विद्या सर्वार्थि साधिका

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PERIODIC TEST - 1

Class: XI

Subject: Physics (042) MM : 40

Date : 14-07-2025 Time: 1Hr 30 min

General Instructions:

1. There are 20 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. Section A consists of 12 MCQs of 1 mark each, Section B consists of 2 very short answer type questions of 2 marks each, Section C consists of 2 short answer type questions of 3 marks each, Section D consists of 2 case study-based questions of 4 marks each and Section E consists 2 long answer type questions of 5 marks each.
4. There is no overall choice. However, an internal choice has been provided in section D and E. You have to attempt only one of the choices in such questions.
5. Take g near the surface of earth as 10 m/s^2.

SECTION A

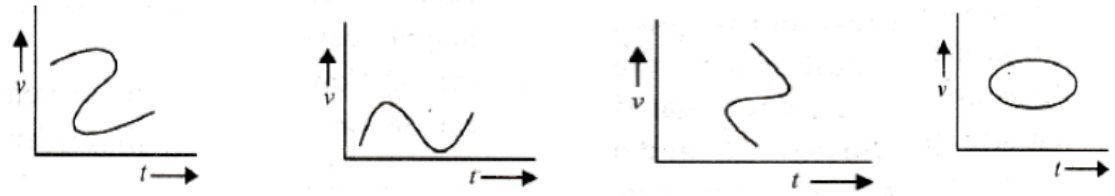
1. What are the number of significant digits in the measurements 4.080 cm and 0.071 respectively? (1)
   (A) 4 and 2 (B) 2 and 4 (C) 3 and 2 (D) 3 and 3

2. What is the dimensional formula of pressure? (1)
   (A) $[M^0L^{-1}T^{-2}]$ (B) $[ML^{-1}T^{-2}]$ (C) $[M^0L^{-1}T^{-1}]$ (D) $[MLT^{-2}]$

3. Two vectors have magnitudes 6 units and 8 units respectively. Find the magnitude of the resultant if the angle between them is 90°. (1)
   (A) 14 units (B) 2 units (C) 100 units (D) 10 units

4. A particle is moving in x direction. The equation of motion is $x = 2t^2$. Here x and t are in m and s respectively. What are the magnitudes of its position and velocity at t = 2 seconds? (1)
   (A) 8 m and 4 m/s (B) 2 m and 8 m/s (C) 8 m and 8 m/s (D) 4 m and 4 m/s

5. Which of the following velocity-time graph shows a realistic situation for a body in motion? (1)



(A) (B) (C) (D)

6. A stone is dropped from a top of a tower 40 m high. How long will it take to reach the ground? (1)
   (A) $\sqrt{2}$ s (B) $2\sqrt{2}$ s (C) $3\sqrt{2}$ s (D) 2 s

7. The magnitude of the vector $2\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$ is _____. (1)
   (A) 3 units (B) 17 units (C) $\sqrt{17}$ units (D) 1 unit

8. The total vertical distance covered by a freely falling body in a given time is directly proportional to _____. (1)
   (A) time (B) product of the time and acceleration due to gravity
   (C) square of time (D) square of acceleration due to gravity

9. The resultant of two forces P and Q is R. If one of the forces is reversed in direction, then the resultant becomes S. In that case, $R^2 + S^2 =$ _____. (1)
(A) $P^2 + Q^2$ (B) $P^2 + Q^2 + 4PQ\cos\theta$ (C) $2(P^2 + Q^2)$ (D) $P^2 - Q^2$

10. A ball of mass 100 g, projected at an angle of 30° from the ground with an initial velocity of 11 m/s, acceleration due to gravity is g = 10 m/s^2, what is the maximum height attained? (1)
(A) 1.5 m (B) 3.0 m (C) 1.0 m (D) 2.0 m

For question numbers 11 and 12, select the correct answer from the codes (A), (B), (C) and (D) as given below.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is NOT the correct explanation of (A).
(C) (A) is true but (R) is false
(D) (A) is false and (R) is also false.

