विद्या सर्वार्थि साधिका

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PERIODIC TEST – 1

Class: XI

Subject: Physics (042) MM : 40

Date : 16-07-2024 Time: 1 Hr. 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 twelve 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 two long answer questions of 5 marks each and Section E consists two case study based questions of 4 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. Use of calculators is not allowed.

SECTION A

1. Write the number of significant digits in 1.230 cm. (1)
   (A) 4 (B) 3 (C) 2 (D) 1

2. What is the SI unit of solid angle? (1)
   (A) degree (B) radian (C) Ω (D) steradian

3. The surface tension is defined as the force per unit length acting at right angles to an imaginary line drawn on the free surface of liquid. What is the dimension of surface tension? (1)
   (A) $[M^0L^0T^{-2}]$ (B) $[M^1L^0T^{-2}]$ (C) $[M^1L^1T^{-2}]$ (D) $[M^0L^1T^{-1}]$

4. Two vectors $\vec{A}$ and $\vec{B}$ of equal magnitude, when added, give a vector of same magnitude. What is the angle between $\vec{A}$ and $\vec{B}$? (1)
   (A) 0º (B) 90º (C) 120º (D) 180º

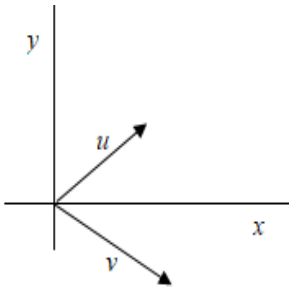
5. Find the magnitude of the displacement vector $\frac{1}{3}\hat{\imath} + \frac{2}{3}\hat{\jmath} + \frac{2}{3}\hat{k}$ meters. (1)
   (A) 9 m (B) 1 m (C) $\frac{25}{9}$ m (D) $\frac{5}{3}$ m

6. Two forces $\vec{A}$ and $\vec{B}$ (A > B) are acting on mass simultaneously. When they are parallel, the net force is 20 N and when they are antiparallel the net force is 10 N. Find the magnitudes of A and B. (1)
   (A) 15 N and 5 N (B) 5 N and 15 N (C) 20 N and 10 N (D) 10 N and 20 N

7. Differentiation of any function gives its _____. (1)
   (A) rate of change (B) area below the graph (C) summation (D) average value

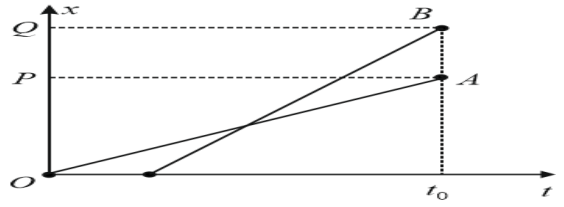
8. Figure shows the orientation of two vectors u and v in the XY plane. If $\vec{u} = a\hat{\imath} + b\hat{\jmath}$ and $\vec{v} = c\hat{\imath} + d\hat{\jmath}$, which of the following is correct? (1)

   (A) *a* and *c* are positive while *b* and *d* are negative.
   (B) *a*, *c* and *b* are positive while *d* is negative.
   (C) *a*, *d* and *b* are positive while *c* is negative.
   (D) *a*, *b*, *c* and *d* are all positive.



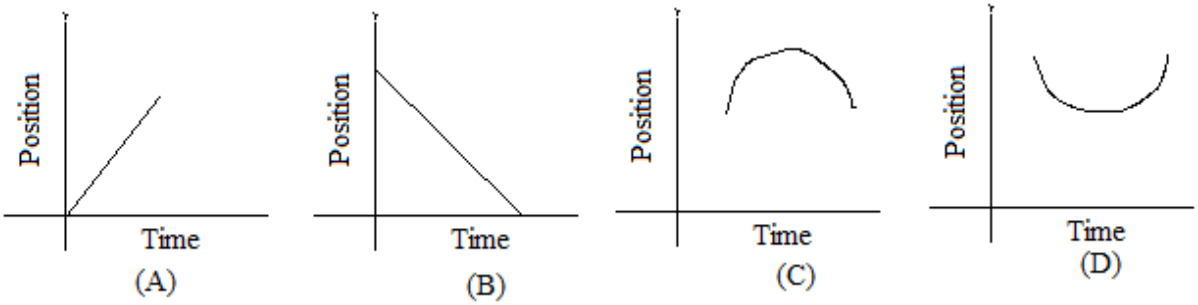
OR

8. The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q respectively are shown in figure. Choose the correct option from below.



