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INDIAN SCHOOL SALALAH

FINAL EXAMINATION - FEBRUARY 2026 (AY 2025-26)



PHYSICS (042)

Class: XI

Date: 8th Feb 2026

Time: 3 Hrs.

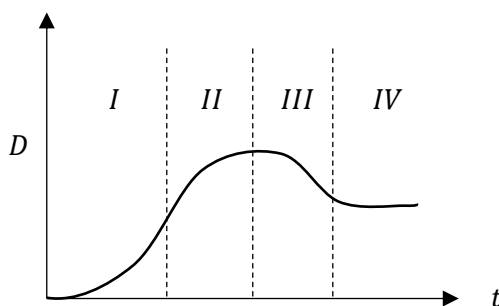
Maximum Marks: 70

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 must 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 wherever necessary.
 - (i) $c = 3 \times 10^8$ m/s
 - (ii) $G = 6.674 \times 10^{-11} \text{ m}^2 \text{ kg}^{-1} \text{ s}^{-2}$
 - (iii) $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$
 - (iv) $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$
 - (v) $k_B = 1.38 \times 10^{-23} \text{ J K}^{-1}$
 - (vi) $\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$

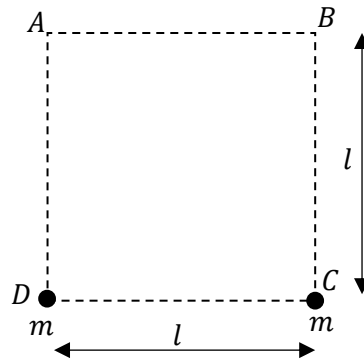
SECTION A

1. Consider the following pairs of physical quantities. Identify the pair that **does not** have the same dimensions: 1
- (A) Plane angle and Solid angle
 - (B) Velocity gradient and Frequency
 - (C) Work and Torque
 - (D) Angular momentum and Energy
2. A length is measured as 12.35 cm and breadth as 6.20 cm. Calculate the area with correct significant figures. 1
- (A) 76.57 cm^2 (B) 76.6 cm^2 (C) 76.60 cm^2 (D) 77 cm^2
3. In a displacement–time graph of one-dimensional motion, which region shows displacement, velocity, and acceleration all in the same direction? 1
- (A) Region I (B) Region II (C) Region III (D) Region IV



4. A body travelling with uniform acceleration crosses two points *A* and *B* with velocities 20 m/s and 30 m/s respectively. The speed of the body at the midpoint of *A* and *B* is nearest to 1
- (A) 22 m/s (B) 24.5 m/s (C) 25 m/s (D) 25.5 m/s
5. The maximum load a wire can withstand without breaking, when its length is reduced to half of its original length, will 1
- (A) Be double (B) Be half (C) Be four times (D) Remain same
6. A uniform metallic rod(copper) rotates about its perpendicular bisector with constant angular speed. If it is heated uniformly to raise its temperature slightly 1
- (A) Its speed of rotation increases.
 - (B) Its speed of rotation decreases.
 - (C) Its speed of rotation remains same.
 - (D) Its speed of rotation first decreases then increases.

7. In the following figure, if $-50 J$ of work is required to bring a 10 kg object to point A from infinity, then work required to move this 10 kg to point B from point A is 1



- (A) $50 J$ (B) $-50 J$ (C) $-100 J$ (D) Zero
8. One mole of ideal gas undergoes expansion under constant pressure during which its temperature changes by $1K$. The work done by the gas is 1
 (A) Zero (B) $273 J$ (C) $8.31 J$ (D) $6.6 J$
9. 1 mole of H_2 gas is contained in a box of volume $V = 1m^3$ at $T = 300 K$. The gas is heated to a temperature of $T = 3000 K$ and the gas gets converted to a gas of hydrogen atoms. The ratio of final pressure to initial pressure of the box is 1
 (A) 1:1 (B) 2:1 (C) 10:1 (D) 20:1
10. If momentum of a body increases by 20% , then the increase in its kinetic energy is 1
 (A) 40% (B) 44% (C) 48% (D) 56%
11. A particle executes simple harmonic motion between $x = -A$ and $x = +A$. The minimum time taken for it to go from 0 to $A/2$ is T_1 and to go from $A/2$ to A is T_2 , then 1
 (A) $T_1 < T_2$ (B) $T_1 > T_2$ (C) $T_1 = T_2$ (D) $T_1 = 2T_2$
12. Two vibrating tuning forks produce progressive waves given by $y_1 = 4 \sin 500\pi t$ and $y_2 = 2 \sin 506\pi t$. Number of beats produced per minute is 1
 (A) 360 (B) 180 (C) 60 (D) 3

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

(A) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

(B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(C) If Assertion is true but Reason is false.

(D) If both Assertion and Reason are false.

