केंद्रीय विद्यालय संगठन, कोलकाता संभाग
KENDRIYA VIDYALAYA SANGATHAN, KOLKATA REGION

सत्रांत परीक्षा / SESSION ENDING EXAMINATION – 2025-26

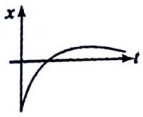
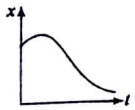
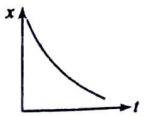
कक्षा/CLASS: ग्यारहवीं / XI **अधिकतम अंक /MAX. MARKS:** 70

समय/ TIME: 03 घंटे /HOURS

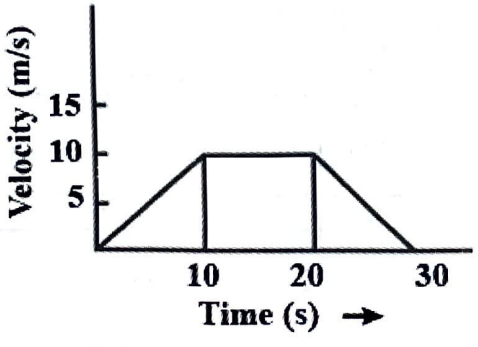
विषय/ SUB : भौतिकी / PHYSICS (042)

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.

SECTION – A		
S.NO.	**QUESTION**	**MARKS**
1	**Rounding 2.745 to three significant figures gives:** (a) 2.75 (b) 2.74 (c) 2.73 (d) 2.745	1
2	**Among the four graphs shown in the figure, there is only one graph for which average velocity over the time interval (0, 7) can vanish for a suitably chosen T. Which one is it?** **(a)**  **(b)**  **(c)** 	1

	 **(d)**	
3	Out of the following which statement is not true regarding friction (a) Maximum value of static friction is proportional to the normal reaction (b) Friction is the component of the contact force parallel to the surfaces in contact (c) Friction opposes motion between the two surfaces. (d) Friction is independent of the area of contact	1
4	If momentum (p), area (A) and time(t)are taken to be fundamental quantities then energy has the dimensional formula (a) [pA−1T−1] (b) [P2AT] (c) [pA−1/2T] (d) [pA1/2T−1]	1
5	A body constrained to move along the z-axis of a coordinate system is subject to a constant force F given by F = (− i + 2 j + 3 k)N where i, j, k are unit vectors along the x-, y- and z-axis of the system respectively the work done by this force in moving the body a distance of 4 m along the z-axis is (a)-4J (b)8J (c)12J (d) 20J	1
6	The measurement of a thermodynamic property known as temperature is based on: (a) Zeroth law of Thermodynamics (b) First law of Thermodynamics (c) Second law of Thermodynamics (d) None of these	1
7	Which of the following statement is not true about the spring force (a) The work done by the spring force in a cyclic process is zero. (b) The spring force is position dependent (c) The work done by the spring force depends only on the end points.	1

	(d) The spring force is an example of a constant force which is conservative	
8	Which of the following is not a unit of time ? (a) Second (b) Year (c) Light year (d) None of the above	1
9	If the unit of force is 100 N, unit of length is 10m and unit of time is 100 s, what is the unit of mass in this system of units? (a) 10^3 kg (b) 10^4 kg (c) 10^2 kg (d) 10^5 kg	1
10	In the following graph, distance travelled in metres is:  (a) 200m (b) 400m (c) 300m (d) 500m	1
11	The resultant of two forces, one double the other in magnitude, is perpendicular to the smaller of the two forces. Find the angle between the forces. **(a)** 150^0 **(b)** 90^0 **(c)** 120^0 **(d)** 60^0	1
12	Four objects of mass 2Kg each are placed at the corners of a square with side length 2m. If one corner is at the origin and the adjacent sides lie along the positive x and y axes, determine the position of the centre of mass of this system. (a) (0,1)	1

