XI

WORK SHEET PHYSICS CLASS XI
(PROPERTIES OF MATTER, THERMODYNAMIC AND KINETIC THEORY OF GASES)

1. What do you understand by (i) elastic bodies (ii) plastic bodies (iii) stress (iv) strain.
2. Discuss the behavior of a wire under varying load.
3. State Hooke's law. Define Young's Modulus of elasticity and rigidity modulus.
4. Differentiate between a ductile and a brittle material.
5. A structural steel rod has a radius of 10 m and a length of 1 m. A 100 kN force stretches it along its length. Calculate elongation produced. Young's modulus of structural steel is 2×10^{11} Nm^{-2}.
6. Describe the working of hydraulic lift by using Pascal's law.
7. State Pascal's law.
8. Obtain an expression for pressure due to fluid column.
9. What is atmospheric pressure? How will you measure this pressure by using Torricelli's barometer?
10. What is meant by the term coefficient of viscosity? State Stoke's law.
11. Define terminal velocity and find an expression for the terminal velocity in case of a spherical body falling in viscous liquid.
12. State properties of streamline flow.
13. What is critical velocity and Reynold's number?
14. State and prove Bernoulli's theorem.
15. State and prove Toricelli's theorem.
16. What is an aerofoil? Explain how it helps lift an aircraft.
17. Define Surface tension and surface energy?
18. Obtain relation between Surface tension and surface energy.
19. Define capillarity. Derive an expression for the rise of a liquid in a capillary tube.
20. When a shaving brush is dipped into water and then taken out, its hairs are stick together. Why?
21. What is angle of contact? When is it obtuse? When is it acute?
22. Why is the pressure on the concave side of a liquid drop or bubble more than that on its convex side?
23. Show that $p_i - p_o = 2T/R$, where p_i and p_o are inside and outside pressures of liquid drop, T is the surface tension and R is the radius of the drop.
24. Explain cleaning action of a detergent.
25. The terminal velocity of a copper ball of radius 2.0 m falling through a tank of oil is 6.5 cms^{-1}. Compute the viscosity of the oil. Density of oil is $1.5 \times 10^3 kgm^{-3}$. Density of copper is 8.9×10^3 kgm^{-3}.
26. What is the pressure inside an air bubble of radius 0.01×10^{-3}m situated at a depth of 30 cm below the free surface of a liquid of density $900kgm^{-3}$and surface tension 0.072 Nm^{-1}?

27. Show that coefficient of volume expansion is three times the coefficient of linear expansion.
28. Distinguish between conduction and convection.
29. Define coefficient of thermal conductivity and write an expression for the same.
30. State First Law of Thermodynamics. Apply this law to isothermal process.
31. Obtain an expression for the work done in an adiabatic process.
32. State II law of thermodynamics.
33. Define two specific heats of gas. Explain why C_p is greater than Cv. Show that for an ideal gas $C_p - C_v = R$, where C_p and C_v are the molar specific heats at constant pressure and volume respectively.
34. Explain what is heat engine. Give an expression for its efficiency.
35. Give schematic diagram and explain the working of a refrigerator. Write the expression for co-efficient of performance of a refrigerator.
36. State assumptions of kinetic theory of gases.
37. Obtain an expression for the pressure of a gas.
38. State Boyle's law.
39. State law of equipartition of energy.
40. For a rigid diatomic molecule prove that $C_p/C_v = 7/5$.
41. Define mean free path and obtain an expression for the same.
42. Eight rain drops of radius 10^{-3} m each falling down with a terminal velocity of 5×10^{-2} m/s coalesce to form a bigger drop. Calculate the terminal velocity of the bigger drop.
43. Calculate the height to which water will rise in a capillary tube of 0.5×10^{-3}m diameter when surface tension of water is 0.074 Nm^{-1}. Given g= 9.8 ms^{-2}.
44. An iron sphere has a radius of 10 cm at a temperature of 0^0C. Calculate the change in volume of the sphere if it is heated to 100^0C. Coefficient of linear expansion of iron = $11x10^{-6}C^{-1}$.
45. A sphere of aluminum of 0.047 kg placed for sufficient time in a vessel containing boiling water, so that the marble is at 100^0C. It is then immediately transferred to 0.14 kg copper calorimeter containing 0.25 kg of water at 20^0C. The temperature of water rises and attains a steady state at 23^0C. calculate the specific heat capacity of aluminum.(sp. Heat of water = $4.18 \times 10^3 Jkg^{-1}C^{-1}$ and sp. Heat of copper = $0.386 \times 10^3 Jkg^{-1}C^{-1}$.)
46. Calculate the heat required to convert 3 kg of ice at - 12^0C kept in a calorimeter to steam at 100^0C. Given specific heat capacity of ice = 2100 $Jkg^{-1}C^{-1}$, specific heat capacity of water is $4.18 \times 10^3 Jkg^{-1}C^{-1}$, latent heat of fusion of ice = 3.35×10^5 Jkg^{-1} and latent heat of steam 2.256×10^6 Jkg^{-1}.
47. A body cools from 50^0C to 40^0C in 6 minute, when its surrounding temperature is 30^0C. What will be its temperature 12 minutes after the start of the experiment?

