Mandavya P U College, Neharu Nagara, Mandya
I PUC – Preparatory Examination (2024-25)
Physics – 33

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

Register number

General Instructions:

1. ***All parts (A to D) 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 relevant formula and detailed solution 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 figure in the number 2.64×10^{24} kg is**
   (A) 3 (B) 10 (C) 24 (D) 6
2. **Instantaneous acceleration is defined as the limit of**
   (A) average velocity as the time interval Δt goes to zero
   (B) average displacement as the time interval Δt goes to zero
   (C) average acceleration as the time interval Δt goes to zero
   (D) average speed as the time interval Δt goes to zero
3. **If a constant velocity vector is multiplied by duration (of time), we get**
   (A) a constant vector (B) a displacement vector (C) a scalar (D) an acceleration vector
4. **"Forces always occur in pairs". This statement is consistent with**
   (A) Newton's first law of motion (B) Newton's second law of motion
   (C) Newton's third law of motion (D) Aristotelian law of motion
5. **The instantaneous power is expressed as (the symbols have usual meaning)**
   (A) $P = \vec{F} \times \vec{s}$ (B) $P = \vec{F} \times \vec{v}$ (C) $P = \vec{F} \cdot \vec{a}$ (D) $P = \vec{F} \cdot \vec{v}$
6. **The column - I is the list of physical quantities of rotational motion and the column – II, the list of dimensions. Identify the correct match.**

Column-I	Column-II
(i) Angular velocity	(a) $[M^1 L^2 T^{-2}]$
(ii) Torque	(b) $[M^0 L^0 T^{-1}]$
(iii) Angular momentum	(c) $[M^1 L^2 T^{-1}]$

   (A) (i) – (a), (ii) – (b), (iii) – (c) (B) (i) – (b), (ii) – (a), (iii) – (c)
   (C) (i) – (c), (ii) – (a), (iii) – (b) (D) (i) – (b), (ii) – (c), (iii) – (a)
7. **The escape speed from the surface of the earth has a value of**
   (A) 11.2 m s^{-1} (B) 11.2 km s^{-1} (C) 11.2 km h^{-1} (D) 11.2 cm s^{-1}

8. **The ratio of hydraulic stress to the corresponding hydraulic strain is called**
   (A) bulk modulus (B) Young's modulus (C) shear modulus (D) elastomers
9. **The venturi-meter works based on the principle of**
   (A) Pascal's law (B) Bernoulli's principle (C) magnus effect (D) Boyle's law
10. **Calorimetry means measurement of**
   (A) temperature (B) pressure (C) heat (D) colou
11. **Which among the following is the example for thermodynamic extensive variable?**
   (A) temperature (B) pressure (C) volume (D) density
12. **Below are the statements related to specific heat capacity of gases.**
   Statement 1: $C_p - C_v = R$ is true for any ideal gas, whether mono, di or polyatomic.
   Statement 2: The ratio of specific heats for monoatomic gas is $\frac{9}{7}$
   (A) Both the statements 1 and 2 are correct (B) Only Statement 1 is correct
   (C) Only statement 2 is correct (D) Both the Statements 1 and 2 are wrong
13. **The force acting on a simple harmonic motion is proportional to the**
   (A) acceleration (B) frequency (C) wavelength (D) displacement
14. **Transverse waves can propagated through**
   (A) fluids only (B) both solids and fluids (C) solids only (D) None of these
15. **With reference to stationary waves, the points at which the amplitude is zero are**
   (A) Antinodes (B) normal modes (C) nodes (D) harmonics

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

(volume, Charle's law, period, intersection of diagonals, Boyle's law, natural convection)

16. The center of mass of a rectangular lamina lie at the point of -------
17. Trade wind phenomena is an example of ----------
18. In an isochoric process, the quantity remains constant is ----------
19. Pressure of a given mass of a gas varies inversely with volume, keeping temperature constant. This statement is referred as ----------.
20. The smallest interval of time after which the motion is repeated is called its ---------

PART – B

III. Answer any <u>FIVE</u> of the following questions: 5×2=10

21. Write any two limitations of dimensional analysis.
22. Draw the position-time graph for motion of an object with (a) positive acceleration (b) zero acceleration
23. State the triangle law of vector addition.

24. Write any two advantages of friction.
25. What is elastic and inelastic collision?
26. A square lead slab of area 0.05 m^2 in which a shearing force (on its narrow face) of 9.0×10^4 N is applied. Calculate the stress applied to it.
27. Define mean free path of molecules in a gas. Mention any one of the factor in which it depends.
28. Write any two differences between progressive and stationary waves.

PART – C

IV. Answer any <u>FIVE</u> of the following questions: 5×3=15

29. Derive the kinematic equation $x = v_0 t + 1/2\ at^2$ using v-t graph, where the symbols have their usual meanings.
30. Find the magnitude of the resultant of two vectors $\vec{A}$ and $\vec{B}$ in terms of their magnitudes and angle θ between them.
31. State and prove the conservation of linear momentum in the case of collision of two bodies.
32. In a ballistics demonstration a police officer fires a bullet of mass 50.0 g with speed 200 ms^{-1} on soft plywood of thickness 2.00 cm. The bullet emerges with only 10% of its initial kinetic energy. What is the emergent speed of the bullet? (Given: initial kinetic energy of the bullet is 1000 J)
33. Show that moment of a couple does not depend on the point about which the moments have taken.
34. State and explain Universal Law of Gravitation. Name the scientist who experimentally determined the value of Gravitational constant 'G'.
35. Give the Bernoulli's equation for the flow of an ideal fluid in stream line motion. Mention any two applications.
36. Define the terms i) Latent heat of fusion, ii) Latent heat of vaporization and iii) specific heat capacity of the substance.

PART – D

V. Answer any <u>THREE</u> of the following questions: 3×5=15

37. State the law of conservation of mechanical energy. Show that the total mechanical energy of a body falling freely under gravity is conserved.
38. Define torque. Show that the torque is equal to the rate of change of angular momentum of a particle.
39. Derive an expression for gravitational potential energy of a body.
40. (a) State and explain second law of thermodynamics. (2)
    (b) Explain briefly the working of Carnot's heat engine and define its efficiency. (3)
41. Define simple harmonic motion (SHM). Show that in SHM, the acceleration is directly proportional to its displacement at the given instant.

VI. Answer any <u>TWO</u> of the following questions: **2×5=10**

42. A cricket ball is thrown at a speed of 56 m/s in a direction, making an angle 30° with the horizontal. Calculate
    a) maximum height,
    b) total time taken by the ball to return to the earth and
    c) the distance from thrower to the point where the ball returns to the earth.
43. A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of 15 m/s. How long does the body take to stop?
44. A copper block of mass 2.5 kg is heated in a furnace to a temperature of 500 ^{0}C and then placed on a large ice block. What is the maximum amount of ice that can melt? (Specific heat of copper = 390 J kg^{-1} K^{-1}; heat of fusion of water = 335000 J kg^{-1}.
45. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45 Hz. The mass of the wire is 0.035 kg and its linear mass density is 4.0×10^{-2} kg m^{-1}. What is (a) the speed of the transverse wave on the string, and (b) the tension in the string?