KOTHARI INTERNATIONAL SCHOOL, NOIDA
ANNUAL EXAMINATION, SESSION: 2025-26
GRADE: 11 SUBJECT: PHYSICS (042)
SET A

DAY & DATE: MONDAY - FEBRUARY 16, 2026
MAXIMUM MARKS: 70 **TIME ALLOTTED: 3 HOURS**
NAME: _____ **ROLL NO: _____**

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 4 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 two questions in Section B, one question in Section C 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

Q1. The Vander Waals equation is given by **(1)**

$$(P + \frac{a}{V^2})(V - b) = RT$$

where P is pressure, V is volume, T is absolute temperature of given sample of a gas, R is called molar gas constant, a and b are Vander Waal's constant.

The dimensional formula for RT is same as for
(A) Energy
(B) Force
(C) Latent heat
(D) Specific heat

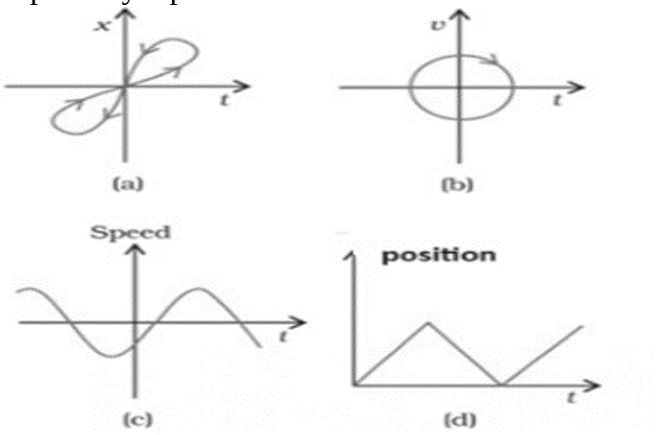
Q2. Study the following statements (For a particle moving along straight line) **(1)**

(i) **F** may be along **v**
(ii) **F** may be opposite **v**
(iii) **F** may be normal to **v**
(iv) **F** may be at an angle to **v**

In which cases is the force parallel or antiparallel to the velocity?

(A) (i) and (ii) only
(B) (i), (ii) and (iii) only
(C) (ii) and (iv) only
(D) (i), (ii), (iii) and (iv)

Q3. A student plots the graphs related to motion of four objects as given in figures. Which figure/figures cannot possibly represent one dimensional motion? **(1)**



(A) Figure a only
(B) Figure b only
(C) Figure d only
(D) Figures (a), (b) and (c)

Q4. Which of the following equations does **not** represent the position of an object moving in a plane with a **non-zero constant acceleration**? **(1)**

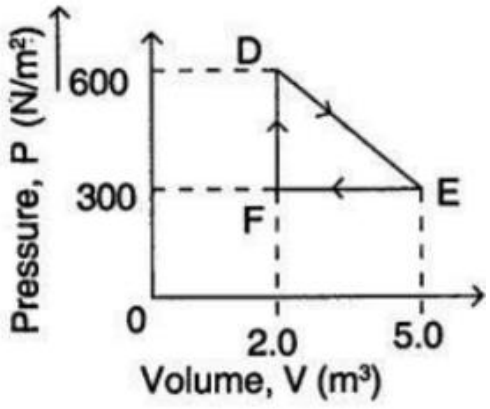
(A) $\vec{r}_1 = 1.0\,t\,\hat{i} + 3t^2\,\hat{j}$

(B) $\vec{r}_2 = (5.0 + 3.0t)\,\hat{i} + 5t^2\,\hat{j}$

(C) $\vec{r}_3 = 5t\,\hat{j}$

(D) $\vec{r}_4 = 3.0t^2\,\hat{i} - 4t^3\,\hat{j}$

Q5. A thermodynamic system is taken from an original state to an intermediate state by the linear process shown in figure below. Its volume is then reduced to the original value from E to F by an isobaric process. Calculate the total work done by the gas from D to E to F. **(1)**



