

**GAIL DAV PUBLIC SCHOOL**  
**WORK SHEET -1, UNIT -I, DIMENSIONS**

**MCOs**

**1. Which of the following is a fundamental quantity?**

- a). Velocity                      b) Force                      c) Length                      d). Pressure

**2. Which of the following quantities is derived from fundamental quantities?**

- a). Mass                      b).Time                      c).Temperature                      d). Acceleration

**3. The unit of work is derived from which fundamental quantities?**

- a). Mass and length                      b). Force and distance                      c). Mass, length, and time                      d). Power and time

**4. How many significant figures are in the number 0.004506?**

- a) 4                      b) 3                      c) 6                      d) 5

**5. Which number has 3 significant figures?**

- a) 0.070                      b) 700                      c)  $7.00 \times 10^2$                       d) 0.007

**6. Round 76.483 to 3 significant figures.**

- a) 76.5                      b) 76.4                      c) 76.48                      d) 76

**7. Which of the following quantities is dimensionless?**

- a). Pressure                      b). Strain                      c) Velocity                      d). Force

**8. The dimensional formula of Planck's constant (h) is:**

- a).  $[ML^2T^{-1}]$                       b).  $[M L^2 T^{-1}]$                       c).  $[ML^2T^{-1}]$                       d).  $[MLT^{-2}]$

**9. Which of the following equations is dimensionally correct?**

- a)  $v=u+at^2v$                       b)  $v= u + at^2$                       c)  $v=ut+at^2$                       d)  $s=ut+1/2at^2$

**10. If velocity v, time t, and acceleration a are fundamental quantities, the dimension of distance is:**

- a). vt                      b). at                      c).  $at^2$                       d). va

**SHORT ANSWER TYPE QUESTIONS :**

1. The Van der Waal equation for 1 mole of a real gas is  $(P + a/V^2)(V - b)$  where P is the pressure, V is the volume, T is the absolute temperature, R is the molar gas constant and a, b are Van der Waal constants. Find the dimensions of a/b

2. The velocity of water waves may depend on their wavelength  $\lambda$ , the density of water  $\rho$  and the acceleration due to gravity g. Using the method of dimensional analysis, derive the relation between  $\lambda$ , g, and  $\rho$

**3. What is the dimensional formula of Planck's constant.**

**4. State the principle of dimensional homogeneity. Use it to check whether the equation  $v = u+at$  is dimensionally correct.**

**5. Derive the dimensional formula of pressure. Write its SI unit.**

# GAIL DAV PUBLIC SCHHOL

## WORKSHEET-2

### CLSS – XI PHYSICS

#### Unit – I: Dimensions

1. Write the dimensional formulae of the following quantities:

(i) Torque (ii) impulse (iii) planck's constant (iv) specific heat (v) power (vi) surface tension (vii) gravitational constant (viii) pressure (ix) coefficient of viscosity (X) angular momentum

2. The frequency 'n' of an oscillating drop may depend upon radius 'r' of drop, density 'ρ' of liquid and surface tension 's' of the liquid. Establish an expression for 'n' dimensionally.

3. The orbital velocity 'v' of a satellite may depend on its mass 'm', the distance 'r' from the centre of earth and acceleration due to gravity 'g'. Obtain an expression for its orbital elocity

4. If  $x = a + b t^2 + c t^3$ , where x is in meter and t in second, what is the unit of 'c' ?

5. The time period of an oscillating drop of radius 'r' density ρ and surface tension 's' is  $t = \sqrt{\rho r^3 / s}$ . Check the correctness of the relation.

6. Check the correctness of equations

(a)  $\lambda = \frac{h}{mv}$  (b)  $n = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$  (c)  $E = mc^2$  (d)  $v = \sqrt{2GM/R}$  using dimensions.

7. In a gas equation  $(P + \frac{a}{V^2})(V - b) = RT$ , what are the dimensions of 'a' and 'b', where symbols have their usual meaning.

8. Find the value of 100 j on a system which has 20 cm, 250g and half minute as fundamental units of length, mass and time respectively.

9. Find the dimensions of 'a/b' in the eq.  $F = a \sqrt{x} + b t^2$ , where F is force, x is displacement and 't' is time.

10. If the units of force, energy and velocity are 20 N, 200 J and 5m/s respectively. Find the units of length ,mas and time.

