



**Section- A (Very Short Answer Type)**

1. Define physical quantity and write steps for measurement.
2. What are fundamental units and derived units?
3. List the seven basic and two supplementary physical quantities, their units and symbol in S.I. system.
4. Define dimensions, dimensional formula and dimensional equation.
5. Name various applications of dimensional analysis.
6. State principle of homogeneity of dimensions.
7. Give limitations of method of dimensions.
8. Check the correctness of  $F = m \cdot a$ .
9. If the units of force and length each are doubled, then how many times the unit of energy would be affected?
10. Can a quantity has dimensions but still has no units?
11. Justify  $L + L = L$  and  $L - L = L$ .
12. Can there be a physical quantity that has no unit and no dimensions?
13. If  $g$  is the acceleration due to gravity and  $\lambda$  is wavelength, then which physical quantity does represented by  $\sqrt{g\lambda}$ .

**Short answer type questions (2 marks)**

1. Name any three physical quantities having the same dimensions and also give their dimensions.
2. In Vander Wall's equation  $(P + a/V^2)(V - b) = RT$ , Determine the dimensions of  $a$  and  $b$ .
3. Deduce the dimensional formulae for the following physical quantities.  
A) Gravitational constant. B) Power C) coefficient of viscosity D) Surface tension.
4. Name the four basic forces in nature. Arrange them in the order of their increasing strengths.
5. Convert 1 Newton force in to Dyne.
6. Check the dimensional consistency of the equation,  $FS = \frac{1}{2}(mv^2) - mgh$ , where  $S$  is distance moved, and  $v$  is final velocity of body of mass  $m$  and  $F$  is the force acting on it.
7. Convert an acceleration of  $100 \text{ m/s}^2$  into  $\text{Km/hr}^2$ .
8. Convert a velocity of  $72 \text{ km/hr}$  into  $\text{m/s}$  with the help of dimensions.
9. Express the power of  $100 \text{ watt}$  in  $\text{c.g.s}$ .

10. Convert one joule into erg using the dimensional analysis.
11. Convert one Newton into dynes using the method of dimensions.

**Short answer type questions (3marks)**

1. The frequency  $\nu$  of vibration of stretched string depends on its length  $L$  its mass per unit length  $m$  and the tension  $T$  in the string obtain dimensionally an expression for frequency  $\nu$ .
2. Write the dimensional formula of physical quantities viz. area, volume, velocity or speed, acceleration, momentum, force, impulse, work, power, energy, surface tension, coefficient of viscosity, stress and strain.
3. The time period of oscillation of a simple pendulum depends upon mass of bob ( $m$ ); length of string ( $l$ ); acceleration due to gravity ( $g$ ). Derive a relation for the time period ( $t$ ) by using the method of dimension.
4. Pressure ( $P$ ) of a liquid filled in tank depends upon height of column ( $h$ ), density of liquid ( $\rho$ ) and acceleration due to gravity ( $g$ ). Derive a formula for pressure using the method of dimensions.

**(MOTION IN A PLANE)**

**Section- A (Very Short Answer Type)**

1. What is the difference between vector and scalar quantities?
2. Is the magnitude of  $(\vec{A} + \vec{B})$  same as that of  $(\vec{B} + \vec{A})$ .
3. Is the magnitude of  $(\vec{A} - \vec{B})$  same as that of  $(\vec{B} - \vec{A})$ .
4. Under what condition the sum and difference of two vectors will be equal in magnitude?
5. Force  $F$  and displacement  $s$  both are vector quantities. Which type is the quantity work?
6. Two non zero vectors  $\vec{A}$  and  $\vec{B}$  are such that (a)  $\vec{A} \cdot \vec{B} = 0$ , (b)  $\vec{A} \cdot \vec{B} = AB$ . What information do we get about  $\vec{A}$  and  $\vec{B}$  in each case?
7. When is the sum of two vectors maximum and when minimum.
8. What does the slope of v-t graph indicate ?
9. Give an example when a body moving with uniform speed has acceleration.
10. Two balls of different masses are thrown vertically upward with same initial velocity. Height attained by them are  $h_1$  and  $h_2$  respectively what is  $h_1/h_2$ .
11. State the essential condition for the addition of the vector.
12. What is the angle between velocity and acceleration at the peak point of the projectile motion ?
13. What is the angular velocity of the hour hand of a clock ?
14. What is the source of centripetal acceleration for earth to go round the sun ?
15. What is the average value of acceleration vector in uniform circular motion .