1. What are stationary waves? Obtain expression for the frequency of the fundamental mode of the stationary waves on a stretched string.

2. Explain Dopplers effect of sound. Derive an expression for the apparent frequency when
   a) A source is moving toward stationary observer
   b) A observer is moving towards stationary source.

3. Discuss the formation of standing waves and hence find the expression for the frequency of fundamental and overtones in an organ pipe open at both ends.

4. A whistling ~~train~~ train passed across a stationary person. What is the apparent change in the freq of the whistling that the person observes, if the actual frequency of the whistle is f, speed of the train is V_s and that of sound wave in air is V.

5. What is the effect of (i) humidity (ii) Temperature on speed of sound.

6. A transverse harmonic wave on a string is described by $y(x,t) = 5.0 \sin(40.0t + 0.020x + \pi/3)$,

where x and y are in cm and t in sec. The +ve direction of x is from left to right.

a) Is this a travelling wave or standing wave?

b) what is the initial phase at origin?

c) what is the least distance between two successive crests in the wave?

d) What are its amplitude and frequency?

e) What are the speed and direction of its propagation

7. A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz source? Will the same source be in resonance with the pipe if both ends are open? (Consider speed of sound in air is 340 ms^{-1}.)

8. Explain how bats can ascertain distances, directions, nature and sizes of the obstacles without any "eyes".

9. State principle of superposition. Obtain the expression for equation of travelling waves

10. Write down any three differences between travelling and stationary waves.

Oscillations

1. Write an expression for KE, PE and total energy of a body in SHM, represented by $y = A \sin \omega t$.

2. Show that in SHM, the acceleration is directly proportional to its displacement at the given instant. Also find the expression for the time period of a body in SHM.

3. Show that the motion of a simple pendulum is simple harmonic and hence derive an expression for the time period of oscillation.

4. A mass 'm' attached to the end of a horizontal spring is displaced to a distance 'x' and released. At what position from the mean position the KE and PE are equal.

5. Show that the projection of uniform circular motion along any one of its diameter of a circle is SHM.

6. A wave pulse is travelling on a string of linear mass density 1.0 g/cm under a tension of 10 N. Calculate the time taken by the pulse to travel a distance of 50 cm on the string.

7. Draw the displacement, velocity and acceleration graph of a particle executing SHM against time.

8. Define following terms in context of SHM & oscillations
   a) Damping
   b) resonance.

9. What is the length of a seconds' pendulum.

10. The acceleration due to gravity on the surface of moon is $1.7\ ms^{-2}$. What is the time period of a simple pendulum on the surface of moon if its time period on the earth surface is 3.5 sec. (Consider g on earth surface $= 9.8\ ms^{-2}$)

- Work-power-Energy

1. Discuss the situation where the work done is
   a) positive b) negative c) zero.

2. Derive the expression for
   a) potential energy stored in a body due to heigh
   b) potential energy stored in a stretched string
   c) kinetic energy of a moving body

3. State and prove Work-Energy theorem
   a) for constant force
   b) for variable force

4. Show that the work done by the non-conservative force is equal to the change in mechanica energy.

5. Differentiate between
   a) Conservative and Non-conservative force

6. Obtain expression for final speeds of two bodies suffer elastic collision in one-dimension.

7. Define dot product of two vectors. Write its any two properties.

8. If force acting on a body is $\vec{F} = 3\hat{i} + 4\hat{j}$ that causes the body to displace by $\vec{r} = 5\hat{k}$. Calculate the amount of work done.

9. What will be the percentage change in kinetic energy if
   a) speed is increased by 10%, mass remains same
   b) momentum is increased by 20%.

SYSTEM OF PARTICALS

1. Define Centre of mass. obtain expression for $\vec{R}_{CM}$ of two body system.

2. Define a) Torque b) Angular momentum
   c) Moment of Inertia d) Radius of Gyration

3. Show that
   a) $L = I\omega$ b) $\tau = I\alpha$
   c) $\frac{d\vec{L}}{dt} = \vec{\tau}$ d) $\omega = \omega_0 + \alpha t$, $\theta = \omega_0 + \frac{1}{2}\alpha t^2$
   e) Rotational KE $= \frac{1}{2} I\omega^2$

4. Obtain expression for KE of a rolling body
   i) Perpendicular Axis Theorem

6. What do you understand by conservation of angular momentum. Write any three applications in brief.

7. Solve all example questions of chapter.

GRAVITATION

1. State kepler's laws of planetary motion and prove third law.
2. Show that value of 'g' is independent to mass of the object.
3. Discuss the variation of 'g' with
   a) Altitude b) depth
4. What is gravitational potential. Obtain its expression on earth surface.
5. Define and derive the expression for
   a) Escape velocity b) orbital speed.
6. 6. Read and solve all example questions.
7. Obtain expression for total energy of revolving satellite.
8. Show that 2nd law of kepler's planetary motion is a consequence of law of conservation of angular momentum.