

UNITS AND MEASUREMENT

- Give any two advantages of SI system.
- Obtain the value of 1 parsec in metre.
- Define 1 par sec.
- The length, breadth and thickness of a rectangular sheet of metal are 4.234m, 1.005 m and 2.01 cm respectively. Find the area and volume of the sheet to correct significant figure.
- The numbers 2.745 and 2.735 on rounding off to 3 significant figures will be which number?
- Solve the following and express the result to an appropriate number of significant figures:
 - Add 6.2 g, 4.33 g and 17.456 g
 - Subtract 63.54 kg from 187.2kg
- What are the dimensions of "a" and "b" in the gas equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ for real gas, where P and V are pressure and volume respectively?
- A gas bubble from an explosion under water oscillates with period "T", which depends on static pressure (P), density of water (d), total energy (E) of explosion. Find expression for period T.
- What is the principle of homogeneity in dimensions?
- Check the following relation is dimensionally correct or not.

$$FS = \frac{1}{2} m v^2 - \frac{1}{2} m u^2$$

Where F is force, S is the distance, u and v are the initial and final velocities respectively.

- Write the dimensions of Stefan's constant and current density.
- Write the dimensional formula of bulk modulus of elasticity.
- Is the following equation dimensionally, correct?

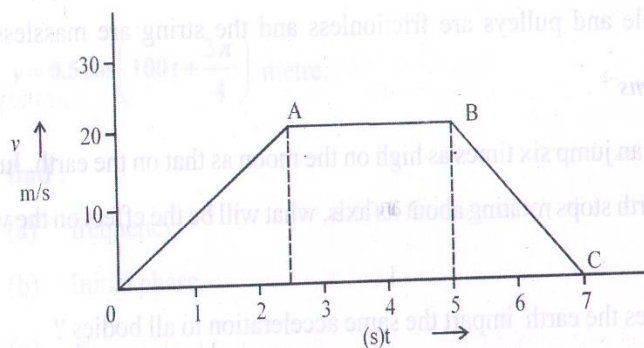
$$S = ut + \frac{1}{2} a t^2$$

- Convert 0.01 newton into dyne using the method of dimensions.

MOTION IN A STRAIGHT LINE

- The position of an object moving along x axis is given by $x = a + bt^2$ where $a = 8.5$ m, $b = 2.5$ m/s² and t is measurement in seconds. What is its velocity at $t = 0$ s and $t = 2$ s. what is the average velocity between $t = 2$ s and $t = 4$ s?
- Read each statement given below carefully and state with reasons, if it is true or false, a particle in one dimensional motion
 - With zero speed at an instant may have non- zero acceleration at that instant
 - With positive value of acceleration must be speeding up.
- The displacement in meters of a particle moving along x- axis is given by $x = 18 t + 5 t^2$. Calculate the instantaneous velocity at $t = 12$ s, average velocity between $t = 2$ s and $t = 3$ s
- Derive the equation of motion $s = ut + \frac{1}{2} a t^2$ using graphical method.
- Obtain equation of motion for constant acceleration using method of calculus.
- A ball is thrown upward with the speed of 5 m/s, from the height of 10 m from the ground, ball finally return to the ground. Make velocity time graph for motion of ball.
- A ball is thrown vertically upwards with a velocity of 20 m/s from the top of a multistory building, the height of a point from where the ball is thrown is 25 m from the ground
 - How high will ball rise?
 - How long will it be before the ball hits the ground?
- A player throws a ball upwards with an initial speed of 29.4 m/s. what are the velocity and acceleration of the ball at the highest of its motion?

9. What is the ratio of the distance travelled by a body falling freely from rest in the first, second, and third seconds of fall?
10. A food packet is released from a helicopter which is rising steadily at 2 m/s. after two seconds
 - (a) Find the velocity of the packet
 - (b) How far is the packet below helicopter.
11. An object starts from a point, moves certain distance and returns to the original position. Make the distance time graph for it.
12. Draw position graph for non-uniform motion, when body starts from origin with (i) increasing velocity (ii) decreasing velocity.
13. The velocity time graph for a vehicle is shown in figure:
 - (a) Draw acceleration time graph for it.
 - (b) Calculate distance covered in 7 seconds.



14. What does the area under the velocity- time graph represent?
15. Draw the following graphs for an object projected upward with a velocity u which comes back to the same point after some time
 - (a) Acceleration versus time graph
 - (b) Speed versus time graph
 - (c) Velocity versus time graph

MOTION IN A PLANE

1. Define the following vectors
 - (a) Negative vector
 - (b) Position vector
 - (c) Null vector
2. Choose the vector quantity out of the following: potential energy, kinetic energy, torque and mass.
3. When the addition of two vectors can be zero?
4. State and prove triangle law of vector addition. Two forces whose magnitudes are in the ratio 3: 5 give resultant of 28 N. if angle of their inclination is 60° . Find magnitude of each force.
5. The maximum value of resultant of 2 vectors A and B ($A > B$) is " n " times the minimum value of the resultant. When angle between the vectors is θ , the resultant is half the sum of the vectors. Then show that $\cos \theta = -\frac{(n^2+2)}{2(n^2-1)}$
6. At what angle do the forces $(P + Q)$ and $(P - Q)$ act so that the resultant is $\sqrt{3P^2 + Q^2}$?
7. What should be the angle between two vectors, if their resultant is to be equal to either of them?
8. State in the following cases, whether the motion is one, two or three dimensional:
 - (a) A kite flying on a windy day
 - (b) A speeding car on a long straight high way
 - (c) A carom coin rebounding from the side of the board
 - (d) An insect crawling on a globe
 - (e) A planet revolving around its star

9. The position of a particle is given by $r = 3\hat{i} + 2\hat{j} + 4\hat{k}$ m where t is in seconds.
 - (a) Find the velocity and acceleration of the particle.
 - (b) What is the magnitude and direction of velocity of the particle at t = 2 sec?
10. An object is projected into space at an angle θ with the horizontal with velocity u. find an expression for its time of flight, maximum height attained and horizontal range.
11. A cricketer can throw a ball to a maximum horizontal distance of 100 m. how much high above the ground can the cricketer throw the same ball?
12. The actual range of a projectile $\sqrt{3}/2$ times of its maximum range. What is the angle of projection for the actual range?
13. Prove that the maximum horizontal range is four times the maximum height attained by a projectile when fired at an inclination so as to have maximum horizontal range.
14. A stone is thrown from a bridge at an angle 30° down with the horizontal with a velocity of 20 m/s. the stone strikes the water after 2 sec, calculate the height of the bridge from the water level.
15. For what angle of projection of projectile is the range maximum?
16. What will be effect on maximum height of a projectile when its angle of projection is changed from 60° to 30° , keeping the same initial velocity of projection?
17. A rifle is aimed at an angle 60° above the horizontal and a bullet is fired from it with the speed 300 m/s. just as the bullet leaves the gun (i) how fast is it rising? (ii) how fast is it moving parallel to the ground?
18. A body is projected with a velocity of 39 m/s at an angle of 30° with the vertical. Find the maximum height, time of flight and horizontal range.
19. Define uniform circular motion.
20. Define angular velocity and angular acceleration.