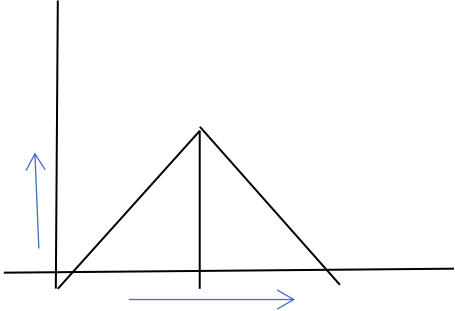
11. The wavelength  $\lambda$  associated with a moving electron depends on its mass, its velocity and Planck's constant 'h'. Prove dimensionally that  $\lambda = \frac{h}{mv}$

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## WORKSHEET

### CLSS – XI PHYSICS

#### Unit-2, Kinematics

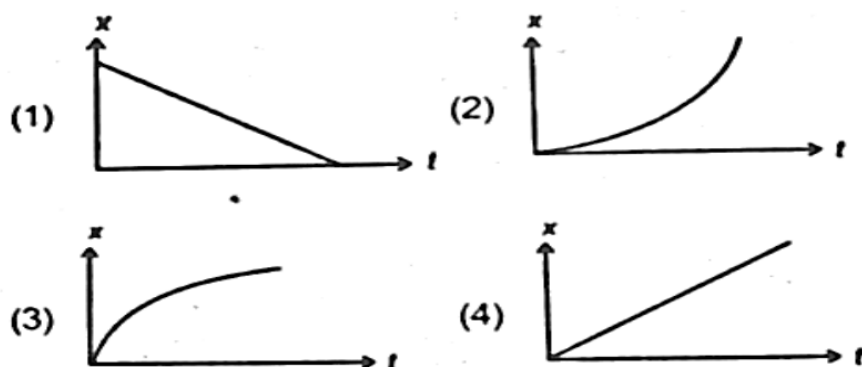
- The displacement of a particle is given by the equation  $x = 18t + 5t^2 + t^3$ .  
Find (i) the average velocity of the particle during the time interval between  $t_1 = 2$  s and  $t_2 = 4$  s  
(ii) instantaneous velocity at  $t = 4$  s and (iii) instantaneous acceleration at  $t = 2$  s
- A cricketer can throw a ball to a maximum horizontal distance of 100 m . How high above the ground can the cricketer throw the same ball ?
- Find the torque of a force  $7i + 3j - 5k$  about the origin. The force acts on a particle whose position vector is  $i - j + k$  .
- The position of a particle varies as  $x = at^4 - bt$ . Calculate the acceleration of particle at 1 second. Where 'a' & 'b' are constants.
- Find the value of  $\lambda$  so that the vectors  $A = 2i + \lambda j + k$  and  $B = 4i - 2j - 2k$  are perpendicular to each other.
- The speed time graph of a particle moving along a fixed direction is shown in figure. Find  
(i) distance travelled by the particle from  $t = 0$  sec to  $t = 5$  sec and  
(ii) average speed between interval  $t = 0$  to  $t = 10$  sec  
time  

- A ball initially at rest, is released from the top of a tower of height 27 meters. It takes 'T' seconds to reach the ground. Find the height of the ball above the ground at  $t = T/3$  .
- A food packet is released from a helicopter which is rising steadily at 2 m/s. After 2 seconds (i) what is the velocity of the packet ? (ii) How far is it below the Helicopter .
- A stone of mass 0.1 kg tied to one end of a string 1.0 m long is revolved in a horizontal circle at the rate of  $10/\pi$  revolutions per second. Calculate the tension in the string.
- A stone is thrown horizontally with a speed  $\sqrt{2gh}$  from the top of a wall of height 'h' . If it strikes the level ground through the foot of ground at a distance 'x' from the wall. What is the value of 'x'?
- Define cross product of vectors. Find a unit vector perpendicular to vectors  $A = 3i - 2j - 2k$  and  $B = 2i - j + 3k$ .

12. A body is thrown up with a velocity of 78.4 m/s. Find how high will it rise and how much time will it take to return to its point of projection.
13. Points P,Q and R are in a vertical line such that PQ = QR . A ball at P is allowed to fall freely. What is the ratio of times descent through 'PQ" and QR ' .
14. A constant force F, acting on a body of mass 20 kg , changes its velocity from ( 2 i ) m/s to ( 6i ) m/s in 40 s . Find the magnitude and direction of force .
15. A particle of mass 0.5 kg , moves along the X – axis with a velocity  $v = kx^{3/2}$  where  $k = ( S ) m^{-1/2} s^{-1}$  . Find the work done by net force acting on it during its displacement from  $x = 0$  to  $x = 2$  m.

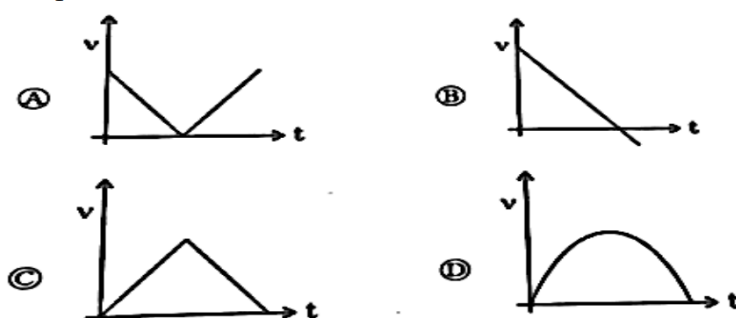
### MULTIPLE CHOICE QUESTIONS(MCQ)

