



Delhi Public School, Howrah

PERIODIC TEST -I (2024-2025)

Class-XI

Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

SUBJECT: PHYSICS (CODE- 042)

Time:-3 Hours

F.M.-70

General Instructions:

- (1) There are 33 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) All the sections are compulsory.
- (4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
- (5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
- (6) Use of calculators is not allowed.
- (7) You may use the following values of physical constants where ever necessary.

i. $c = 3 \times 10^8$ m/s

ii. $m_e = 9.1 \times 10^{-31}$ kg

iii. $e = 1.6 \times 10^{-19}$ C

iv. $\mu_0 = 4\pi \times 10^{-7}$ TmA⁻¹

v. $h = 6.63 \times 10^{-34}$ Js

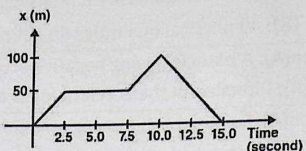
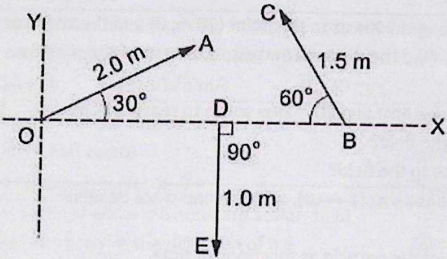
vi. $\epsilon_0 = 8.854 \times 10^{-12}$ C²N⁻¹m⁻²

vii. Avogadro's number = 6.023×10^{23} per gram mole

SECTION - A		
1.	Given: $\alpha = \frac{F}{\sqrt{2}} \sin(\beta t)$ (here V = velocity, F = force, t = time): Find the dimension of α and β . (A) $\alpha = [M^1L^1T^0]$, $\beta = [T^{-1}]$ (B) $\alpha = [M^1L^1T^{-1}]$, $\beta = [T^1]$ (C) $\alpha = [M^1L^1T^{-1}]$, $\beta = [T^{-1}]$ (D) $\alpha = [M^1L^{-1}T^0]$, $\beta = [T^{-1}]$	1
2.	If force, acceleration and time are taken as fundamental quantities, then the dimensions of length will be: (A) $[FT^2]$ (B) $[F^{-1}A^2T^{-1}]$ (C) $[FA^2T]$ (D) $[AT^2]$	1
3.	The value of universal gravitation constant is $G = 6.67 \times 10^{-11}$ kg ⁻¹ m ³ s ⁻² . Find the value of G in CGS system of units. (A) 6.67×10^{-8} (B) 6.67×10^2 (C) 0.149×10^{-2} (D) 0.149×10^2	1
4.	In a certain system of units, 1 unit of time is 5 sec, 1 unit of mass is 20 kg and 1 unit of length is 10 m. In this system, one unit of power will correspond to (A) 16 watts (B) 1/16 watts (C) 25 watts (D) none of these	1

5.	An ant is at a corner of a cubical room of side 'a'. The ant can move with a constant speed u. The minimum time taken to reach the farthest corner of the cube is: (A) $\frac{3a}{u}$ (B) $\frac{\sqrt{3}a}{u}$ (C) $\frac{\sqrt{5}a}{u}$ (D) $\frac{(\sqrt{2}+1)a}{u}$	1
6.	The figure shows the displacement time graph of a particle moving on the X-axis. Find the correct statement for the particle. (A) The particle is continuously going in positive y direction. (B) The particle is at rest. (C) The velocity increases up to a time and then becomes constant. (D) The particle moves at a constant velocity up to a time and then stops.	1
7.	Consider the motion of the tip of the minute hand of a clock. In one hour (A) the displacement is non - zero (B) the distance covered is zero (C) the average speed is zero (D) the average velocity is zero	1
8.	The displacement of a body from a reference point is given by, $\sqrt{x} = 2t - 3$, where 'x' is in metres and t in seconds. This shows that the body: (A) is at rest at $t = 3/2$ (B) is having constant velocity (C) is decelerated (D) is in uniform motion	1
9.	Raindrops are falling vertically with a velocity of 10 m/s. To a cyclist moving on a straight road the raindrops appear to be coming with a velocity of 20 m/s. The velocity of cyclist is: (A) 10 m/s (B) $10\sqrt{3}$ m/s (C) 20 m/s (D) $20\sqrt{3}$ m/s	1
10.	If $ \vec{A} + \vec{B} = \vec{A} - \vec{B} $ then which of the following options cannot be true? (A) \vec{A} is a null vector (B) \vec{B} is a null vector (C) \vec{A} is perpendicular to \vec{B} (D) \vec{A} is parallel to \vec{B}	1
11.	If \hat{a} is a vector and x is a non-zero scalar, then (A) $x\hat{a}$ is a vector in the direction of a \hat{a} (B) $x\hat{a}$ is a vector collinear to \hat{a} (C) $x\hat{a}$ and \hat{a} have independent directions (D) none of these.	1
12.	The resultant of two forces, one double the other in magnitude is perpendicular to the smaller of the two forces. The angle between the two forces is (A) 150° (B) 90° (C) 60° (D) 120°	1
	For question numbers 13 to 16, two statements are given- one labeled as Assertion (A) and the other labeled as 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 the 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 true. (e) Both A and R is false.	
13.	Assertion (A): In a projectile motion, the velocity at its highest point is zero. Reason (R): In a projectile motion from ground to ground projection, the acceleration is g downwards due to which speed of the projectile first decreases then increases to the same value.	1

