ARMY PUBLIC SCHOOL, DHAULA KUAN
PRE-ANNUAL EXAMINATION 2025-26
SUBJECT : PHYSICS

ASS:- XI
RATION: -3 hrs **MAX. MARKS: - 70**

NERAL INSTRUCTIONS: -

1. *All questions are compulsory. There are 33 questions in all.*
2. *This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.*
3. *Section A contains sixteen questions, 12 MCQ and 4 Assertion Reasoning based of 1 mark each, Section B contains 5 questions of 2 marks each, Section C contains 7 questions of 3 marks each, Section D contains 2 case study-based questions of 4 marks each and Section E contains 3 long answer questions of 5 marks each.*
4. *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 must attempt only one of the choices in such questions.*
5. *Use of calculators is not allowed.*

SECTION – A

1. A constant force acts on a particle and its displacement y (in cm) is related to time t(in s) by equation, $t=\sqrt{y}+3$. What is the displacement of particle when its velocity is zero? 1
(A) zero (B) 3 (C) 9 (D) 1

2. A cyclist moves in such a way that he takes 60° turn after every 100m. What is the displacement when he takes seventh turn? 1
(A) 100m (B) 200m (C) $100\sqrt{3}$ (D) $100/\sqrt{3}$

3. A person holds a spring balance with a mass m hanging from it goes up and up in an aeroplane, then the reading of the weight of body as indicated by spring balance, will: 1
(A) go on increasing (B) go on decreasing
(C) first increase and then decrease (D) remain same.

4. A particle is projected making an angle of 45^0 with the horizontal having kinetic energy K. The kinetic energy at the highest point will be 1
(A) K (B) $K/\sqrt{2}$ (C) 2K (D) K/2

5. A particle moves along X axis from x= 0 to x=5m under the influence of a force given by $F = 7-2x+3x^2$. Find the work done in the process? 1
(A) 145J (B) 67.5J (C) 135J (D) 100J

6. The centre of mass of a system of particles does not depend on 1
(A) position of the particles (B) mass of the particles
(C) relative distance between the particles (D) force acting on the particles.

7. A disc of radius 2 m and mass 100 kg rolls on a horizontal floor. Its centre of mass has speed of 20 cm/s. How much work needed to stop it? 1
(A) 30 kJ (B) 2 J (C) 1 J (D) 3 J

8. If g is the acceleration due to gravity on the earth's surface, the gain in potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is: 1
(A) mgR/2 (B) 2mgR (C) mgR (D) mgR/4

9. A geo stationary satellite is orbiting earth at a height of 6R above surface of earth, R being radius of earth. Time period of another satellite at a height of 2.5R from surface of earth is: 1
(A) $6\sqrt{2}$hrs (B) 6hrs (C) $6\sqrt{3}$hrs (D) 10hrs

10. Radius of one arm of hydraulic lift is four times of radius of other arm. What force should be applied on narrow arm to lift 100kg: 1
(A) 26.5N (B) 62.5N (C) 6.25N (D) 8.3N

11. The length of a simple pendulum executing simple harmonic motion is increased by 21%. The percentage increase in the time period of the pendulum of increased length is: 1
(A) 50% (B) 21% (C) 42% (D) 10.5%

12. The tension in piano wire is 10N. What should be the tension in the wire to produce a note of double the frequency: 1
(A) 5N (B) 20N (C) 40N (D) 80N

ASSERTION AND REASON BASED QUESTIONS

Directions: *In the following questions,*
A statement of ***Assertion (A)*** *is followed by a statement of* ***Reason (R)****. Mark the correct choice as.* ***(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) *A is false and R is true* ***OR*** *Both A and R are false.*

13. **Assertion:** When two vibrating tuning forks having frequencies 256 Hz and 512 Hz are held near each other, beats cannot be heard. 1
Reason: The principle of superposition is valid if frequencies of the oscillator are equal.