(A) B lives closer to the school than A
(B) B walks faster than A
(C) B starts from the school earlier than A
(D) B overtakes A on the road twice.

9. Which one of the following graphs represents positive acceleration? (1)



10. The velocity of an object changes from 5 m/s to 2 m/s in 2 s. What is its acceleration? (1)
(A) 1.5 m/s^2 (B) –1.5 m/s^2 (C) 3.5 m/s^2 (D) – 3.5 m/s^2

For question numbers 11 and 12, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions 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. Assertion: When we change the unit of measurement of a quantity, its numerical value changes. (1)
Reason: Smaller the unit of measurement, smaller is its numerical value.

12. Assertion: The average and instantaneous velocities have same value in a uniform motion. (1)
Reason: In uniform motion, the velocity of an object increases uniformly.

SECTION B

13. Each side of a cube is measured to be 7.203 m. What are the total surface area and the volume of the cube to appropriate significant figures? (2)

14. What is magnitude of addition of two vectors whose magnitudes are 25 units and 10 units? The angle between them is 60°. (2)

SECTION C

15. If $y = 2x^3 + 5$ find the rate of change of y with respect to x at (i) x = 0 and (ii) x = 2. (3)

16. The time period of a simple pendulum (T) depends on the length of (l) and acceleration due to gravity (g). Derive the expression for the time period of simple pendulum using dimensional analysis. (3)

SECTION D

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

OR

Two vectors A and B with magnitudes 20 m and 10 m are making angle 30° and 60° respectively with x axis. Resolve them into perpendicular components along x and y axes. Also find the resultant vector (i) when they are added and (ii) when they are subtracted.

18. Draw a $(v-t)$ of a uniformly accelerated motion. Derive the three equations of motion from the graph. (5)

OR

Distance travelled by an object in nth second is found by calculating the distance travelled for n seconds and (n-1) seconds and subtracting them. Derive the expression for distance travelled by a uniformly accelerated object in nth second.

SECTION E

Questions 19 and 20 are Case Study Based questions and are compulsory. Each question carries 4 marks.

19. Measurement of any physical quantity involves comparison with a certain basic, arbitrarily chosen, internationally accepted reference standard called unit. The units for the fundamental or base quantities are called fundamental or base units. The units of all other physical quantities can be expressed as combinations of the base units. Such units obtained for the derived quantities are called derived units. A complete set of these units, both the base units and derived units, is known as the system of units. The system of units which is at present internationally accepted for measurement is the SI units

(i) From the following which one is not a base unit? (1)
(A) m (B) N (C) kg (D) s

(ii) What is the SI unit of electric current? (1)
(A) coulomb (B) ampere (C) tesla (D) volt

(iii) What is the value of 72 km/h in m/s? (1)
(A) 0.072 m/s (B) 259.2 m/s (C) 20 m/s (D) 4.32 m/s

(iv) How many base units are there? (1)
(A) 3 (B) 5 (C) 7 (D) 9

20. Stopping distance of vehicles: When brakes are applied to a moving vehicle, the distance it travels before stopping is called stopping distance. It is an important factor for road safety and depends on the initial velocity (u) and the braking capacity, or deceleration, $-a$ that is caused by the braking. The stopping distance is proportional to the square of the initial velocity. Doubling the initial velocity increases the stopping distance by a factor of 4 (for the same deceleration).
Reaction time: When a situation demands our immediate action, it takes some time before we really respond. Reaction time is the time a person takes to observe, think and act. For example, if a person is driving and suddenly a boy appears on the road, then the time elapsed before he slams the brakes of the car is the reaction time. Reaction time depends on complexity of the situation and on an individual.

(i) The stopping distance is proportional to _____ . (1)
(A) u (B) u^2 (C) 1/u (D) $u^{½}$

(ii) The initial velocity if tripled, how does the stopping distance change? (1)
(A) By a factor of 4 (B) By a factor of 3
(C) By a factor of 9 (D) By a factor of 6

(iii) A motor car moving at a speed of 72 km/h cannot come to a stop in less than 3.0 s. On a high way the car driver sees a cow crossing a road and applies the brakes. At what distance the car should be from the cow so that it does not collide with the cow. Human response time is 0.5 s (2)

OR

(iii) Ram is trying to measure his reaction time by a simple experiment. He took a ruler and dropped it vertically through the gap between his thumb and forefinger and catches immediately. He found the distance d travelled by the ruler. 'd' was found to be 20.0 cm. Estimate his reaction time. Take g as 10 m/s^2.