(A) 100J

(B) -100J

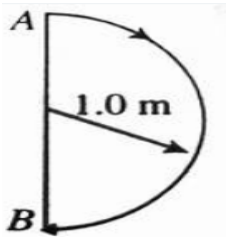
(C) 450J

(D) 600J

Q6. The moment of inertia of a solid sphere of radius (R) and mass (M) about its diameter is **(1)**

(A) $MR^2/4$
(B) $2MR^2/5$
(C) $MR^2/2$
(D) MR^2

Q7. In 1 s, a particle goes from point A to point B moving in a semicircle of radius 1 m as shown in figure. **(1)**

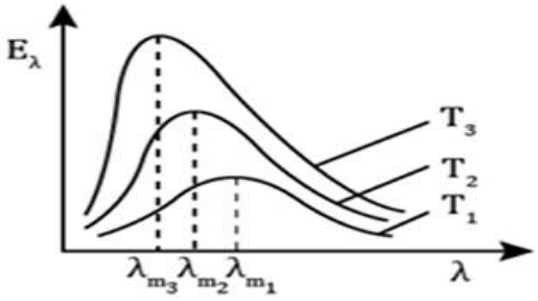


The magnitude of the average velocity is
(A) Zero
(B) 1 m/s
(C) 2 m/s
(D) 3.14 m/s

Q8. A travelling wave is represented by $y=a \sin(\omega t - kx)$ is incident on a rigid boundary. Which of the following equation represents the reflected wave from the rigid boundary? **(1)**

(A) y = a sin (ωt + kx)
(B) y = -a sin (ωt + kx)
(C) y = a sin (ωt – kx)
(D) y= -a sin (ωt – kx)

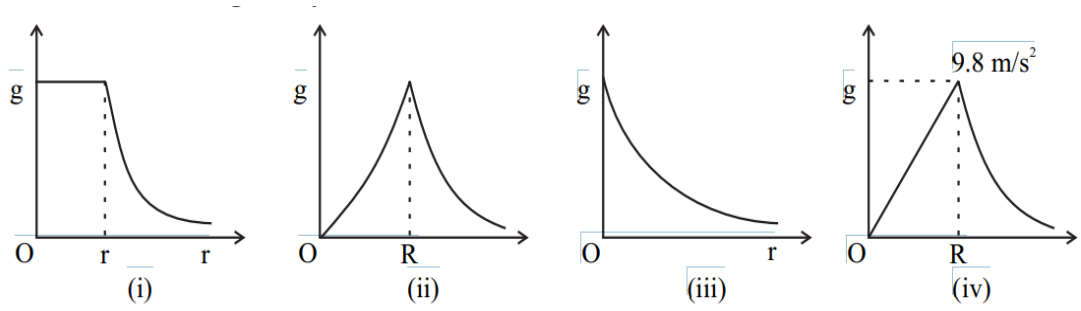
Q9. The graph shows the variation of radiation energy emitted per unit area per unit wavelength by three black bodies at absolute temperatures T_1, T_2, and T_3. The relation between T_1, T_2, and T_3 is: **(1)**



(A) $T_1 > T_2 > T_3$
(B) $T_1 < T_2 < T_3$
(C) $T_1 > T_2 < T_3$
(D) $T_1 < T_2 > T_3$

Q10. Two satellites S_1 and S_2 are orbiting at distances of 2R and 3R from the centre of the Earth respectively, where R is the radius of the Earth. If the time periods of their revolutions are T_1 and T_2 respectively, then find $\mathbf{(T_1/T_2)^{2/3}}$ **(1)**
(A) 4/3
(B) 3/4
(C) 2/3
(D) 3/2

Q11. Which of the following graph shows the correct variation of acceleration due to gravity with distance from the centre of the earth? **(1)**



(A) (i)
(B) (ii)
(C) (iii)
(D) (iv)

Q12. If the extension in a spring is increased to 4 times then the potential energy **(1)**
(A) remains the same
(B) becomes 4 times
(C) becomes one fourth
(D) becomes 16 times

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) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(C) Assertion is true but Reason is false.
(D) Both Assertion and Reason are false.

