L}$$

## (Part-II)

**Note: Attempt any Three (3) questions.**

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**Q.5.(a) Prove by graph: (4)**

$$2aS = v_f^2 - v_i^2$$

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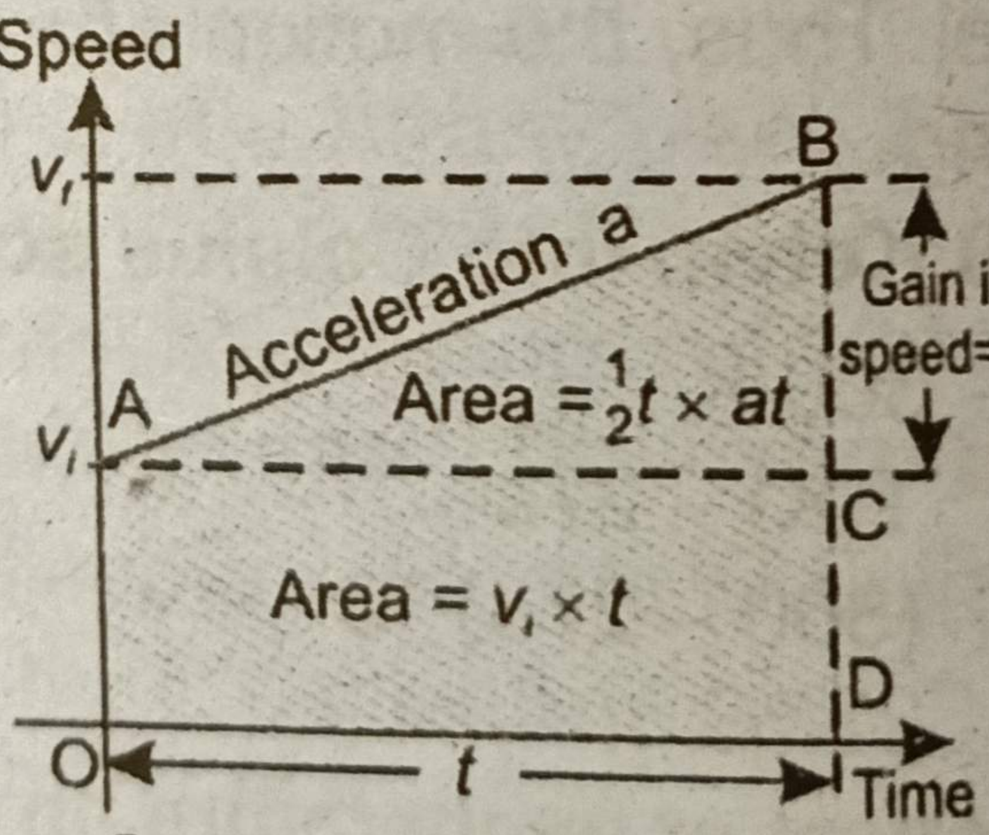
**Ans**




**Thirds equation of motion:**

In speed-time graph shown in figure, the total distance S travelled by the body is given by the total area OABD under the graph.

$$\text{Total area OABD} = S = \frac{OA + BD}{2} \times OD$$

Or

$$2S = (OA + BD) \times OD$$

Multiply both side by $\frac{BC}{OD}$, we get: $\left(\because \frac{BC}{OD} = a\right)$

$$2S \times \frac{BC}{OD} = (OA + BD) \times OD \times \frac{BC}{OD}$$

$$2S \times \frac{BC}{OD} = (OA + BD) \times BC$$

Putting the values in the above equation, we get

$$2S \times a = (v_i + v_f) \times (v_f - v_i)$$

$$2aS = v_f^2 - v_i^2$$

**(b) Find the number of significant figures from following values: (3)**

**(i) 100.8 s (ii) 0.00580 km (iii) 210.0 g**

**Ans**

(a) All the four digits are significant. The zeros between the two significant figures 1 and 8 are significant. To write the quantity in scientific notation, we move the decimal point two places to the left, thus

$$100.8 \text{ s} = 1.008 \times 10^2 \text{ s}$$

(b) The first two zeros are not significant. They are used to space the decimal point. The digit 5, 8 and the final zero are significant. Thus there are three significant figures. In scientific notation, it can be written as $5.80 \times 10^{-3}$ km.

(c) The final zero is significant since it comes after the decimal point. The zero between last zero and 1 is also significant because it comes between the significant figures. Thus the number of significant figures in this case is four. In scientific notation, it can be written as $210.0 \text{ g} = 2.100 \times 10^2$ g.

