Long Answer type Questions (8 Marks)

Work Energy and Power:

1. Develop the notions of work and kinetic energy and show that it leads to work-energy theorem. What are collisions? Explain the possible types of collisions? Develop the theory of one-dimensional elastic collision. State and prove law of conservation of energy in case of a freely falling body.

System of Particles and Rotational Motion:

2. State and prove the principle of conservation of angular momentum. Explain the principle of conservation of angular momentum with examples.

Oscillations :

3. Define simple harmonic motion. Show that the motion of (point) projection of a particle performing uniform circular motion, on any diameter, is simple harmonic.

4. Show that the motion of a simple pendulum is simple harmonic and hence derive an equation for its time period. What is seconds pendulum? Derive the equation for the kinetic energy and potential energy of simple harmonic oscillator and show that the total energy of a particle in simple harmonic motion is constant at any point on its path.

Thermal Properties of Matter :

5. State and explain Newton's Law of cooling. State the conditions under which Newton'ss Law of cooling is applicable.
    A body cools down from 60^0C to 50^0C in 5 minutes and to 40^0C in another 8 minutes. Find the temperature of the surroundings.

Mechanical Properties of Fluids:

6. State Bernoulli's principle. From conservation of energy in a fluid flow through a tube, derive Bernoulli's equation. give an application of Bernoulli's theorem.

Short Answer type Questions (4 Marks) Motion in

a Straight Line:

1. A particle moves in a straight line with uniform acceleration. Its velocity at time $t = 0$ is v_1 and at time $t = t$ is v_2. The average velocity of the particle in this time interval is $(v_1 + v_2)/2$. Is this correct? Substantiate your answer.

3. A bird holds a fruit in its beak and flies parallel to the ground. It lets drop the fruit at some height. Describe the trajectory of the fruit as it falls to the ground as seen by a) the bird (b) a person on the ground.

Problems:

4. A man walks on a straight road from his home to an market 2.5 km away with a speed of 5 km h^{-1}. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 kkm h^{-1}. What is the (a) magnitude of average velocity and (b) average speed of the man over the time interval 0 to 50 min.
5. A car travels the first third of a distance with a speed of 10 kmph, the second third at 20 kmph and the last third at 60 kmph. What is its mean speed over the entire distance?
6. A bullet moving with a speed of 150 ms^{-1} strikes a tree and penetrates 3.5 cm before stopping. What is the magnitude of its retardation in the tree and the time taken for it to stop after striking the tree?

Motion in a Plane:

7. State parallelogram law of vectors. Derive an expression for the magnitude and direction of the resultant vector.
8. Show that a boat must move at an angle with respect to river water in order to cross the river in minimum time?
9. Define unit vector, null vector and position vector. If prove that the angle between   and is 90^0.
10. Show that the trajectory of an object thrown at certain angle with the horizontal is a parabola. Show that the maximum height and range of a projectile are and respectively where the terms have their regular meanings.
11. A force 2i + j - k Newton acts on a body which is initially at rest. At the end of 20 seconds the velocity of the body is 4i + 2j - 2k ms^{-1}. What is the mass of the body?

Laws of Motion:

12. Explain advantages and disadvantages of friction.
13. Mention the methods used to decrease friction.
14. Why is pulling the lawn roller preferred to pushing it?

System of Particles and Rotational Motion:

15. Distinguish between Centre of mass and Centre of gravity.
16. Define vector product. Explain the properties of a vector product with two examples.
17. Define angular velocity, Derive v = r $\Box$.
    a) Angular velocity (b) Unit (c)
18. Define angular acceleration and torque. Establish the relation between angular acceleration and torque.

Mechanical Properties of Solids:

19. Define stress and explain types of stress.
20. Describe the behavior of a wire under gradually increasing load

Mechanical Properties of Fluids:

21. Explain Surface Tension and Surface Energy.

Thermal Properties of Matter:

22. Two identical rectangular strips one of copper and the other of steel are riveted together to form a bimetallic strip. What will happen on heating? Pendulum clocks generally go fast in winter and slow in summer. Why

23. In what way is the anomalous behavior of water advantageous to aquatic animals.

24. Explain triple point of water.

25. Define two principle Specific heats of a gas. Which is greater and why?

Thermodynamics:

26. State and explain the first law of thermodynamics.

27. Derive the relation between the two heat capacities of a gas on the basis of first law of thermodynamics. Obtain an expression for the work done by an ideal gas during isothermal change.