Q13. **Assertion (A):** Time taken by a body to complete a given work has nothing to do with energy of the body. **(1)**
Reason(R): Power of a body is the rate of doing work.

Q14. **Assertion (A):** $\vec{\tau} = \vec{r} \times \vec{F}$ and $\vec{\tau} \neq \vec{F} \times \vec{r}$ **(1)**
Reason (R): Cross product of vectors is commutative.

Q15. **Assertion (A):** Two bodies at different temperatures T_1 and T_2, when brought in thermal contact, do not necessarily settle to the same temperature $\frac{(T_1+T_2)}{2}$. **(1)**
Reason (R): Two bodies may have different thermal capacities.

Q16. **Assertion (A):** The speed of sound in a gas is not affected by change in pressure at constant temperature. **(1)**
Reason (R): The speed of sound in a gas is given by

$$v = \sqrt{\frac{\gamma P}{\rho}}$$

SECTION – B

Q17(I) (I) Write two limitations of dimensional analysis. **(2)**
(II)The time dependence of a physical quantity P is given by $P = Po \exp(-\alpha t^2)$, where α is a constant and t is time. What is the dimensional formula of constant α?

OR

Q17(II) Find the dimensions of the quantity q from the expression:

$$T = 2\pi\sqrt{\frac{ml^3}{3Yq}}$$

where T is the time period of a bar of length l, mass m and Young's modulus Y.

Q18. Two vectors are given as **(2)**

$$\vec{a} = p\hat{i} + \hat{j} - \hat{k} \quad \text{and} \quad \vec{b} = \hat{j} - \hat{k}$$

such that $|\vec{a} \times \vec{b}| = \sqrt{2}$. Find the value of p.

Q19. The velocity of a body of mass 2 kg as a function of t is given by V (t) = $2t\hat{i} + t^2\hat{j}$. Find the momentum and the force acting on it, at time t = 2 s. **(2)**

Q20. Apply first law of thermodynamics to **(2)**
(I) an isochoric process,
(II) a cyclic process and
(III) an isobaric process.

State what happens to heat absorbed in each case.

Q21(I) The angular velocity of a particle moving along a circle of radius 50 cm is increased in 5 minutes from 100 rpm to 400 rpm Find (i) angular acceleration and (ii) linear acceleration. **(2)**

OR

Q21(II) **Justify the following statements:**

(A) Wrench with a longer arm is preferred over one with a shorter arm.

(B) A diver (or skater) varies his/her angular speed by outstretching arms and legs.

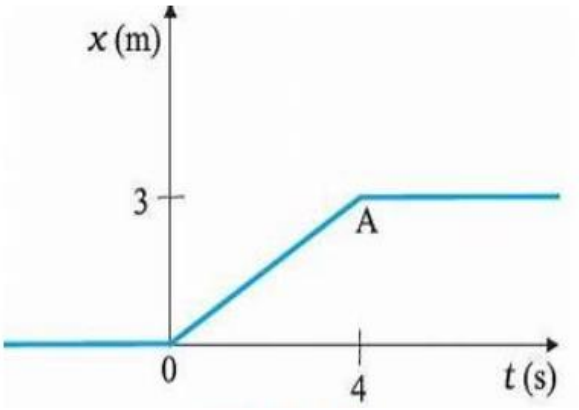
SECTION – C

Q22. The frequency ‘υ’ of vibration of the stretched string depends upon **(3)**

(i)length ‘l’ of the string
(ii)mass per unit length ‘m’ of the string
(iii)Tension ‘T’ in the string.

Obtain dimensionally an expression for the frequency ‘υ’.

Q23(I) The following figure shows the position–time graph of a particle of mass **4 kg**. **(3)**



(A)What is the force on the particle for

(I) $0 < t < 4$ s
(II) $t > 4$ s

(B**)** Impulse at t=0 and t=4 s (considering 1-Dimensional motion only).

