26.06.25

Delhi Public School, Howrah

PERIODIC TEST I (2025-2026)

Class-XI

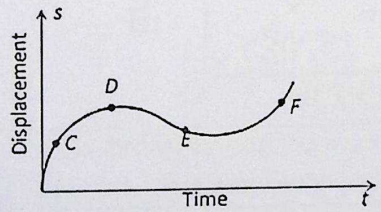
Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

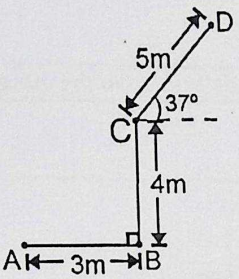
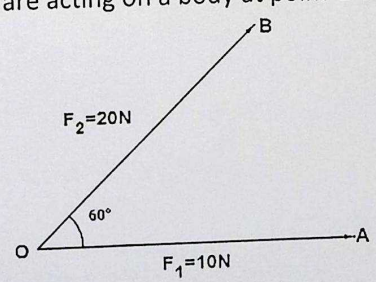
SUBJECT: PHYSICS (CODE- 042)

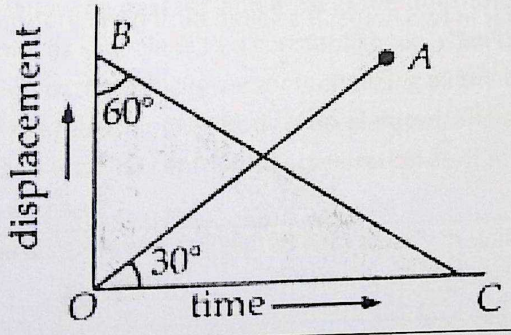
Time:-3 Hours **F.M.-70**

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. $m_e = 9.1$ x10-31 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. $\varepsilon_0 = 8.854 \times 10^{-12}\ C^2 N^{-1} m^{-2}$
vii. Avogadro's number = 6.023×10^{23} per gram mole

	SECTION - A	
1.	Consider the relation $F = a + bx$, where F is force and x is the distance. The dimensional formula of $\frac{[a]^2}{[b]}$ will be that of (A) acceleration (B) force (C) energy (D) power	1
2.	The displacement-time graph of a moving body is shown in the figure below. The instantaneous velocity is negative at point  (A) C (B) D (C) E (D) F	1
3.	The dimension of kinetic energy is same as that of (A) force (B) pressure (C) work (D) momentum	1
4.	The number of significant figures in 0.06900 is (A) 5 (B) 4 (C) 2 (D) 3	1

5.	A jet airplane travelling at the speed of 500 km h^{-1} ejects its products of combustion at the speed of 1500 km h^{-1} relative to the jet plane. What is the speed of those products with respect to an observer on the ground? (A) 500 km h^{-1} (B) 1000 km h^{-1} (C) 1500 km h^{-1} (D) 2000 km h^{-1}	1
6.	A particle moves along a path ABCD as shown in the figure.  Then the magnitude of net displacement of the particle from position A to D is: (A) 10 m (B) $5\sqrt{2}$ m (C) 9 m (D) $7\sqrt{2}$ m	1
7.	A clock has a minute-hand 10 cm long. Find the average velocity between 6.00 AM to 6.30 AM for the tip of the minute hand. (A) 22/21 cm min^{-1} (B) 2/21 cm min^{-1} (C) 12/21 cm min^{-1} (D) 2/3 cm min^{-1}	1
8.	The displacement of a body from a reference point is given by, $\sqrt{x} = 2t - 3$, where 'x' is in metre and t is in second. This shows that the body: (A) is at rest at t = 3/2 (B) is having a constant velocity (C) is decelerated (D) is in uniform motion	1
9.	During projectile motion acceleration of a particle at the highest point of its trajectory is: (A) g (B) zero (C) less than g (D) dependent upon projection velocity	1
10.	If $\vec{A} = \vec{B} + \vec{C}$ and the magnitudes of $\vec{A}, \vec{B}$ and $\vec{C}$ are 5,4 and 3 units respectively, the angle between $\vec{B}$ and $\vec{C}$ is (A) $\cos^{-1}(3/5)$ (B) $\cos^{-1}(4/5)$ (C) $\pi/2$ (D) $\sin^{-1}(3/4)$	1
11.	A unit less quantity (A) never has a nonzero dimension (B) always has a nonzero dimension (C) may have a nonzero dimension (D) does not exit	1
12.	Two forces are acting on a body at point O as shown in the figure below.  The resultant force acting on the body will have a magnitude of (A) $5\sqrt{2}$ N (B) $5\sqrt{3}$ N (C) 10 N (D) $10\sqrt{7}$ N	1