28. Obtain an expression for the work done by an ideal gas during adiabatic change.

29. Compare isothermal process and adiabatic process.

Gravitation:

30. Derive the relation between acceleration due to gravity(g) at the surface of a planet and Gravitational constant (G).

31. What is orbital velocity? Obtain an expression for it.

32. Escape is escape velocity? Obtain an expression for it. What is a geostationary satellite? State its users.

Kinetic Theory of gases:

33. Explain the Kinetic interpretation of temperature.

34. How specific heat capacity of mono atomic, diatomic and poly atomic gases can be explained on the basis of law of Equipartition of Energy?

35. What is the ratio of r.m.s speed of Oxygen and Hydrogen molecules at the same temperature? Four molecules of a gas have speeds 1,2,3 and 4 km/s. Find the rms speed of the gas molecules. Calculate the molecular K.E of 1 gram of Helium (molecular weight 4) at 127 $^\circ$C Given R = 8.31 J mol^{-1} K^{-1}.

54. When pressure increases by 2%, what is the percentage decrease in the volume of a gas, assuming Boyle's law is obeyed?

Very Short Answer Type Questions (2 Marks)

Physical World:

1. What is the Physics?

2. What is the discovery of C.V.Raman?

3. What are the fundamental forces in nature?

4. a) Acceleration due to gravity. -
   b) Law of gravitation
   Which of the following has symmetry?

5. What is the contribution of S.Chandra Sekhar to Physics?

Units and Measurements:

6. Distinguish between accuracy and precision.
7. What are the different types of errors that can occur in a measurement?
8. How can systematic errors be minimized or eliminated?
9. Illustrate how the result of a measurement is to be reported indicating the error involved.
10. What are significant figures and what do they represent when reporting the result of a measurement? Distinguish between fundamental units and derived units.
11. Why do we have different units for the same physical quantity?
12. What is dimensional analysis?
13. How many orders of magnitude greater is the radius of the atom as compared to that of the nucleus? Express unified atomic mass unit in kg.

Motion in a straight line:

14. The states of motion and rest are relative. Explain.
15. How is average velocity different from instantaneous velocity?
16. Give an example where the velocity of an object is zero but its acceleration is not zero.
17. A vehicle travels half the distance L with speed v_1 and the other half with speed v_2. What is the average speed?

Motion in a plane:

18. The vertical component of a vector is equal to its horizontal component. What is the angle made by the vector with x-axis?
19. A vector V makes an angle q with the horizontal. The vector is rotated through an angle ☐. Does this rotation change the vector V?
20. Two forces of magnitudes 3 units and 5 units act at 60^0 with each other. What is the magnitude of their resultant?
21. . What is the angle between the vector and x-axis?
22. When two right angled vectors of magnitude 7 units and 24 units combine, what is the magnitude of their resultant? If P = 2i + 4j + 14k and Q = 4i + 10k find the magnitude of P + Q.
23. Can a vector of magnitude zero have non zero components?
24. What is the acceleration of a projectile at the top of its trajectory?

Laws of motion:

25. When a bullet is fired from a gun, the gun gives a kick in the backward direction Explain.
26. 29. Why does a heavy rifle not recoil as strongly as a light rifle using the same catridges?
30. If a bomb at rest explodes into two pieces, the pieces must travel in opposite direction. Explain Can the coefficient of friction be greater than one?
31. Why does the car with a flattened tyre stop sooner than the one with inflated tyres?
32. A horse has a pull harder during the start of the motion than later. Explain.
33. What happens to the coefficient of friction if the weight of the body is doubled?

Work Energy and Power:

34. Define: Work, power and Energy. State their SI units.
35. Which physical quantity remains constant (i) In an elastic collision (ii) In an inelastic collision?
36. A body freely falling from a certain height 'h' after striking a sooty floor rebounds and rises to a height h/2. what is the coefficient of restitution between the floor and the body?

System of Particles and Rotational Motion:

37. Is it necessary that a mass should be present at the centre of mass of any system?
38. What is the difference in the position of a girl carrying a bag in one of her hands and another girl carrying a bag in each of her two hands?
39. Why are spokes provided in a bicycle wheel? We cannot open or close the door by applying force at the hinges. why?
40. Why do we prefer a spanner of longer arm as compared to the spanner of shorter arm?