OR

Q23(II) A circular race track of radius *r* is banked at an angle θ. The coefficient of friction between the wheels of race car and road is μ. Derive an expression for the maximum permissible speed to avoid slipping and hence write an expression for the optimum speed of the car to avoid wear and tear of its tyres.

Q24. Write the essential conditions for an isothermal process to take place. Derive an expression for work done during an isothermal process. **(3)**

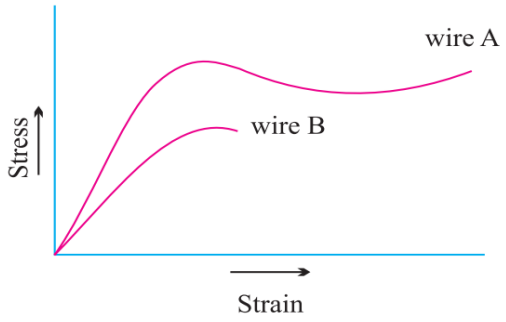
Q25. (A) A body is rotating with uniform angular velocity 'ω' about an axis. Establish the formula for its kinetic energy of rotation. **(3)**
(B) State the factors on which the moment of inertia of a body depends.

Q26. (I)A wave travelling along a string is given by y = 0.005 sin(80x-3t), where the numerical values are in SI units. Symbols have their usual meaning. **(3)**
Calculate the amplitude, frequency, wave length and velocity of the wave.

(II) What is the phase relationship between displacement, velocity and acceleration in SHM?

Q27. (I)Define gravitational potential at a point in the gravitational field. Obtain a relation for it. **(3)**
(II)What is the position at which gravitational potential is?
(A) maximum
(B) minimum.

Q28. Stress-strain curves for two wires of material A and B are as shown in figure given below: **(3)**



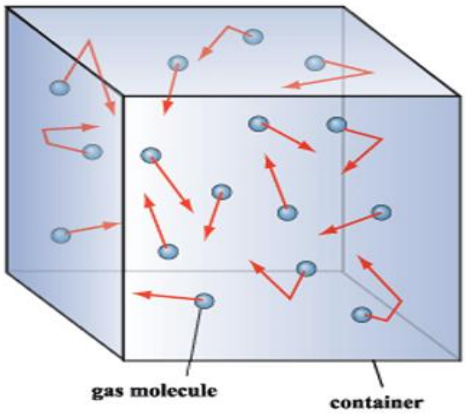
(I) Which material is more ductile?
(II) Which material has greater value of Young's modulus?
(III) Which of the two is stronger material? Give reason in each case.

SECTION – D
Case Study Based Questions

Q29. **Read the following paragraph and answer the questions that follow.** **1 Mark each**

Pressure Exerted by Gas Molecules

Gas molecules move in random motion inside the container. The pressure exerted by the gas is due to the continuous collision of the molecules against the walls of the container. Due to this continuous collision, the walls experience a continuous force which is equal to the total momentum imparted to the walls per second.



(i) Relation between pressure P and average kinetic energy E per unit volume of a gas is
(A) P = 2E/3
(B) P = E/3
(C) P = 3E/2
(D) P = 3E

(ii) At 0 K, which of the following properties of a gas will be zero?
(A) kinetic energy
(B) potential energy
(C) vibrational energy
(D) density

(iii) If the pressure of a given gas is halved at a certain temperature. what will be its volume:?
(A) becomes half
(B) remains constant
(C) becomes double
(D) becomes triple

(iv) The root mean square speed of the molecules of a gas is
(A) independent of its pressure but directly proportional to its Kelvin temperature
(B) directly proportional to the square root of both its pressure and its Kelvin temperature
(C) independent of its pressure but directly proportional to the square root of its Kelvin temperature.
(D) directly proportional to its pressure and its Kelvin temperature.

Q30. **Read the following paragraph and answer the questions that follow.**

Perfect Elastic Collision

A collision is an event/process in which two objects interact strongly for a short amount of time. An elastic collision is a collision between two or more objects in which there is no loss in kinetic energy before and after the collision. If we assume that the colliding objects are part of the system and that there is no force from the surroundings, the final kinetic energy is still in the same form as it was initially. This is because the surrounding forces are considered to have a negligible impact compared to the forces that occur between the colliding objects.