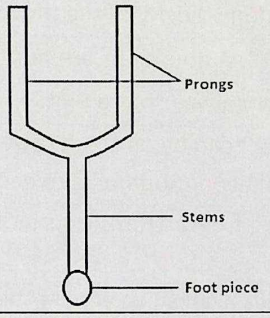
	For question numbers 13 to 16, two statements are given- one labeled as Assertion (A) and the other labeled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below. **A. Both A and R are true and R is the correct explanation of A** **B. Both A and R are true but R is NOT the correct explanation of A** **C. A is true but R is false** **D. Both A and R are false**	
13.	**Assertion (A)**: Uniform circular motion is an accelerated motion. **Reason (R)**: In uniform circular motion velocity of the motion is not constant.	1
14.	**Assertion (A):** All dimensionally correct equations are numerically correct. **Reason (R)**: A dimensionless quantity always has a unit.	1
15.	**Assertion(A):** Resultant of two vectors can be directed towards any one of those two vectors. **Reason(R):** Two vectors can be parallel or antiparallel to each other.	1
16.	**Assertion(A):** In case of a body falling freely near the surface of earth, displacement is directly proportional to the square of time elapsed. **Reason(R):** The freely falling body has a constant acceleration.	1
	SECTION - B	
17.	(a) The orbital velocity 'v' of a satellite depends on its mass 'm', and distance 'r' from the center of the earth and acceleration due to gravity 'g'. Obtain an expression for orbital velocity of the satellite by dimensional analysis. **OR** (b) The time period of an oscillating drop of liquid of radius **r**, density **ρ** and the surface tension **S** is $T = \sqrt{\frac{\rho r^3}{S}}$. Check the correctness of the equation. [Given, surface tension = $\frac{force}{length}$]	2 2
18.	A motor boat covers the distance between two spots on the river in time 8 hours and 12 hours in downstream and upstream respectively. What is the time required for the boat to cover this distance in still water?	2
19.	The displacement-time graph of two bodies P and Q are represented by OA and BC respectively. What is the ratio of velocities of P and Q? Comment about the motion of these two bodies. 	1+1
20.	A ball is thrown vertically upwards with a velocity of 20 m/s. Construct its acceleration-time graph and velocity-time graph with proper scaling. (Ignore air resistance)	1+1
21.	(i) Determine λ for which two vectors $\vec{A} = 2\hat{\imath} + \lambda\hat{\jmath} + \hat{k}$ and $\vec{B} = 4\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$ are perpendicular to each other. (ii) Two equal forces have their resultant equal to either of them. What is the angle of inclination between them?	1+1

SECTION - C

22. (i) A famous relation in Physics relates 'moving mass' m to the 'rest mass' m_0 of a particle in terms of its speed v and the speed of light c. A boy recalls the relation almost correctly but forgets where to put the speed of light c. He writes the equation as: $m = \frac{m_0}{(1-v^2)}$

Correct the equation by checking the dimensional consistency of the equation. **1+2**

(ii) The frequency of a tuning fork depends upon the length L of the prong, the density ρ and the young's modulus Y. From the dimensional considerations, find a possible formula for the frequency of tuning fork. [Given, the unit of Young's modulus is N/m^2]



23. (i) In IPL final cricket match 2025 between RCB and PBKS , a coin was tossed vertically upward. If the air resistance is neglected, find the ratio of the time taken by the coin to ascend and descend? **1+2**

(ii) A mass is dropped from certain height. At the same time another equal mass is thrown horizontally with a velocity of u m/s from the same height . Which one of the two will reach the ground first? Justify your answer with proper calculation.