**Q.6.(a) Define rate of change of momentum and also derive its equation. (4)**

**Ans Derivation of equation:**

Consider a body of mass m moving with initial velocity $v_i$. Let a force F acts on the body which produces an acceleration a in it. This changes the velocity of the body. Let its final velocity after time t becomes $v_f$. If $P_i$ and $P_f$ be the initial momentum and final momentum of the body related to initial and final velocities respectively then

$$P_i = mv_i$$

and $$P_f = mv_f$$

$\therefore$ Change in momentum = final momentum – initial momentum

or $$P_f - P_i = mv_f - mv_i$$

Thus the rate of change in momentum is given by:

$$\frac{P_f - P_i}{t} = \frac{mv_f - mv_i}{t}$$

$$= m\frac{v_f - v_i}{t}$$

Since $\frac{v_f - v_i}{t}$ is the rate of change of velocity equal to the acceleration a produced by the force F.

$$\therefore \quad \frac{P_f - P_i}{t} = m\,a$$

According to Newton's second law of motion,

$$F = ma$$

or $$\frac{P_f - P_i}{t} = F$$

Equation above also defines force and states Newton's second law of motion as:

"When a force acts on a body, it produces an acceleration in the body and will be equal to the rate of change of momentum of the body."

SI unit of momentum defined by above equation is newton-second (Ns) which is the same as $kgms^{-1}$.

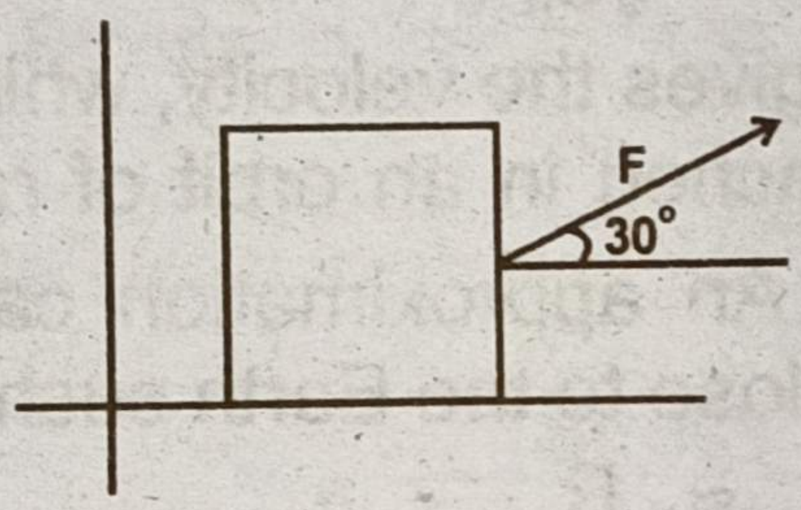
**(b) A man is pulling a trolley on a horizontal road with a force of 200 N making 30 degree with the road. Find horizontal and vertical components of its force. (3)**

**Ans** $F = 200$ N

$\theta = 30°$ with the horizontal

$F_x = ?$

$F_y = ?$




Since $F_x = F \cos \theta$

or $F_x = 200 \times \cos 30°$

$= 200 \times 0.866 = 173.2$ N

Similarly, $F_y = F \sin \theta$

or $F_y = 200 \times \sin 30°$

$= 200 \times 0.5 = 100$ N

Thus, horizontal and vertical components of the pulling force are 173.2 N and 100 N respectively.

**Q.7.(a) Derive the equation of motion of artificial satellites. (4)**

**Ans** Consider a satellite of mass m revolving around the Earth at an altitude h in an orbit of radius $r_o$ with orbital velocity $v_o$. The necessary centripetal force required is given by equation.

$$F_c = \frac{mv_o^2}{r_o}$$

This force is provided by the gravitational force of attraction between the Earth and the satellite and is equal to the weight of the satellite $w'(mg_h)$. Thus

$$F_c = w' = mg_h \quad (A)$$

$$\text{or} \quad mg_h = \frac{mv_o^2}{r_o}$$

$$\text{or} \quad v_o^2 = g_h r_o$$

$$\text{or} \quad v_o = \sqrt{g_h r_o} \quad (B)$$

$$\text{as} \quad r_o = R + h$$

$$\therefore \quad v_o = \sqrt{g_h (R + h)} \quad (C)$$

Equation (B) gives the velocity, which a satellite must possess when launched in an orbit of radius $r_o = (R + h)$ around the Earth. An approximation can be made for a satellite revolving close to the Earth such that $R >> h$.

$$R + h \approx R$$

$$\text{and} \quad g_h \approx g$$

$$\therefore \quad v_o = \sqrt{gR} \quad (D)$$

A satellite revolving around very close to the Earth, has speed $v_o$ nearly 8 $kms^{-1}$ or 29000 $kmh^{-1}$.