	(b) (1,1) (c) (2,2) (d) (2,0)	

Directions:
(a)Both assertion and reason are correct and reason is the correct explanation of the assertion
(b) Both assertion and reason are correct and reason is not the correct explanation of the assertion
(c)Assertion is correct, reason is incorrect
(d)Assertion and reason both incorrect

13	**Assertion :** The centre of mass of a body may lie where there is no mass. **Reason :** Centre of mass of body is a point, where the whole mass of the body is supposed to be concentrated.	1
14	Assertion : When a simple pendulum is made to oscillate on the surface of moon, its time period increases. Reason : Moon is much smaller as compared to earth.	1
15	**Assertion:** Astronauts feel weightless inside an orbiting satellite. **Reason:** Gravitational force is zero inside an orbiting satellite.	1
16	Assertion : The change in air pressure effect the speed of sound. Reason : The speed of sound in a gas is inversely proportional to square root of pressure.	1
	SECTION – B	
17	The SI unit of power is watt, where, $1J=1kgm^2s^{-2}$ In a new system of units, the unit of mass is a^a kg, the unit of length is b^b m, and the unit of time is c^c s. Show that in this new system, the magnitude of 1 joule becomes $a^{-1}b^{-2}c^2$	2
18	Prove work-energy theorem for a variable force.	2
19	State law of equipartition of energy and using it derive the values of C_p and C_v of monoatomic gas.	2
20	Draw stress-strain curve and indicate the following: (a) Fracture point (b) Proportion limit (c) Permanent set **OR** State Hooke's law and define Young's modulus of elasticity and write its expression.	2
21	A racing car rounds an unbanked curve of radius 75 meters at a steady speed of 216 km/h. Compare its centripetal acceleration with the acceleration due to gravity.	2

	SECTION – C	
22	(a) Show that trajectory of a projectile is a parabola. (b) A football is kicked at a speed of 20 m s^{-1} in a direction 45° above the horizontal. Calculate the maximum height. **OR** Draw the trajectory of a projectile and derive the expressions for its horizontal range. Find the angle at which a stone should be thrown so that it covers maximum horizontal range.	3
23	(a) The position of an object moving along x-axis is given by $x = a + bt^2$ where a = 8.5 m, b = 2.5 m s^{-2} and t is measured in seconds. What is its velocity at t = 0 s and t = 2.0 s. What is the average velocity between t = 2.0 s and t = 4.0 s? (b) Draw position-time graph for negative acceleration.	3
24	State First law of thermodynamics and write the mathematical expression for it. 5 g of water at 100°C is converted into steam at the same temperature. If the volume of steam is 8355cm^3, find the change in the internal energy of the system. (Latent heat of steam = 2256 J/g, 1 atm=1.013 10^5 N/m^2 and volume of 1 g of water = 1cm^3)	3
25	On the basis of kinetic theory, derive an expression for pressure exerted by an ideal gas.	3
26	What are beats. Write the expression for beat frequency. A tuning fork produces 4 beats/s when sounded with a tuning fork of frequency 512 Hz. The same tuning fork when sounded with another tuning fork of frequency 514 Hz produces 6 beats/s. find the frequency of the tuning fork.	3
27	Four equal masses of M kg each are fixed at the corners of a square of side a. (a) What is the gravitational force acting on a mass m placed at the center of the square? (b) What is the force on the mass m if one of the masses at the corners is removed?	3
28	Define the term torque. On which factors does it depend? Deduce the relation between torque and angular momentum.	3
	SECTION – D	
29	States of matter viz: solid, liquid, and gas are functions of temperature and heat content. During the change of state of a substance, the exchange of heat takes place between the substance and its surrounding. In this process temperature of the substance remains constant. At a certain temperature known as the melting point. Both the solid and liquid states of the substance coexist in thermal equilibrium. Similarly, at boiling point both the liquid and vapor states of the substance co-exist in the thermal equilibrium. There are certain substances which on heating directly pass from solid to vapor state without passing through the liquid state. This is a sublimation process in	4