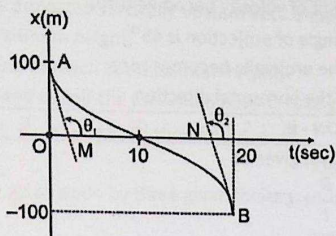
14.	Assertion (A): All constants are dimensionless. Reason (R): All physical quantities do not necessarily have dimensions.	1
15.	Assertion(A): A particle having negative acceleration will slow down. Reason(R): Direction of the acceleration is not dependent upon direction of the velocity.	1
16.	Assertion(A): For an object moving on a circular path, the magnitude of average velocity is equal to average speed. Reason(R): For an object moving on a circular path, magnitude of instantaneous velocity is equal to instantaneous speed.	1
SECTION - B		
17.	The speed of sound in a medium depends upon the coefficient of elasticity of the medium under adiabatic conditions (E) and the density of the medium. Prove that velocity of sound $v = k \sqrt{\frac{E}{\rho}}$. Given, the dimension of coefficient of elasticity (E) is $[ML^{-1}T^{-2}]$. OR The height h to which a liquid rises in a tube of radius (r) depends upon the density of the liquid (d), surface tension (T), and acceleration due to gravity (g). Find the equation of h. Given, the dimension of surface tension is $[MT^{-2}]$.	2
18.	Two projectiles are thrown with different speeds and at different angles so as to cover the same maximum height. Find out the sum of the time taken by each to reach to the highest point, if time of flight is T.	2
19.	(i) A particle starts from the origin, goes along the X-axis to the point (20 m, 0) and then returns along the same line to the point (-20 m, 0). Find the distance and displacement of the particle during the trip. (ii) A man has to go 50 m due north, 40 m due east and 20 m due south to reach a field. (a) What distance he has to walk to reach the field? (b) What is his displacement from his house to the field?	1+1
20.	The position of a particle varies with time t as $r = at(1 - \alpha t)$, where a and α are positive constants. Find: (i) The velocity 'v' and the acceleration 'w' of the particle as functions of time. (ii) Comment on the acceleration of the particle from the value you got.	1+1
21.	(i) Show that $\vec{A} \cdot (\vec{A} \times \vec{B}) = 0$ (ii) When two forces of magnitude P and Q are perpendicular to each other, their resultant is of magnitude R. When they are at an angle of 180° to each other, their resultant is of magnitude $\frac{R}{\sqrt{2}}$. Find the ratio of magnitudes of P and Q.	1+1
SECTION - C		
22.	A body of mass m hung at one end of the spring executes simple harmonic motion. The force constant of the spring is k while its time period of vibration is T. (i) Prove by dimensional method that the equation $T = \frac{2\pi M}{k}$ is incorrect. (ii) Derive the correct equation using dimensional analysis. Given, dimension of force constant(k) is $[MT^{-2}]$	1+2

23.	<p>(i) The figure shows the graph of the x-coordinate of a particle going along the X-axis as a function of time.</p> <p>Find</p> <p>(a) The average velocity during 0 to 10 s,</p> <p>(b) Instantaneous velocity at 2, 5, 8 and 12s.</p> <p>(ii) A bullet going with speed 350 m/s enters a concrete wall and penetrates a distance of 5cm before coming to rest. Find the deceleration.</p>		2+1
24.	<p>A train starts from rest and moves with a constant acceleration of 2.0 m/s^2 for half a minute. The brakes are then applied and the train comes to rest in one minute. Find</p> <p>(a) The total distance moved by the train,</p> <p>(b) The maximum speed attained by the train and</p> <p>(c) The position of the train at a moment when its speed is half the maximum speed.</p>	1+1+1	
25.	<p>(i) Using graphical method derive the equation $S = ut + \frac{1}{2} at^2$.</p> <p>(ii) An object having a velocity 4.0 m/s is accelerated at the rate of 1.2 m/s^2 for 5.0 s. Find the distance travelled during the period of acceleration.</p>	2+1	
26.	<p>Refer to the given figure.</p>  <p>Find</p> <p>(a) the magnitude of the x and y components of \vec{OA}, \vec{BC} and \vec{DE}.</p> <p>(b) the magnitude of the resultant of \vec{OA}, \vec{BC} and \vec{DE}.</p> <p>(c) the angle with the x-axis of the resultant of \vec{OA}, \vec{BC} and \vec{DE}.</p>	1+1+1	
27.	<p>A particle is projected in air at an angle θ to the horizontal, with a velocity of projection u.</p> <p>(i) Derive the equation of trajectory for the particle.</p> <p>(ii) What type of path is followed by the particle according to the equation?</p>	2+1	
28.	<p>(i) If the Vectors $\vec{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\vec{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other, find the value of a?</p> <p>(ii) Find the area of a parallelogram formed from the vectors $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{Q} = 3\hat{i} - 2\hat{j} + \hat{k}$ as adjacent sides.</p> <p>(iii) Rain is falling vertically with a speed of 30 m/s. A woman rides a bicycle with a speed of 10 m/s in the north to south direction. What is the direction in which she should hold her umbrella?</p>	1+1+1	

