विद्या सर्वार्थि साधिका

ANANDALAYA

PERIODIC TEST -1

Class: XI

Subject: Physics (042) MM: 30

Date : 13-07-2023 Time: 1 Hr. 30 min.

General Instructions:

1. There are 17 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. All the sections are compulsory.
3. Section A consists of eleven MCQs of 1 mark each, Section B consists of two questions of 2 marks each, Section C consists of two questions of 3 marks each, Section D consists of one long question of 5 marks and Section E consists of one case study based question of 4 marks.
4. Use of calculators is not allowed.

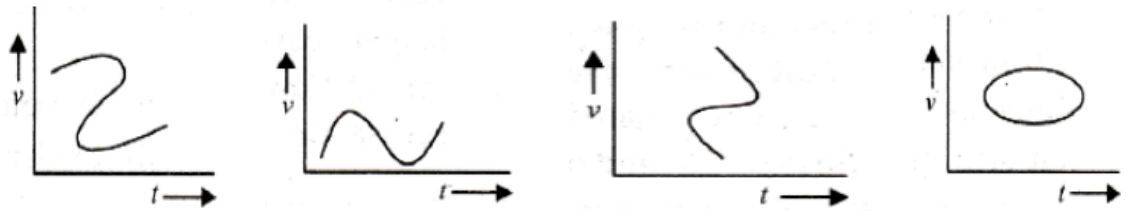
SECTION A

1. Candela is a unit of _____. (1)

   (A) acoustic intensity (C) electric intensity

   (B) luminous intensity (D) magnetic intensity

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

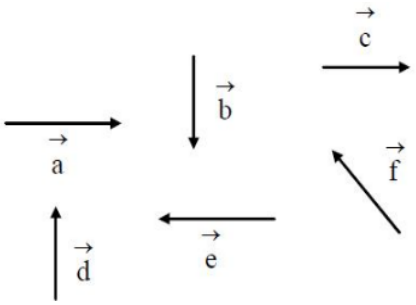


(A) (B) (C) (D)

3. Two bodies A (of mass 1 kg) and B (of mass 3 kg) are dropped from heights 16m and 25m, respectively. The ratio of the time taken by them to reach the ground (t_A/t_B) is ____. (1)

   (A) $4/5$ (B) $12/5$ (C) $5/4$ (D) $5/12$

4. Six vectors, $\vec{a}$ to $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true? (1)



   (A) $\vec{b} + \vec{c} = \vec{f}$

   (B) $\vec{d} + \vec{c} = \vec{f}$

   (C) $\vec{d} + \vec{e} = \vec{f}$

   (D) $\vec{b} + \vec{e} = \vec{f}$

5. Which of the following algebraic operations with scalar and vector physical quantities are meaningful: (1)

   (I) Adding any two scalars.

   (II) Adding a scalar to a vector of the same dimensions.

   (III) Multiplying any vector by any scalar.

   (IV) Multiplying any two scalars

   (A) (I) and (II) (C) (III) and (IV)

   (B) (II) and (III) (D) (I) and (IV)

6. The position x of a particle varies with time t is given as $x = (2t^2 - 4t)\ m$. The velocity of the particle is zero at time t ___. (1)
(A) 1 sec (B) 2 sec (C) 3 sec (D) zero

7. Which of the following is a dimensionless quantity? (1)
(A) Stress (B) Torque (C) Plane angle (D) Impulse

8. A physical quantity is measured in unit u. If n is the numerical value of the quantity, then the exact relation between them is ___. (1)
(A) $n \propto 1/u$ (B) $n \propto u$ (C) $n \propto 1/u^2$ (D) $n \propto u^2$

9. The respective number of significant figures for the numbers 23.023, 0.0002 and 2.1 x 10^{-3} are __. (1)
(A) 5, 5, 2 (B) 5, 1, 2 (C) 5, 1. 3 (D) 5, 2, 2

For question numbers 10 and 11, two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.
(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(B) Both Assertion and Reason are true but Reason is NOT the correct explanation of Assertion.
(C) Assertion is true but Reason is false
(D) Assertion is false and Reason is also false.

10. Assertion: One dimensional motion is always on a straight line. (1)
Reason: In one dimensional motion, the angle between acceleration and velocity must be zero.

11. Assertion: Absolute refractive index of a medium is a dimensionless quantity. (1)
Reason: It is the ratio of velocity of light in vacuum to the velocity of light in the medium.

SECTION B

12. If $\vec{A} = (7i + 6k)$ and $\vec{B} = (3j + 4k)$, find magnitude of $\vec{A} + \vec{B}$ and $\vec{A} - \vec{B}$. (2)

13. (i) Draw position - time graph for positive acceleration. (2)
(ii) A ball thrown vertically upwards. It has a speed of 10 m/s when it has reached one half of its maximum height. How high does the ball rise? Take g = 10 m/s^2 .

SECTION C

14. Check the dimensional consistency of the following equations: (3)
(i) $E = mc^2$ where E, m and c are energy, mass and velocity of light respectively.
(ii) $v = \sqrt{P\rho}$ where v, P and ρ are velocity of sound, pressure and density of medium respectively.

15. The velocity of water waves v may depend on their wavelength λ, the density of water ρ and the acceleration due to the gravity g. Using the method of dimensions, obtain a relation among the physical quantities. (3)

SECTION D

16. Draw a velocity – time graph of a uniformly accelerated motion starting from a non-zero initial velocity. Using the same velocity-time graph, derive the following equations of motion: (5)
$(i)\ v = u + at$ and $(ii)\ s = ut + \frac{1}{2}at^2$ where symbols have their usual meanings.

SECTION E

Questions 17 is a case study based question carrying 4 marks.

17. Parallelogram Law of Vector Addition:

Vector quantities obey the laws of vector addition. There are two laws for the addition of vectors - the triangle law of vector addition and the parallelogram law of vector addition. The parallelogram law of vector addition is used to add two vectors when the vectors that are to be added form the two adjacent sides of a parallelogram by joining the tails of the two vectors.

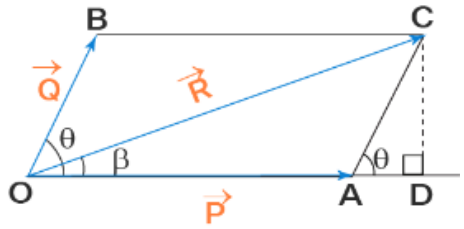
Now, to prove the formula of the parallelogram law, we consider two vectors $\vec{P}$ and $\vec{Q}$ represented by the two adjacent sides of the parallelogram OBCA, respectively. The angle between the two vectors is θ. The sum of these two vectors is represented by the diagonal drawn from the same vertex O of the parallelogram, the resultant $\vec{R}$which makes an angle β with the vector $\vec{P}$.

Here, the vector $\vec{R}$ is called the resultant of the vectors $\vec{P}$ and $\vec{Q}$.

$$\vec{R} = \vec{P} + \vec{Q}$$

Magnitude of the resultant vector:

$$|R| = \sqrt{P^2 + Q^2 + 2PQ\ cos\theta}$$



(i) Two forces 3N and 4N act on a point mass in two mutually perpendicular directions. What is the resultant force on the point mass? (1)

(ii) Is the vector $(\hat{\imath} + \hat{\jmath})$ a unit vector? Justify your answer. (1)

(iii) If $\vec{P} + \vec{Q} = \vec{R}$ and $P = Q = R$, then find the angle between $\vec{P}$ and $\vec{Q}$. (2)

OR

(iii) Prove that vector addition is commutative.