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**(b) A man pulls a block with a force of 300N through 50 m in 60 seconds. Find the power used by him to pull the block. (3)**

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**Ans** We have,

$$F = 300 \text{ N}$$

$$S = 50 \text{ m}$$

$$t = 60 \text{ s}$$

Formula:

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

$$P = \frac{(F)(S)}{t}$$

$$P = \frac{(300)(50)}{60}$$

$$\boxed{P = 250 \text{ watt}}$$

**Q.8.(a) Explain the Young's Modulus.** (4)

**Ans** The ratio of stress to tensile strain is called Young's modulus. Mathematically,

$$\text{Young's modulus } Y = \frac{\text{Stress}}{\text{Tensile strain}}$$

Let $\Delta L$ be the change in length of the rod, then

$$\Delta L = L - L_o$$

Since $$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$$

and $$\text{Tensile strain} = \frac{L - L_o}{L_o} = \frac{\Delta L}{L_o}$$

As $$Y = \frac{\text{Stress}}{\text{Tensile strain}}$$

$$= \frac{F}{A} \times \frac{L_o}{\Delta L}$$

$$\therefore \quad Y = \frac{F\,L_o}{A\,\Delta L}$$

SI unit of Young's modulus is Newton per square metre ($Nm^{-2}$).

**(b) Calculate the volume of a body when a golden bar of mass 0.2 kg has a density of 19300 $kgm^{-3}$.**

**Ans** For golden bar

$$\text{Volume} = \frac{0.2}{19300}$$

$$\text{Volume} = 1.04 \times 10^{-5}\ m^3$$

**Q.9.(a) Sea breeze blows during the day and land breeze blows in night. Explain.** (4)

**Ans** Land and sea breezes are the result of convection. On a hot day, the temperature of the land increases more quickly than the sea. It is because the specific heat of land is much smaller as compared to water. The air above land

gets hot and rises up. Cold air from the sea begins to move towards the land. It is called sea breeze.

At night, the land cools faster than the sea. Therefore, air above the sea is warmer, rises up and the cold air from the land begins to move towards the sea. It is called land breeze.

**(b) Normal human body temperature is 98.6 °F. Convert into Celsius Scale. (3)**

**Ans**

$T = 98.6°F$

$°C = ?$

$K = ?$

$$°C = \frac{9}{5}(T_F - 32)$$

$$°C = \frac{9}{5}(98.6 - 32)$$

$$\boxed{°C = 37°C}$$

## (Part-III)

## (Practical Part)

**Note: Attempt any Two (2) questions.**

**A- Find the cross-sectional area of solid cylinder. (4)**

**L.C. = 0.01 cm Z.E = NIL**

| Sr. No. | Main scale reading (m) | Vernier division coincident main scale (n) | Fraction X = n × L.C (cm) | Diameter Y = M + x |
|---|---|---|---|---|
| 1 | 2.00 cm | 8 | | |
| 2 | 2.00 cm | 5 | | |

**Ans**

| Sr. No. | Main scale reading (m) | Vernier division coincident main scale (n) | Fraction X = n × L.C (cm) | Diameter Y = M + x | D = y ± Zc |
|---|---|---|---|---|---|
| 1 | 2.00 cm | 8 | 0.08 | 2.08 | 2.08 + 0 = 2.08 |
| 2 | 2.00 cm | 5 | 0.05 | 2.05 | 2.05 + 0 = 2.05 |

$$\text{Mean diameter} = D = \frac{2.08 + 2.05}{2}$$

$$\boxed{D = 2.065}$$

$$\text{Radius of cylinder} = r = \frac{D}{2} = \frac{2.065}{2}$$

$$\boxed{r = 1.0325}$$

**B- A student uses a pendulum of length 65 cm and calculates the time for 20 vibrations 32.4 s. Find the value of g by calculating time period. (5)**

**Ans** height = h = 65 cm

Time period = T = ?

For 20 vibrations

$$T = \frac{t_o}{20} = \frac{32.4}{20}$$

$$\boxed{T = 1.62}$$

$$g = \frac{32\ h}{T^2}$$

$$g = \frac{32\ (65)}{(1.62)^2}$$

$$g = \frac{2080}{2.6244}$$

$$\boxed{g = 1008.51\ m\ s^{-2}}$$

**C-(i) Write three precautions to study relationship between Load and Extension with the help of a Helical Spring. (3)**

**Ans** 1. The pointer should move on the scale freely.
2. Note the reading when the pointer is completely stopped.
3. While taking reading, keep eye in level with the pointer.

**(ii) Define Stress. (2)**

**Ans** Stress is a physical quantity that expresses the internal forces that neighbouring particles of a continuous material exert on each other.