24. (a) A car moves first for 0.1 hour with a velocity of 20 km/hr, then for 0.4 hour with a velocity of 60 km/hr and in the last for 0.2 hour with a velocity of 20 km/hr. **1+2**

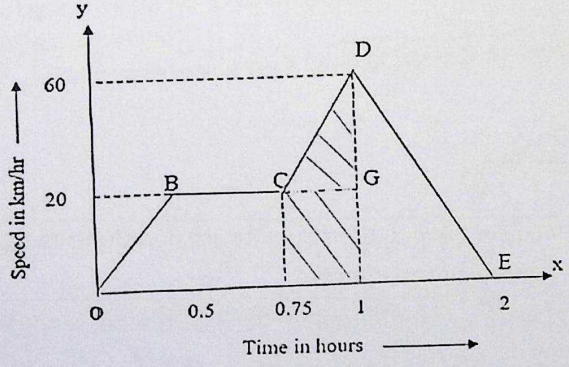
Draw the velocity-time graph for the car and use it to find:

(i) the distance the car moves in the first time interval.

(ii) the time the car takes in first 14 km. Indicate the area corresponding to the journey of first 14 km in your graph.

OR

(b) A train moves from one station to another in two hours. It's speed during the motion is shown in the graph.



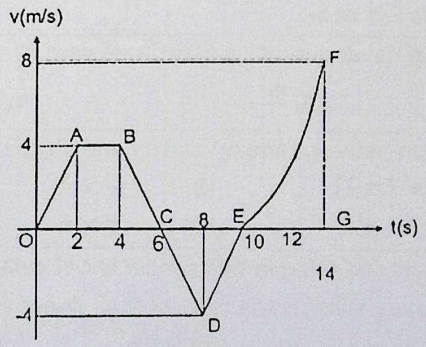
(i) Determine the maximum acceleration during the whole journey.

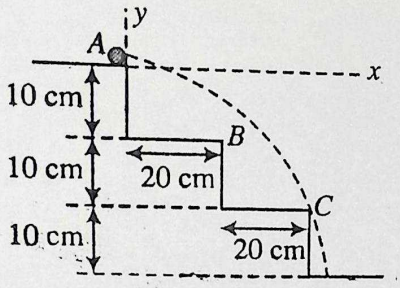
(ii) Also calculate the distance covered during the time interval from 0.75 to 1.00 hour

(iii) Find acceleration of the train at time $1\frac{1}{2}$ hour.

25.	(i) Use graphical method to derive the equation of motion: $v^2 = u^2 + 2as$ (ii) An electron travelling with a speed of 5×10^3 m/s passes through an electric field with an acceleration of 10^{12} m/s^2. How long will it take for the electron to double its speed?	2+1
26.	State polygon law of vector addition. Show with a suitable diagram that it can be deduced from triangle law of vector addition.	1+2
27.	A particle is projected in air at an angle θ to the horizontal, with a velocity of projection u. (i) Derive the equation of trajectory for the particle. (ii) What type of path is followed by the particle according to the equation?	2+1
28.	(i) For any two vectors $\vec{P}$ and $\vec{Q}$, Show that $(\vec{P} \times \vec{Q}) \cdot \vec{P} = 0$ (ii) When two forces of magnitude A and B 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 A and B.	1+2
	SECTION – D	
29.	**Read the following passage and answer the questions based on that.** A person is standing on top of a 100 m high building. He throws two balls vertically upwards at t = 0 and other after a time interval of 1 second. The second ball is thrown at a velocity of half the first ball. The vertical gap between first and second ball is + 15 m at t = 2 s.	
i.	How does the gap between the two balls change with time? (A) increases (B) decreases (C) becomes zero (D) remains constant	1
ii.	Find the velocity of the first ball. (A) 10 m/s (B) 20 m/s (C) 30 m/s (D) 40 m/s	1
iii.	With what velocity was the second ball thrown? (A) 10 m/s (B) 20 m/s (C) 30 m/s (D) 40 m/s	1
iv.	The time taken by the first ball to reach its highest point is (A) 1 s (B) 2 s (C) 3 s (D) 4 s **OR**	1
iv.	The motion of the two balls is (A) accelerated (B) uniform (C) periodic (D) random	
30.	**Read the following passage and answer the questions based on that.** If a body moves in circle with a constant speed, then the magnitude of the velocity is constant but the direction of the velocity vector is changing all the time. Thus velocity is changing with time. Therefore the motion of the body is accelerated. The acceleration is directed towards the centre of the circle and is called centripetal acceleration a_c. If m is the mass of the body then the centripetal force is $F_c = m\, a_c$.	
i.	Centripetal acceleration associated with a body in uniform circular motion is (A) $\frac{v^2}{r}$ (B) $\frac{m^2v^2}{r}$ (C) $\frac{m^2v^2}{r^2}$ (D) $\frac{v}{r}$	1
ii.	Relation between linear velocity and angular velocity of a body moving in circular path is (A) $\vec{v} = \vec{r} \times \vec{\omega}$ (B) $\vec{v} = \vec{\omega} \times \vec{r}$ (C) $\vec{r} = \vec{v} \times \vec{\omega}$ (D) $\vec{\omega} = \vec{v} \times \vec{r}$	1
iii.	Two cars are going in two concentric circular orbits of radius r_1 and r_2 with angular velocities ω_1 and ω_2. What is the ratio of their linear velocities? (A) $\frac{r_1\omega_2}{r_2\omega_1}$ (B) $\frac{r_2\omega_1}{r_1\omega_2}$ (C) $\frac{r_2\omega_2}{r_1\omega_1}$ (D) $\frac{r_1\omega_1}{r_2\omega_2}$	1