(I) Two bodies of mass 0.25 kg each moving towards each other with velocities 3 m/s & 1 m/s respectively. After collision, they stick together. What is the velocity of the combination? **(2)**

(II) Two identical balls A & B collide head on elastically and velocities of A & B before the collision are +0.5 m/s and –0.3 m/s respectively. What are their velocities after the collision? **(1)**

(III) What is the total linear momentum of two equal masses moving with equal speed in opposite directions? **(1)**

SECTION – E

Q31(I) A projectile is fired at an angle θ with the horizontal. **(2+1+2)**

(A) Derive an expression for its horizontal range. Show that there are two angles of projections θ_1 and θ_2 for the same horizontal range, such that $\theta_1 + \theta_2 = 90°$.

(B)Obtain an expression for time of flight.

(C) Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum range.

OR

Q31(II) (A) Find the angle between two vectors if their resultant is equal to either of them. **(1+4)**

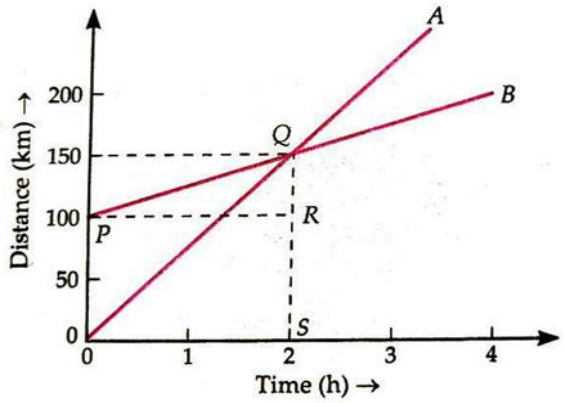
(B) The graph below shows the distance time graphs of two trains which starts moving simultaneously in the same directions. From the graphs find-

(i) How much ahead of A is B when the motion starts?

(ii) What is the speed of B?

(iii) When and where will A catch B?

(iv) What is the difference between the speeds of A and B?



Q32(I) A progressive wave represented by **(2+3)**

$$Y(x,t)=a\sin(kx-\omega t)$$

is incident on a closed organ pipe. After its reflection from the closed end a standing wave is formed in the pipe.

(A) Derive an expression for resultant displacement of standing waves.

(B) Show that only odd harmonics are present in a closed organ pipe.

OR

Q32(II) (A) Consider a particle of mass m executing S.H.M. with amplitude 'a' and constant angular frequency ω. The displacement 'y' of the particle at 't' seconds after starting from mean position is given by Y=a sinωt. **(4+1)**

Derive the expression for the kinetic energy, potential energy and total energy of the particle at time t. Hence plot a graph to show the variation of kinetic energy and potential energy of the particle with displacement.

(B) If a simple pendulum experiment is performed in an airplane flying at a height from the surface of Earth, how does the time period of oscillations gets affected? Explain your answer.

Q33(I) (A) Define terminal velocity of a spherical drop falling through a viscous fluid. Hence show that the terminal velocity v_t of a sphere of radius r, density ρ, falling vertically through a viscous fluid of density σ and coefficient of viscosity η is given by **(3+1+1)**

$$v_t = \frac{2r^2(\rho - \sigma)g}{9\eta}.$$

(B) Use the above formula to explain the observed rise of air bubbles in a liquid.

(C) The terminal velocity of a copper ball of radius 2.0 mm falling through a tank of oil at 20° C is 6.5 cm/s. Calculate the viscosity of the oil at 20° C. Take density of the oil 1.5×10^3 kg/m^3 and density of the copper is 8.9×10^3 kg/m^3.

OR

Q33(II) (A) Show that there is always an excess pressure on the concave side of the meniscus of a liquid. **(2+2+1)**
(B) Obtain an expression for the excess pressure inside (i) a liquid drop (ii) air bubble inside a liquid.
(C) What is the effect of pressure on (a) melting point of ice (b) boiling point of water?