### Section- B (Short Answer Type)

16. A body, acted upon by a force of 50 Newton is displaced through a distance of 10 metre in a direction making an angle of  $60^\circ$  with the force. Calculate the work done by the force.
17. The sum and difference of two vectors A and are mutually perpendicular to each other. Prove that both the vectors are equal in magnitude.
18. The sum and the difference of two vectors are equal in magnitude:  $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ . Prove that the vectors A and B are perpendicular to each other.
19. Prove that vectors  $\vec{A} = i + 2j + 3k$  and  $\vec{B} = 2i - j$  are perpendicular to each other.
20. Two vectors  $\vec{A}$  and  $\vec{B}$  are added. Prove that the magnitude of the resultant vector cannot be greater ( $\vec{A} + \vec{B}$ ) and smaller than ( $\vec{A} - \vec{B}$ ) or ( $\vec{B} - \vec{A}$ ).
- 21.
22. Find the value of p such that the two vectors  $\vec{A} = 2i + 2j + pk$  and  $\vec{B} = 2i - 3j + k$  are mutually perpendicular.
23.  $\vec{A} = 3i + 4j$  and  $\vec{B} = 12i - 5j$ , determine (i) magnitude of  $\vec{A}$ , (ii) value of  $\vec{A} \cdot \vec{B}$ .
24. Find the unit vector parallel to the resultant of the vectors  $\vec{A} = 2i - 6j - 3k$  and  $\vec{B} = 4i + 3j - k$ .
25. Find the scalar and vector products of two vectors:  $\vec{A} = 3i - 4j + 5k$  and  $\vec{B} = -2i + j - 3k$ .
26. Show that the vectors  $\vec{A} = 4i - j + 2k$  and  $\vec{B} = i + 2j - k$  are perpendicular. Find also the vector product of these.
27. Find a unit vector perpendicular to both the vectors  $\vec{A} = 3i + j + 2k$  and  $\vec{B} = 2i - 2j + 4k$ .
28. Find a vector whose magnitude is 12 and which is perpendicular to each of the vectors,  $\vec{A} = 2i + 3j - 2k$  and  $\vec{B} = 6i + 5j - 2k$ .
29. Find out the area of a parallelogram whose adjacent sides are  $i + 2j + 3k$  and  $-3i - 2j + k$ .
30. If  $\vec{A} = A_x i + A_y j + A_z k$  and  $\vec{B} = B_x i + B_y j + B_z k$ , then prove that  $\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$ .
31. Show that when the horizontal range is maximum, height attained by the body is one fourth the maximum range in the projectile motion.
32. A gunman always keeps his gun slightly tilted above the line of sight while shooting. Why?
33. Derive the relation between linear velocity and angular velocity.
34. What do you mean by rectangular components of a vector? Explain how a vector can be resolved into two rectangular components in a plane.
35. The greatest height to which a man can a stone is h, what will be the longest distance upto which he can throw the stone ?

### Section- C (Long Answer Type)

36. What do you mean by scalar and vector quantities? Explain with examples.
37. What do you understand by scalar and vector product of two vectors? Write the formula, explaining the symbols used.
38. State and explain triangle law of vector addition.
39. State and explain parallelogram law of vector addition.
40. Define position, displacement, unit and zero vector with examples.

41. Define centripetal acceleration. Derive an expression for the centripetal acceleration of a particle moving with constant speed  $v$  along a circular path of radius  $r$ .
42. A ball thrown vertically upwards with a speed of  $19.6 \text{ m/s}$  from the top of a tower returns to the earth in  $6 \text{ s}$ . find the height of the tower. ( $g = 9.8 \text{ m/sec}^2$ )

### **(LAWS OF MOTION)**

#### **Section-A (Very Short Answer Type)**

1. Why does the electric fan continue to rotate for some time after the current is switched off?
2. Which law of motion does give the measure of force.
3. A body is acted upon by four external forces. Can it remain at rest?
4. Define 1 Newton.
5. Define 1 dyne.
6. Define linear momentum. Write its unit.
7. Is net force needed to keep a body moving with uniform velocity?
8. Is Newton's 2nd law ( $F = ma$ ) always valid. Give an example in support of your answer?
9. Action and reaction forces do not balance each other. Why?
10. Can a body remain in state of rest if more than one force is acting upon it?
11. Is the centripetal force acting on a body performing uniform circular motion always constant?
12. The string is holding the maximum possible weight that it could withstand. What will happen to the string if the body suspended by it starts moving on a horizontal circular path and the string starts generating a cone?
13. What is the reaction force of the weight of a book placed on the table?
14. What is the maximum acceleration of a vehicle on the horizontal road? Given that coefficient of static friction between the road and the tyres of the vehicle is  $\mu$ .
15. Why guns are provided with the shoulder support?
16. While paddling a bicycle what are the types of friction acting on rear wheels and in which direction?

#### **Section-B ( Short Answer Type)**

1. State Newton's three laws of motion.
2. Prove that Newton's second law is the real law of motion.
3. Explain the principle of conservation of linear momentum with its application.
4. Explain the term impulse of a force. Show that the impulse given to a body is equal to change in momentum.
5. A force acts upon a body of mass  $20 \text{ kg}$ , initially at rest, for  $6 \text{ seconds}$  after which the force ceases. Now the body describes the  $60 \text{ m}$  in the next  $5 \text{ seconds}$ . Find the magnitude of the force.

6. A bullet of mass 0.04 kg moving at 90 m/s speed strikes a heavy wooden block and travels inside it a distance of 60 cm before being stopped. Find the average resistive force on the bullet exerted by the block.
7. A constant force acting on a body of mass 3 kg changes its speed from 2 m/s to 3.5 m/s in 25 s. the direction of motion of the body remains unchanged. What is the magnitude and direction of the force?
8. A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of 15 m/s. How long does the body take to stop?
9. A rocket with a lift-off mass 20,000 kg is blasted upwards with an initial acceleration of  $5 \text{ m/s}^2$ . Find the initial thrust (force) of the blast.

### **Section-C (Long Answer Type)**

10. Explain the types of inertia with one example of each.
11. State Newton's second law of motion. How does it help to measure force? Define S.I. unit of force.
12. What are concurrent forces? State and explain the condition of equilibrium of these forces.