MODEL QUESTION PAPER 2023-24

I PUC - PHYSICS (33)

Time: 3 hours 15 min. **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.*

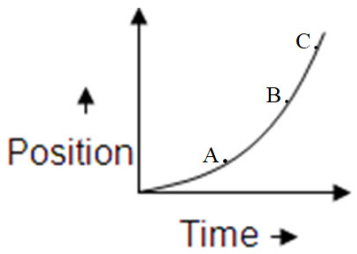
PART – A

I. Pick the correct option among the four given options for ALL of the following questions: **15 × 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) $l = \frac{\pi}{\sqrt{2}\, n d^2}$ (B) $l = \frac{1}{\sqrt{2}\, n d^2}$ (C) $l = \frac{1}{\sqrt{2}\, \pi n d^2}$ (D) $l = \frac{\sqrt{2}}{\pi n d^2}$

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 × 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 × 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 × 5 = 15**

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

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

41. Obtain the expressions for final velocities of two particles undergoing completely elastic collision in one-dimension considering second body to be initially at rest.

42. a) What is a rigid body? What type of motion is observed in a rigid body which is pivoted at the centre of mass? (2)

b) Prove that the time rate of change of the angular momentum of a particle is equal to the torque acting on it. (3)

43. a) State and explain first law of thermodynamics. (2)

b) Mention any three differences between isothermal and adiabatic processes. (3)

44. Write Newton's formula for speed of sound in air. Explain why and how Laplace modified Newton's formula for speed of sound.

VI. Answer any TWO of the following questions: 2 × 5 = 10

45. A body of mass of 8 kg is suspended by a rope of length 2.5 m from the ceiling. A force of 60 N is applied on the body in the horizontal direction. Find the angle that the rope makes with the vertical in equilibrium. (Take g = 10 ms^{-2}). Neglect the mass of the rope.

46. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh at a depth equal to half the radius of the earth if it weighs 250 N on the surface of earth? What will the weight of the same body at the centre of the earth?

47. A copper plate of mass 2 kg is heated to a temperature of 600^{o}C and then placed on large ice block at 0^{o}C. Calculate (i) the maximum quantity of heat that the copper plate can transfer to ice block and ii) the maximum amount of ice it can melt. Given: Specific heat of capacity of copper = 390 J kg^{-1} K^{-1} and latent heat fusion of water = 333×10^3 J kg^{-1}.

48. A block of mass 1 kg is fastened to a spring. The spring has a spring constant of 50 N m^{-1}. The block is pulled to a distance x = 10 cm from its equilibrium position at x = 0 on a frictionless surface from rest at t = 0 and is released.

Calculate (i) angular frequency of oscillations of the block and (ii) the maximum speed with which the block crosses the mean position.

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