SECTION - D

29. Read the following passage and answer the questions.

The graph below gives the displacement of a particle travelling along the X-axis as a function of time. AM is the tangent to the curve at the starting moment and BN is tangent at the end moment ($\theta_1 = \theta_2 = 120^\circ$).



- i. The average velocity during the first 20 seconds is
(A) -10 m/s (B) 10 m/s (C) zero (D) 20 m/s
- ii. The average acceleration during the first 20 seconds is
(A) -10 m/s² (B) 10 m/s² (C) zero (D) 20 m/s²
- iii. The direction of acceleration during the first 10 seconds is
(A) \hat{i} (B) $-\hat{i}$ (C) \hat{j} (D) $-\hat{j}$
- iv. Time interval during which the motion is retarded -
(A) 0 to 20sec. (B) 10 to 20sec. (C) 0 to 10sec. (D) None of these

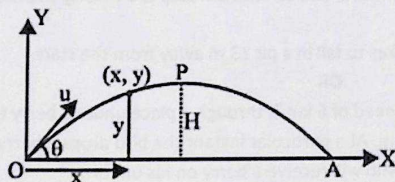
OR

Time interval during which the motion is accelerated -

- (A) 0 to 20sec. (B) 10 to 20sec. (C) 0 to 10sec. (D) None of these

30. Read the following passage and answer the questions based on that.

When a body is projected at an angle θ from the horizontal, the path will be parabolic. For the parabolic path angle (θ) between velocity and acceleration satisfies $0 < \theta < 180$ with $\theta \neq 0$ or 180 . If $\theta = 90$, then path of the particle is circular. If $\theta = 0$ or $180 \rightarrow$ then the path of the particle is a straight line. The trajectory of a projectile in a vertical plane is $y = \sqrt{3}x - 2x^2$ [$g = 10$ m/s²]



- i. Angle of projection θ is
(A) 30° (B) 60° (C) 45° (D) $\sqrt{3}$ rad
- ii. Maximum height H is
(A) $8/3$ m (B) $3/8$ m (C) $\sqrt{3}$ m (D) $2/\sqrt{3}$ m
- iii. Range OA is
(A) $\frac{\sqrt{3}}{2}$ m (B) $\frac{\sqrt{3}}{4}$ m (C) $\sqrt{3}$ m (D) $3/8$ m

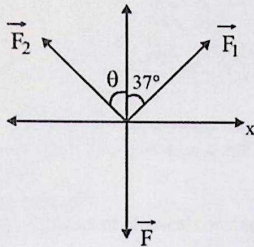
- (a) Find the distance travelled by the particle during the first 40 seconds.
 (b) Also find the average velocity during this period.
- (iii) A woman starts from her home at 9.00 am, walks with a speed of 5 km/h on a straight road up to her office 2.5 km away, stays at the office up to 5.00 pm, and returns home by an auto with a speed of 25 km/h. Choose suitable scales and plot the x-t graph of her motion.

33.

- (i) A ball is projected vertically upward with a speed of 50 m/s. Find
 (a) The maximum height,
 (b) The time to reach the maximum height,
 (c) The speed at half the maximum height. Take $g = 10 \text{ m/s}^2$.
 (ii) If $|\vec{A} \times \vec{B}| = \sqrt{3}|\vec{A} \cdot \vec{B}|$ then find $|\vec{A} + \vec{B}|$.

OR

- (i) A body acted upon by three given forces is under equilibrium.



- (a) If $|\vec{F}_1| = 10 \text{ N}$ and $|\vec{F}_2| = 6 \text{ N}$, find the values of $|\vec{F}_3|$ and θ .
 (b) Express \vec{F}_2 in unit vector form.
- (ii) In a harbour, wind is blowing at the speed of 72 km/h and the flag on the mast of a boat anchored in the harbour flutters along the N-E direction. If the boat starts moving at a speed of 51 km/h to the north, what is the direction of the flag on the mast of the boat?

3+2

3+2