13. **Assertion (A):** If the force acting on a body is inversely proportional to its speed, then its kinetic energy varies linearly with time. 1

Reason (R): Change in kinetic energy of a body is directly proportional to the work done on the body.

14. **Assertion (A):** Angular momentum of an object is moving along a straight line with constant velocity about an arbitrary point is constant in magnitude and direction. 1

Reason (R): If an object moves along a straight line with constant velocity, the perpendicular distance of the line of motion from the point (moment arm) remains constant.

15. **Assertion (A):** When the temperature of a liquid increases, the capillary rise of the liquid decreases. 1

Reason (R): With increase in temperature, angle of contact decreases.

16. **Assertion (A):** The acceleration of a particle executing simple harmonic motion is maximum at the mean position. 1

Reason (R): In simple harmonic motion, velocity is directly proportional to the square of the displacement from the mean position.

SECTION B

17. Verify whether the equation 2

$$v = \sqrt{\frac{2gh}{m}}$$

is dimensionally correct, where v is velocity, g is acceleration due to gravity, h is height, and m is mass.

18. A projectile is thrown with velocity u at an angle θ with the horizontal. Its maximum height is 8 m and horizontal range is 24 m . Calculate u in terms of acceleration due to gravity. 2
19. (a) Define the term radius of gyration of a rigid body about a given axis. 2
 (b) Show that the radius of gyration is equal to the root mean square (rms) value of the perpendicular distance of the constituent particles of the body from the axis of rotation.
20. Show that elastic potential energy density stored in a stretched wire under stress is equal to $\frac{1}{2}\epsilon\sigma$. 2
21. A particle performs simple harmonic motion given by $y = r \sin\omega t$. Derive expressions for its kinetic and potential energies and hence show that total energy is independent of time. 2

OR

A simple pendulum of length l executes oscillation. Show that this oscillation is S.H.M, if amplitude of oscillation is very small also derive an expression for the time period of the simple pendulum. 2

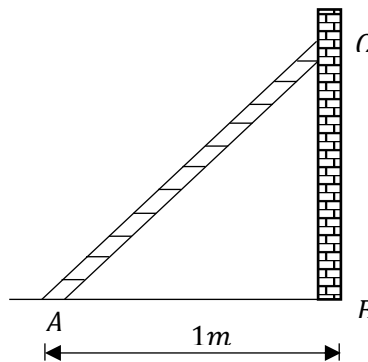
SECTION C

22. Given $\vec{a} + \vec{b} + \vec{c} + \vec{d} = 0$, which of the following statements are correct: 3
- (a) $\vec{a}, \vec{b}, \vec{c}$, and \vec{d} must each be a null vector.
- (b) The magnitude of $(\vec{a} + \vec{c})$ equals the magnitude of $(\vec{b} + \vec{d})$
- (c) The magnitude of \vec{a} can never be smaller than the sum of the magnitudes of \vec{b}, \vec{c} , and \vec{d} . Justify your answer
- (d) $\vec{b} + \vec{c}$ must lie in the plane of \vec{a} and \vec{d} if \vec{a} and \vec{d} are not collinear, and in the line of \vec{a} and \vec{d} , if they are collinear.
23. Two bodies of masses m_1 and m_2 are connected by a light, inextensible string passing over a smooth, frictionless pulley. With the help of suitable labelled free body diagram, derive expression for (i) the acceleration of masses and (ii) tension in the string when the system is released from the rest. 3

24. (a) A satellite is revolving around the earth at a height h from the surface of the earth. Obtain an expression for its time period in terms of mass of the earth, radius of the earth and height h . 3

(b) Show that, if the satellite is orbiting very close to the surface of the earth, the time period $T = 2\pi\sqrt{R/g}$.

25. A 3m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall as shown in figure. Find the reaction forces of the wall and the floor. 3



26. (a) Adiabatic expansion results in cooling. Why? 3

(b) In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35 cal, how much is the net work done by the system in the latter case? (Take 1 cal = 4.19 J)

27. A raindrop falling from very high altitude falls with constant speed. Why? Obtain an expression for this speed of radius of the raindrop is r , density of air is σ and density of water is ρ . 3

OR

What do you mean by excess pressure? Derive an expression for excess pressure inside a soap bubble. 3

28. (a) State law of equipartition of energy 3

(b) Using the above law, show that for monatomic gas $\gamma = 5/3$.

SECTION D

29. In modern transportation engineering, the efficiency of transit vehicles is analysed through their kinematic profiles. Consider a test vehicle moving along a strictly rectilinear track. The vehicle's mission profile consists of three distinct phases:

Phase I (Acceleration): Starting from a state of rest at the origin ($x = 0, t = 0$), the vehicle undergoes uniform acceleration at $a_1 = 4.0\text{m/s}^2$ for an interval of 5.0s.