	which the solid changes to the vapor state of the substance. The process of change of state depends on pressure and temperature. (i) The states of matter, such as solid, liquid, and gas, are dependent on what factors? a) Density and Mass b) Temperature and Heat Content c) Volume and Weight d) Pressure and Density (ii) What happens to the temperature of a substance during its state change? a) It increases continuously b) It decreases continuously c) It fluctuates randomly d) It remains constant (iii) At the melting point, which states of a substance coexist in thermal equilibrium? a) Solid and Liquid b) Liquid and Gas c) Solid and Gas d) All states (iv) At the boiling point, which states of a substance coexist in thermal equilibrium? a) Solid and Liquid b) Liquid and Gas c) Solid and Gas d) All states **OR** (v) What is the process called when a substance changes directly from a solid to a gas without passing through the liquid state? a) Condensation b) Evaporation c) Sublimation d) Vaporization	
30	A simple pendulum is set into motion with a small displacement from its equilibrium position. The pendulum oscillates with a period T, and the length of the string is L. A simple pendulum is oscillating on the surface of Earth with an acceleration due to gravity g. Now, the same pendulum is taken to a place where the value of g is reduced to half. A simple pendulum is subjected to air resistance, causing its amplitude to	4

decrease over time. The pendulum undergoes damped oscillations. A simple pendulum of length L is oscillating under the influence of gravity. The restoring force on the pendulum is proportional to the displacement from the equilibrium position. A simple pendulum is displaced by a large angle from its equilibrium position. The oscillation is no longer simple harmonic.

(i) If the length of the pendulum is doubled, how does the time period of oscillation change?

A) The time period remains the same
B) The time period increases by a factor of 2
C) The time period increases by a factor of $\sqrt{2}$
D) The time period increases by a factor of 4

(ii) How does the time period of the pendulum change when it is moved to a place where g is reduced to half?

A) The time period becomes $\sqrt{2}$ times the original
B) The time period remains the same
C) The time period doubles
D) The time period becomes half of the original

(iii) Which of the following is true for a damped simple pendulum?

A) The time period remains constant but the amplitude decreases
B) The time period increases as the damping increases
C) The amplitude increases as damping increases
D) The time period decreases as damping increases

(iv) Which of the following correctly describes the restoring force for a simple pendulum?

A) The restoring force is independent of the amplitude
B) The restoring force is proportional to the displacement for small angles
C) The restoring force is inversely proportional to the displacement
D) The restoring force is independent of gravity

OR

(v) For a large displacement (large amplitude), how does the time period of the simple pendulum compare with that of small oscillations?

A) The time period decreases
B) The time period increases
C) The time period remains the same
D) The time period becomes independent of the amplitude

	SECTION – E	
31	State Bernoulli's principle and derive Bernoulli's equation. Write two applications. **OR** Derive an expression for the excess pressure inside a soap bubble. Two soap bubbles have radii in the ratio 2:3. Compare the excess of pressure inside these bubbles. Also compare the works done in blowing these bubbles.	5
32	(a) State universal law of gravitation. Write its expression. (b) Find the variation of acceleration due to gravity at depth 'd' from the surface of the earth. **OR** Define orbital velocity of a satellite. Derive expressions for the orbital velocity of a satellite. Show that the escape velocity of a body from the earth's surface is $\sqrt{2}$ times its velocity in a circular orbit just above the earth's surface.	5
33	When vehicles move on curved roads, the road is often "banked". (a) What is banking? (b) Draw a suitable diagram and derive the expression of maximum velocity of a car moving on a banked road. (c) Which parameters of the banked road can be changed (specify, increase/decrease), such that the car can move with greater velocity safely. **OR** Derive an expression for centripetal acceleration of a particle moving with uniform speed v along a circular path of radius r. Discuss the direction of this acceleration. Calculate the angular speed of flywheel making 420 revolutions per minute.	5