iv.	If two bodies have circular path of radius r_1 and r_2 and their time period are the same, the ratio of the angular speed is (A) 1:2 (B) 2:1 (C) 1:1 (D) 1:5	1
	OR	
iv.	What would be the direction of motion of a stone moving in a circular path if at certain time it's string gets broken? (A) straight line (B) parabola (C) circular path (D) can't be predicted	
	SECTION - E	
31.	(a) (i) Equation of a progressive wave is given as $y = A \sin(\omega t - kx + \varphi)$ Where, y represents displacement of medium particle, A represents maximum displacement of medium particle, t represents time, x represents position of particle and φ represents phase angle in radian. Find the units of A, ω and k. (ii) If momentum (P), area (A) and time (T) are taken to be fundamental quantities, then find the dimensional formula of energy.	3+2
	OR	
	(b) (i) A new system of units is proposed in which unit of mass is α kg, length β meter and of time is γ sec. How much will 5 J measure in this new system? (ii) Out of formulae (i) $y = a \sin 2\pi t/T$ and (ii) $y = a \sin vt$ for the displacement y of a particle undergoing a certain periodic motion, rule out the wrong formula on dimensional grounds. Give proper justification to it.	2+3
32.	(a) (i) A stone loses $1/10^{th}$ of its velocity on passing through a sand bag of length x. For its velocity to be made zero, how many more similar bags are to be placed on its path? (ii) A car initially travelling with a speed of 72 km/h decelerates uniformly at 2 m/s^2. Calculate (1) the stopping distance. (2) the time it takes to stop. (3) the distance it travels during third second.	2+3
	OR	
	(b) (i) Two balls A and B are thrown at the same time. A is thrown vertically upwards with a speed of 20 m/s from the ground and B is thrown vertically downwards from a height of 40 m with the same speed and along the same line of motion. At which height above the ground the two balls will collide? (ii) For a particle moving along x-axis, v-t graph is shown below. OA, AB, BC, CD & DE are straight lines, but EF is a curve having equation $v = \frac{1}{2}(t-10)^2$ Find - (1) distance travelled and displacement of the particle in first 6s. (2) distance travelled and displacement of the particle from 6s to 10s. (3) distance travelled and displacement of the particle from 10s to 14s.	2+3



33.	(a) (i) A particle starts from the origin at t = 0 s with a velocity of 10.0 $\hat{j}$ m/s and moves in the x-y plane with a constant acceleration of (8.0 $\hat{i}$ + 2.0 $\hat{j}$) m s^{-2}. (1) At what time is the x- coordinate of the particle 16 m? (2) What is the y-coordinate of the particle at that time? (3) What is the speed of the particle at the time? (ii) A stair case contains 3 steps each 10 cm high and 20 cm wide, as shown in the figure below. What should be the minimum horizontal velocity of a ball rolling off the uppermost plane so as to hit directly the lowest plane. (g = 10 m/s^2)  **OR** (b) (i) A cricket ball is thrown at a speed of 28 m s^{-1} in a direction 30° above the horizontal. Calculate - (1) the maximum height. (2) the time taken by the ball to return to the same level, and (3) the distance from the thrower to the point where the ball returns to the same level. (ii) A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 25 s, what is the magnitude and direction of acceleration of the stone?	3+2 3+2