Phase II (Cruise): Upon reaching its target velocity, the vehicle maintains this constant speed for a duration of 15.0s.

Phase III (Deceleration): To arrive at the terminal station, the propulsion system is disengaged and braking is applied, resulting in a uniform retardation until the vehicle comes to a complete halt over a displacement of 50.0m.

I Calculate the maximum velocity (v_{max}) achieved by the vehicle at the end of Phase I. 1

(A) 10.0m/s (B) 20.0m/s (C) 25.0m/s (D) 40.0m/s

II Determine the total displacement of the vehicle during the "Cruise" phase (Phase II). 1

(A) 150m (B) 200m (C) 300m (D) 450m

III Evaluate the magnitude of the uniform retardation required in Phase III to bring the vehicle to rest within the specified 50m distance. 1

(A) 2.0m/s^2 (B) 4.0m/s^2 (C) 5.0m/s^2 (D) 8.0m/s^2

IV If the motion is represented on a Velocity-Time ($v - t$) graph, what is the significance of the area bounded by the graph and the time axis from $t = 0$ to the final stop? 1

(A) The average acceleration of the vehicle.

(B) The total distance covered by the vehicle.

(C) The instantaneous power of the engine.

(D) The change in the vehicle's momentum.

30. A research laboratory uses a solid slab to maintain a steady heat flow between two regions kept at temperatures T_1 and T_2 ($T_1 > T_2$). The slab has thickness L , cross-sectional area A , and thermal conductivity K . To reduce heat loss without changing the temperature difference, the slab is modified by replacing it with two

different materials joined in series, each of thickness $L/2$. Material X has thermal conductivity K , while material Y has thermal conductivity $2K$. Heat conduction is assumed to be steady and one-dimensional.

- I Calculate the ratio of heat current through the original slab to that through the modified composite slab. 2
- II Will the temperature gradient be the same in both materials X and Y in the composite slab? Justify your answer. 1
- III If the two materials were instead arranged in parallel, would the effective thermal conductivity increase or decrease compared to the series arrangement? Give reason. 1

SECTION E

31. (a) State Newton's laws of motion and show that third law is contained in second law. 5
- (b) A truck starts from rest and accelerates uniformly at 2.0 m s^{-2} . At $t = 10 \text{ s}$, a stone is dropped by a person standing on the top of the truck (6 m high from the ground). Calculate the speed of the stone at $t = 11 \text{ s}$. (Neglect air resistance.)

OR

- (a) Define the terms (i) limiting friction (ii) coefficient of limiting friction. 5
 - (b) State the laws of limiting friction.
 - (c) Plot a graph to show variation of friction with applied force. Label the region of (i) static friction (ii) kinetic friction.
 - (d) A block slides down a rough inclined plane of inclination θ with constant velocity. If this block is projected up the plane with a velocity v_0 , then at what distance along the inclined plane, the block will come to rest?
32. (a) Define the term spring force and plot a graph between spring force versus elongation. 5
- (b) Using the above the above graph, obtain an expression for the elastic potential energy stored in the stretched spring.
 - (c) Identify the quantity that can be obtained from the slope of above graph.

- (d) A bullet of mass 10 g travels horizontally with a speed of 100 m/s and is absorbed by a wooden block of mass 990 g suspended by a string. Calculate the vertical height through which the block rises. Take $g = 10\text{ m/s}^2$.

OR

Two bodies of masses m_1 and m_2 are moving along the same straight line with initial velocities u_1 and u_2 , respectively. They undergo a perfectly elastic collision. 5

- (a) Derive expressions for their velocities v_1 and v_2 after the collision using the laws of conservation of momentum and kinetic energy.
- (b) Show that if $m_1 = m_2$, the two bodies simply exchange their velocities after the collision.
- (c) A lift pump of power 2000 W pumps water to an average height of 15 m to fill a tank $3\text{ m} \times 2\text{ m} \times 1\text{ m}$. The efficiency of the pump is 75% . What is the time required to fill the tank?

33. (a) Obtain expression for speed of sound in air according to Laplace. 5

(b) Using the above expression, justify the following statements

- (i) Speed of sound is independent of pressure.
- (ii) Speed of sound increases with temperature.
- (iii) Speed of sound increases with humidity.

OR

(a) A transverse travelling wave $y_1 = r \sin(\omega t - kx)$ is incident on a fixed end of a stretched string. 5

(i) Write the expression for the reflected wave and hence obtain the resultant standing wave.

(ii) Apply boundary conditions at $x = 0$ and $x = L$ to obtain the condition for allowed wavelengths.

(b) For the travelling harmonic wave $y_{(x,t)} = 2\cos 2\pi(10t - 0.008x + 0.35)$, where x and y are in cm and t in s . Calculate

(i) The phase difference between oscillatory motion of two points separated by 4 m

(ii) Speed of the wave.