Oscillations:

41. Can a simple pendulum be used in an artificial satellite?

Mechanical properties of Solids:

42. state the Hooke's law of elasticity. State the units and Dimensions of stress.
43. state the units and Dimensions of modulus of elasticity.
44. State the units and dimensions of Young's Modulus.
45. State units and Dimensions of rigidity modulus
46. State Units and Dimensions of Bulk modulus.
47. State Units and Dimension of Bulk Modulus.
48. State the examples of nearly perfectly elastic and plastic bodies.

Mechanical properties of Fluids:

49. Define average pressure. mention its units and dimensional formula. Is it a scalar or vector? Define viscosity. What are its units and dimensions?
50. What is the principle behind the carburetor of an automobile?
51. What is Magnus effect?
52. Why are drops and bubbles are spherical?
53. Give an expression for the excess pressure in a liquid drop?
54. Give an expression for the excess pressure in an air bubble inside the liquid?
55. Give an expression for the excess pressure for the soap bubble in air?
56. What are water proofing agents and water wetting agents? What do they do?
57. What is angle of contact?
58. Mention any two example that obey Bernoulli's theorem.

Thermal Properties of Matter:

59. Can a substances contract on heating? Give an example.
60. Why gaps are left between rails on a railway track?
61. Why do liquids have no linear and areal expansions?
62. What is latent heat of fusion?
63. What is latent heat of vapourisation?
64. What are the units and dimension of specifics gas constant?
65. Why utensils are coated black? why the bottom of the utensils are made of copper?
66. States wein's displacement law.
67. Ventilators provided in rooms just below the roof. Why?
68. Does a body radiate heat at 0 K? Does its radiate heat at 0^0 C?
69. State the different modes of transmission of heat. Which of these modes require medium? What is greenhouse effect? Explain Global warming.
70. Define absorptive power of a body. What is the absorptive power of a perfect black body? State Newton's law of cooling.
71. The roof of building are often painted white during summer why?

Thermodynamics:

72. Define thermal equilibrium. How does it Lead to zeroth law of thermodynamics?
73. Which of the two will increase the pressure more, an adiabatic (or) an isothermal process in reducing the volume to 50%?
74. A thermos flask containing a liquid is shaken vigourously. What happens to its temperature?
75. How much will be the internal energy change in i) Isothermal process ii) Isothermal process.
76. The coolant in a chemical or a nuclear plant should have high specific heat. why?

Gravitations:

77. State the unit and dimension of the universal gravitational constant(G).
78. What would be the change in acceleration due to gravity (g) at the surface. If the radius of earth decreases by 2% keeping the mass of earth constant?
79. What are the factors that make 'g' the least at the equator and maximum at the poles?
80. "Hydrogen is in abundance around the sun but not around earth". Explain.
81. What is the time period of revolution of a geostationary satellite? Does it rotate from west to east or form East to West?
82. What are polar satellite?

Kinetics theory of gases:

83. Define mean free path.
84. Name the two prominent phenomena which provide conclusive evidence of molecular motion. How does Kinetic theory justify Avogadro hypothesis and show that Avogadro Number in differences gases is same?
85. When does a real gas behaves like an ideal gas?
86. State Boyle's law and Charles law.
87. State Dalton's law of partial pressure-
88. Pressure of an idea gas in a container is independent of shape of the container explain.
89. Explain the concept of degrees of freedom for molecules of a gas.
90. What is the expression between pressure and Kinetic energy of a gas molecule?
91. The absolute temperature of a gas is increased by 3 times. what will be the increase in rms velocity of the gas molecule?

Problems:

1. A machine gun fires 360 bullets per minute and each bullet travels with a velocity of 600 ms^{-1}. If the mass of each bullet is 5 gm, find the power of the machine gun?
2. A pump is required to lift 600 kg of water per minute from a well 25 m deep and to eject it with a speed of 50 ms^{-1}. Calculate the power required to perform the above task?
3. A ball falls from a height of 10 m on to a hard-horizontal floor and repeatedly bounces. if the coefficient of restitution is, what is the total distances travelled by the ball before it ceases to rebound?

****