14. **Assertion:** Bernoulli's theorem is applicable only on laminar flow. 1
Reason: Laminar flow is considered to be non-viscous.

15. **Assertion:** In an elastic collision between two bodies, energy of each body is conserved. 1
Reason: The total energy of an isolated system is conserved.

16. **Assertion:** The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of the body. 1
Reason: The part of the weight is spent in producing downward acceleration, when body is in elevator.

SECTION–B

17. An object weighing 50 kg is kept in a lift. Find its weight as recorded by a spring balance when the lift (take $g = 10\ m/s^2$) 2
(a) moves upwards with a uniform velocity of 5 ms^{-1}
(b) moves upwards with a uniform acceleration of 2 ms^{-2}
(c) moves downwards with a uniform acceleration of 2 ms^{-2}
(d) falls freely under gravity.

18. Two masses m_1 and m_2 ($m_1 > m_2$) are connected at the two ends of an inextensible string. 2
The string passes over a smooth frictionless pulley. Obtain the acceleration of the masses and the tension in string.

19. At what temperature will the average velocity of oxygen molecules be sufficient so as to escape from the earth? [Given: Escape velocity from the earth is 11.0 km/sec, the mass of one molecule of oxygen is 5.34×10^{-26} kg and $k = 1.38 \times 10^{-23}\ JK^{-1}$]. 2

20. A particle executes simple harmonic motion of amplitude A. At what distance from mean position is its kinetic energy equal to its potential energy?

OR 2

A body describes simple harmonic motion with an amplitude of 5cm and period of 0.2 s. Find the acceleration and velocity of the body when the displacement is (a) 5cm (b) 0cm.

21. Derive the expression for the work done during an isothermal expansion process. 2

OR

Derive the expression for the work done during an adiabatic expansion process.

SECTION –C

22. A gas bubble, from an explosion under water, oscillates with a period T proportional to $p^a d^b E^c$, where p is the static pressure, d is the density of water and E is the total energy of the explosion. Find the values of a, b and c. 3

23. A particle starts from origin at t = 0 with a velocity $5\,\hat{i}$ m/s and moves in XY-plane under the action of a force, which produces a constant acceleration of $3\,\hat{i} + 2\,\hat{j}$ m/s^2. 3
(a) What is the y-coordinate of the particle at the instant its x-coordinate is 84 m?
(b) What is the speed of the particle at this time?

24. A body of mass 0.5kg travels in a straight line with velocity $v=ax^{3/2}$ where $a=5$ m$^{-1/2}$ s^{-1}. 3
What is the work done by the net force during its displacement from x = 0 to x = 2 m?

25. (a) Deduce the relation between torque and angular momentum. 3
(b) A scale AB of length L is held vertically with its one end A on the floor and is then allowed to fall. Find the speed of other end B when it strikes the floor, assuming the end on the floor does not slip.

26. Two wires of equal cross section but one made of steel and other copper are joined end to end. When the combination is kept under tension, the elongation in the two wires is found to be equal. Given Young's moduli of steel and copper are 2×10^{11} N/m^2 and 1.1×10^{11} N/m^2. Find the ratio between lengths of steel and copper wires. 3

OR

Show that $\alpha = \beta/2$ and $\gamma = 3\,\alpha$, where symbols have their usual meanings. 3

27. (a) State the second laws of thermodynamics.
(b) An electric heater supplies heat to a system at a rate of 100W. If system performs work at a rate of 75 joules per second. At what rate is the internal energy increasing? 3

28. On the basis of kinetic theory, derive an expression for the pressure exerted by an ideal gas.

SECTION –D
CASE-STUDY BASED MCQs

29. **Newton's laws of motion:**
The first law refers to the simple case when the net external force on a body is zero. The second law of motion refers to the general situation. When there is net external force acting on the body. It relates the net external force to the acceleration of the body. These qualitative observations lead to the second law of motion expressed by Newton as follow: The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction in which the force acts. According to the Second Law $F = k\,(\Delta p/\Delta t) = ma$, where k is a constant of proportionality.
In the second law, F = 0 implies a = 0.
The second law is obviously consistent with the first law.