1. The slope of velocity time graph gives  
 (a) distance (b) displacement (c) acceleration (d) speed
2. If the displacement of an object is proportional to square of time, then the object is moving with  
 (a) constant acceleration (b) uniform motion  
 (c) constant velocity (d) non uniform motion
3. An athlete finishes a round of circular track of radius R in 40 sec. What is his displacement at the end of 2 min 20 sec?  
 (a) 2R (b)  $2\pi R$  (c)  $7\pi R$  (d) Zero
4. A ball is dropped from height h. The velocity attained by the ball just before reaching the ground is  
 (a)  $\sqrt{2gh}$  (b)  $\sqrt{3gh}$  (c)  $\sqrt{gh}$  (d) zero
5. A car travels from A to B at a speed of 20 Km/hr and returns at a speed of 30 Km/hr the average speed of the car for the whole journey is  
 (a) 5 Km/hr (b) 24 Km/hr (c) 25 Km/hr (d) 50 Km/hr
6. A 100 m long train is moving with a uniform velocity of 45 Km/hr. The time taken by the train to cross a bridge of length 1 Km is  
 (a) 58 second (b) 68 second (c) 78 second (d) 88 second
7. If  $t = \sqrt{x+4}$ , then  $(dx/dt)_{t=4}$  is  
 (a) 4 (b) zero (c) 8 (d) 16

8. The position-time ( $x-t$ ) graph for positive acceleration is



9. A ball is thrown vertically upward. Ignoring the air resistance, which one of the following plot represents the velocity-time plot for the period ball remains in air?



#### ASSERTION REASON BASED QUESTION:

In the following questions a statement of assertion(A) is followed by a statement of reason(R) mark the correct choice as

(a) If both assertion and reason are true and reason is the correct explanation of the assertion

(b) If both assertion and reason are true but reason is the not correct explanation of assertion

(c) If assertion is true but reason is false

(d) If both assertion and reason are false

1. **ASSERTION:** The speed of a body can be negative. **REASON:** If the body is moving in the opposite direction of positive motion, then its speed is negative.

2. **ASSERTION:** An object can have constant speed but variable velocity. **REASON:** SI unit of speed is m/s.

3. **ASSERTION:** In real-life, in a number of situations, the object is treated as a point object. **REASON:** An object is treated as point object, as far as its size is much smaller than the distance, it moves in a reasonable duration of time.

4. **ASSERTION:** The speedometer of an automobile measures the average speed of the automobile.

**REASON:** Average velocity is equal to total distance divided by total time taken.

5. **ASSERTION:** A body can have acceleration even if its velocity is zero at that instant of time.

**REASON:** The body will be momentarily at rest when reverses its direction of motion

6. **ASSERTION:** When a body is dropped or thrown horizontally from the same height it would reach the ground at the same time

**REASON:** Horizontal velocity has no effect on the vertical motion

**CASE STUDY BASED QUESTIONS:**

**1. Operation Sindoor Projectile Motion in Combat Scenario:**

During Operation Sindoor, the Indian Army's artillery unit must neutralize an enemy bunker located on a hilltop. The bunker is 200 meters horizontally away and 50 meters above the artillery position. A mortar is fired with an initial velocity of 80 m/s at an angle of  $30^\circ$  with the horizontal. Assume  $g=10 \text{ m/s}^2$ . Ignore air resistance.

(i) What is the maximum height attained by the mortar shell?

(a) 80 m      (b) 160 m      (c) 40 m      (d) 320 m

(ii) What would be the horizontal range of the mortar if launched on level ground (same velocity and angle) ?

(a) 3203 m      (b) 554.2 m      (c) 640 m      (d) 160 m

(iii) What is the time of flight for the mortar shell if launched on level ground?

(a) 8 s      (b) 16 s      (c) 4 s      (d) 10 s

(iv) To ensure the mortar shell reaches the elevated bunker (50 m height), which adjustment is most critical?

(a) Increase the launch angle      (b) Decrease the launch angle

(c) Increase the launch velocity      (d) Both B and C

**2. A student is practicing the javelin throw. The javelin is thrown with an initial velocity of 32 m/s at an angle of  $35^\circ$  above the horizontal, from a height of 2 meters above the ground. Assume gravitational acceleration  $g=9.8 \text{ m/s}^2$  and air resistance is negligible. Take  $\cos(35^\circ)\approx 0.8192$**

(i) What is the horizontal component of the initial velocity?

(a) 26.2 m/s      (b) 22.6 m/s      (c) 18.7 m/s      (d) 20.1 m/s

(ii) What is the maximum height (from the ground) reached by the javelin during its flight? 15.7 m      (b) 17.2 m      (c) 19.3 m      (d) 21.6 m

(iii) At the maximum height of the javelin's trajectory, which of the following statements is TRUE?

(a). Both horizontal and vertical components of velocity are zero

(b). Only the vertical component of velocity is zero

(c). Only the horizontal component of velocity is zero

(d). The javelin comes to a complete stop momentarily

(iv) Which factor determines how long the javelin stays in the air (time of flight), assuming no air resistance?

(a) Only the horizontal component of velocity

(b) Only the angle of projection

(c) Only the vertical component of velocity and initial height

(d) Both horizontal and vertical components equally

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