PREPARATORY EXAM - JAN 2025
I PUC - PHYSICS (33)

Time: 3 hours   **Max Marks: 70**

General Instructions:

1. All parts are compulsory.
2. For Part – A questions, first written-answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

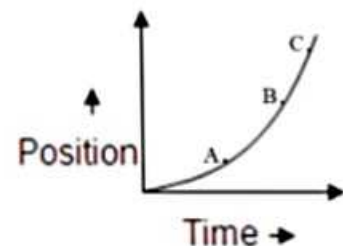**I. Pick the correct option among the four given options for ALL of the following questions:** $15 \times 1 = 15$

1. The number of significant figures in 3.500 is

    (A) 2   (B) 3   (C) 4   (D) 1

2. If v_A, v_B and v_C are the magnitudes of instantaneous velocities corresponding to the points A, B and C of the given position-time graph of a particle respectively, then

    (A) $v_A = v_B = v_C$ (B) $v_A > v_B > v_C$

    (C) $v_A < v_B < v_C$ (D) $v_A < v_B = v_C$

3. A vector is multiplied with a positive integer. The direction of the resultant vector is

    (A) same as the initial vector   (B) opposite to the initial vector

    (C) perpendicular to the initial vector   (D) not specified

4. 'An external force is required to keep a body in motion'. This is the statement of

    (A) Newton's first law of motion   (B) Newton's second law of motion

    (C) Aristotelian law of motion   (D) Newton's third law of motion

5. The non-contact force encountered in mechanics is

    (A) normal reaction   (B) frictional force   (C) tension in a spring   (D) gravitational force

6. 1 calorie is equal to

    (A) 4.186 J   (B) 1.6×10^{-19} J   (C) 3.6×10^6 J   (D) 10^{-7} J

7. A girl is sitting with folded hands on a swivel chair rotating with considerable angular speed. 'I' and 'ω' are the moment of inertia and angular speed of the chair along with girl about the axis of rotation. She stretches her arms horizontally while the chair is rotating. During this

    (A) I decreases and ω increases   (B) I increases and ω decreases

    (C) both I and ω increase   (D) both I and ω decrease

8. The SI unit of universal gravitational constant (G) is :

    (A) $N\,m^2\,kg^{-1}$ (B) $N\,m^2\,kg^{-2}$ (C) $N\,m\,kg^{-2}$ (D) $N\,m^2\,kg^{-3}$

9. The ratio of lateral strain to longitudinal strain in a stretched wire is called

   (A) shear strain   (B) compressibility   (C) Poisson's ratio   (D) Young's modulus

10. The angle of contact is acute in case of

    (A) water-lotus leaf interface   (B) water-waxy surface interface

    (C) water-oily surface interface   (D) water-glass interface

11. The change from solid state to vapour state without passing through the liquid state is called

    (A) vaporisation   (B) melting   (C) regelation   (D) sublimation

12. Below are two statements:

    (I) In a cyclic process, the total heat absorbed equals the work done by the system.

    (II) The change in internal energy of the system is zero during cyclic process.

    (A) Statement I is wrong but the statement II is correct

    (B) Statement I is correct but the statement II is wrong

    (C) Both the statements I and II are correct and II is the correct explanation for I

    (D) Both the statements I and II are correct and II is not the correct explanation for I

13. The mean free path for gas molecules is given by the expression (with symbols having their usual meaning)

    (A) $l = \dfrac{\pi}{\sqrt{2}\,nd^2}$ (B) $l = \dfrac{1}{\sqrt{2}\,nd^2}$ (C) $l = \dfrac{1}{\sqrt{2}\,\pi\,nd^2}$ (D) $l = \dfrac{\sqrt{2}}{\pi\,nd^2}$

14. The function of time which is not periodic among the following is

    (A) $\sin \omega t$ (B) $\cos \omega t$ (C) $e^{-\omega t}$ (D) $\sin \omega t + \cos \omega t$

15. Air column present in an open pipe is vibrating in fundamental mode. It contains

    (A) a node and an antinode   (B) a node and two antinodes

    (C) two nodes and an antinode   (D) two nodes and two antinodes

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: 5 × 1 = 5

(decrease, elastic, elliptical, beats, increase, speed)

16. During uniform circular motion, an object moves in circular path with constant_____.

17. According to Kepler, all planets move in _____ orbits around the Sun.

18. The viscosity of liquids decreases with _____ in temperature.

19. According to kinetic theory of gases, collisions between the molecules of a gas are_____.

20. The phenomenon often used by artists to tune their musical instruments is _____.

PART – B

III. Answer any FIVE of the following questions: $5 \times 2 = 10$

21. Mention any two applications of dimensional analysis.

22. Two vectors of same units have magnitude of 8 unit and 5 unit. What are the maximum and minimum magnitude of resultant that can be obtained with the two vectors?

23. Give any two methods of reducing friction.

24. State and explain work-energy theorem for a constant force.

25. Mention the two conditions required for the mechanical equilibrium of a rigid body.

26. Why does moon has no atmosphere? Explain.

27. What is meant by thermal expansion? Give relation between coefficient of volume expansion and coefficient of linear expansion of a material.

28. What is a Carnot engine? Name the working substance used in it.

29. Give the positions at which the potential energy of a particle executing SHM will be (i) maximum and (ii) zero.

PART – C

IV. Answer any FIVE of the following questions: $5 \times 3 = 15$

30. What is meant by range of a projectile? Give the expression for the same. What is the angle of projection for which the range of a projectile maximum?

31. State and explain Newton's second law of motion. Define SI unit of force.

32. Define work done by a force. Mention two cases in which work done by a force on an object is zero.

33. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 s. Calculate the angular acceleration of the wheel assuming the acceleration to be uniform.

34. Distinguish between the three different moduli of elasticity of a material.

35. State Bernoulli's principle. Give Bernoulli's equation in fluid dynamics. What is Magnus effect?

36. Explain briefly the land breeze.

37. Using the expression of total internal energy of one mole of monatomic gas, obtain the expression for the molar specific heat of a monatomic gas at constant volume.

38. Define (i) frequency and (ii) wavelength of a wave. Give an example for non-mechanical wave.

PART – D

V. Answer any THREE of the following questions: $3 \times 5 = 15$

39. Derive the equation $x = v_0 t + \dfrac{1}{2} at^2$ using v-t graph.

40. Show that the trajectory of a projectile is a parabola.

41.state and prove the law of conservation of linear momentum from Newton's third law of motion

42.what is rigid body and derive relation between torque and angular momentum of a particle

43,Derive the efficiency of Carnot heat engine by using p-v diagram

44.Derive the expression for time period of a simple pendulum execute SHM

V1.Answer any two of the following   2x5=10

45.A body of mass 2kg is acted upon by two perpendicular forces 4N and 3N.caluculate the magnitude and direction of the acceleration of a body

46.what will be the acceleration due to gravity on the surface of the moon if its radius is $1/4$ th   the radius of the earth and its mass $1/80$ th of the mass of earth ?

47.Tea in a cups takes 10 minutes to cool from 85^0 C to 75^0 C   How much time is takes to cool from 75^0 C to 65^0 C if the surrounding temperature is 35^0 C ?

48.A progressive wave is given by $y=0.5 \sin 2\pi \left(\frac{t}{0.02} - \frac{x}{0.5}\right)$ where x and y are in meters and t in second. Find the amplitude frequency wavelength velocity of the wave.