- The second law of motion is a vector law.
- The second law of motion is applicable to a single point particle as well as to the rigid body but internal forces is not considered in F.
- The second law of motion is a local relation which means that force F at a point in space (location of the particle) at a certain instant of time is related to a at that point at that instant.

(i) If maximum and minimum values of the resultant of two forces acting at a point are 7N and 3N respectively, the smaller force is equal to (1)

(A) 4 N (B) 5N (C) 3N (D) 2 N

(ii) A person sitting in an open car moving at constant velocity throws a ball vertically upward in air, the ball falls (1)

(A) exactly in the hand of the person (B) outside the car

(C) in the car ahead of the person (D) in the car behind the person.

(iii) A particle of mass 4 kg, at rest is acted upon by a steady force of 4 N. Distance travelled by the particle in 4 seconds is (1)

(A) 16 m (B) 2 m (C) 8 m (D) 4 m

(iv) A 30 g bullet travelling initially at 500 m/s penetrates 12 cm into wooden block. The average force exerted will be (1)

(A) 31250 N (B) 41250 N (C) 31750 N (D) 3040 N

30. **Acceleration due to gravity and its variation:**

Acceleration due to gravity is the acceleration gained by an object due to gravitational force. Its SI unit is m/s^2. It has both magnitude and direction; hence, it's a vector quantity. Acceleration due to gravity is represented by g. The standard value of g on the surface of the earth at sea level is 9.8 m/s^2.

The value of acceleration due to gravity 'g' is affected by

- Altitude above the earth's surface.
- Depth below the earth's surface.
- The shape of the earth.
- Rotational motion of the earth.

Answer the following questions:

(i) Determine the height at which acceleration due to gravity becomes g/9 in terms of R (radius of earth), (2)

(ii) How much below the surface of Earth does the acceleration due to gravity become 1% of its value at the Earths surface?(R = 6400 km) (1)

(iii) Draw a graph showing variation of acceleration due to gravity with distance r from the centre of Earth. (1)

SECTION –E

31. (a) A Simple harmonic motion is expressed by the equation Y = A sin (ωt). Deduce expressions for velocity and acceleration and hence draw graphs to show variation of displacement, velocity and acceleration for one complete cycle in SHM.

(b) If a body executing linear SHM has a velocity of 4ms^{-1} when its displacement is 3m from mean position and a velocity of 3ms^{-1} when its displacement is 4m, then find amplitude and angular speed of the oscillation

OR

(a) What do you mean by stationary waves. Obtain the first three modes of vibration (frequencies) for stationary waves produced in an open pipe.

(b) An open pipe is suddenly closed at one end with the result that the frequency of the third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the pipe. Determine fundamental frequency of open pipe? 5

32. (a) Derive the expression for terminal velocity of a rain drop of radius r and density σ, falling in air of density ρ and coefficient of viscosity η.

(b) Calculate the work done in breaking a drop of water of radius 1 cm into one million droplets of the same size. Surface tension of water is 72 x 10^{-3}N/m.

OR 5

(a) State and prove Bernoulli's principle for an ideal fluid.
(b) If the velocity head of a stream line flow is equal to 10 cm, find its speed of flow?

33. (a). Define parallelogram law of vector of addition. Derive the expression for the magnitude and direction of the resultant vector.
(b). The sum of the magnitude of two forces acting at a point is 18 N and the magnitude of their resultant is 12 N. If the resultant makes an angle of 90^0 with the force of smaller magnitude, what are the magnitudes of the two forces?

Motion in plane 5

OR

(a) Determine the equation of trajectory and time of flight of a projectile fired with a certain velocity u making an angle θ with the horizontal.
(b) Prove that the horizontal range is same when angle of projection is (i) greater than 45^0 by certain value and (ii) less than 45^0 by the same value.