11. A: The slope of the velocity-time graph at any instant for unform motion is zero. (1)
R: For uniform motion, acceleration is zero.

12. A**:** In projectile motion, the angle between the instantaneous velocity and acceleration at the highest point is 90°. (1)
R**:** At the highest point, velocity of projectile will be in horizontal direction only.

SECTION B

13. The velocity v of depends upon the time t according to the equation $v = a + bt + \frac{c}{d+t}$. Write the dimensions of a, b, c and d. (2)

14. Define scalar product of two vectors. Find the angle between the two vectors $2\hat{\imath} + 3\hat{\jmath} - 4\hat{k}$ and $3\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$. (2)

SECTION C

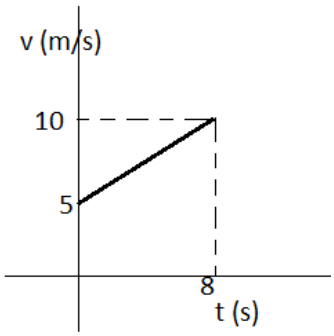
15. The centripetal force F acting on a particle moving uniformly in a circular path depends on its mass (m), velocity (v) and radius of the circular path. Derive the formula for F using dimensions. (3)

16. Show that the path of a projectile is a parabola. (3)

SECTION D

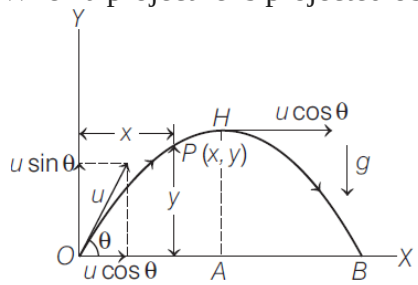
Question numbers 17 and 18 are case based questions.

17. A particle is moving along x axis. Its x coordinates verses time graph is shown below.



(i) What is the type of motion? (1)
(ii) What is the magnitude of the acceleration? (1)
(iii) Write an equation of motion of the particle from the graph. (1)
(iv) What is the displacement between t = 0 seconds and t = 8 seconds. (1)

18. Projectile motion is a form of motion in which an object or particle is thrown with some initial velocity near the earth's surface and it moves along a curved path under the action of gravity alone. The path followed by a projectile is called its trajectory, which is shown below. When a projectile is projected obliquely, then its trajectory is as shown in the figure below.



Here, velocity u is resolved into two components, we get (a) u cosθ along OX and (b) u sinθ along OY.

(i) The acceleration of the object in horizontal direction is _____. (1)

(A) constant (B) decreasing (C) increasing (D) zero

(ii) The vertical component of velocity at point H is _____. (1)

(A) maximum (B) equal to horizontal component

(C) double to that at O (D) zero

(iii) (A) The vertical component of initial velocity is 15 m/s. Find the time of flight. (2)

OR

(B) The time of flight of a projectile is 2 s. If the range of the projectile is 200 m, what could be the initial horizontal velocity? What could be the initial vertical velocity?

SECTION E

19. (A) Derive the equations of motion (i) $v = u + at$ and (ii) $s = ut + \frac{1}{2}at^2$ using analytical method. (5)

OR

(B) Draw a (v-t) graph of a uniformly accelerated motion starting with an initial velocity 'u'. Obtain the expression for displacement $s = ut + \frac{1}{2}at^2$ using the graph.

20. (A) State parallelogram law of vector addition. Two vectors $\vec{A}$ and $\vec{B}$ are added to get vector $\vec{R}$. The angle between $\vec{A}$ and $\vec{B}$ is θ. Find the expression for the magnitude and direction of $\vec{R}$ using parallelogram law of vector addition. (5)

OR

(B) A particle is projected with an initial velocity 'u' at an angle Θ with the horizontal. Derive the expression for its maximum height and range.