BRAIN INTERNATIONAL SCHOOL

SESSION 2024-25

CLASS: XI **REVISION SHEET** **SUBJECT: PHYSICS**

CH:1 Units and Measurements

1. Find the dimensions of a/b in the equation: F= $a\sqrt{x} + bt^2$, where F is force, x is distance and t is time.
2. Find the dimensions of a/b in the relation: P = $\frac{a-t^2}{bx}$, where P is pressure, x is distance and t is time.
3. The vander wall's equation for a gas is $(P + \frac{a}{V^2})(V - b) = RT$. Determine the dimensions of a and b. Hence write the SI units of a and b.
4. In the equation: $y = a\sin(\omega t - kx)$, t and x stand for time and distance respectively. Obtain the dimensional formula for ω and k.
5. Consider a simple pendulum, having a bob attached to a string, that oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple pendulum depends on (i) mass m of the bob (ii) length *l* of the pendulum and (iii) acceleration due to gravity g at the place. Derive the expression for its time period using method of dimensions.
6. The velocity 'v' of water waves depends on the wavelength 'λ', density of water 'ρ' and the acceleration due to gravity 'g'. Deduce by the method of dimensions the relationship between these quantities.
7. A body of mass m is moving in a circle of radius r with angular velocity ω. Find expression for centripetal force acting on it by the method of dimensions.

CH:2 Motion in Straight Line

8. **Assertion:** A body may be accelerated even when it is moving uniformly.
   Reason: When direction of motion of the body is changing, the body must have acceleration.
9. **Assertion:** Displacement of a body may be zero when distance travelled by it is not zero.
   Reason: The displacement is the longest distance between initial and final position.
10. **Assertion:** The position-time graph of a uniform motion, in one dimension of a body cannot have negative slope.
    Reason: In one – dimensional motion the position does not reverse, so it cannot have a negative slope.
11. **Assertion:** Position-time graph of a stationary object is a straight line parallel to time axis.
    Reason: For a stationary object, position does not change with time.
12. **Assertion:** Velocity-time graph for an object in uniform motion along a straight path is a straight line parallel to the time axis.
    Reason: In uniform motion of an object velocity increases as the square of time elapsed.
13. Using integration technique and Graphical method prove that

    (a) $\boldsymbol{v^2 - u^2 = 2as}$

    (b) $\boldsymbol{s = ut + \frac{at^2}{2}}$

    (c) $\boldsymbol{v = u + at}$

    (d) $\boldsymbol{s_{nth} = u + \frac{a}{2}(2n - 1)}$

CH:3 Motion in A Plane

14. State triangle law of vector addition and derive a formula for magnitude of resultant of two vectors.

15. State parallelogram law of vector addition and derive a formula for magnitude of resultant of two vectors.

16. Derive various parameters in angular projectile motion

(a) Equation of path (trajectory)

(b) Time of flight

(c) Maximum height attained

(d) Horizontal range

(e) Velocity at any instant

17. Derive various parameters in horizontal projectile motion

(a) Equation of path (trajectory)

(b) Time of flight

(c) Horizontal range

(d) Velocity at any instant

18. Show that there are two angles of projection for which the horizontal range is same for a projectile.

19. Find the angle of projection at which the horizontal range and maximum height of a projectile are equal.

20. Derive an expression for the centripetal acceleration of a body moving in a circular path of radius '*r*' with uniform speed '*v*'

CH:4 Laws of Motion

21. Show that newton's second law of motion is the real law of motion.

22. Define angle of repose and angle of friction. Establish a relation between them.

23. Derive an expression for acceleration of a body down a rough inclined plane? (Sliding only)

24. Explain why it is easier to pull a lawn roller than to push it.

25. Discuss the concept of apparent weight of a man in an elevator.

26. Discuss the banking of roads and railway tracks and derive a formula for safe turning on a rough banked road.

27. Why does a cyclist bend while taking a circular turn? Explain with the help of necessary calculations.

CH:5 Work, Energy and Power

28. State and prove the work energy theorem for a variable force.

29. What are conservative and non-conservative forces? give one example of each.

30. Obtain an expression for minimum velocity of projection of a body at the lowest point for looping a vertical loop.

31. Discuss elastic collision in one dimension. Derive an expression for velocities of two bodies after such a collision.

32. Prove that two identical particles move at right angles to each other after elastic collision in two dimensions.

33. Show that there is loss of kinetic energy during one dimensional inelastic collision.

34. Derive an expression for the elastic potential energy of a stretched spring.

CH: 6 System of Particles and Rotational Motion

35. Derive a formula for centre of mass of a 2-particle system.

36. When does a rigid body said to be in equilibrium? State the necessary condition for a body to be in equilibrium.

37. Derive the relation between angular momentum and torque.

38. Derive a formula for moment of inertia.

39. Derive an expression for the rotational kinetic energy of a body.

40. State theorem of perpendicular axes and theorem of parallel axes on moment of inertia.

41. Relation between

(a) torque and angular acceleration

(b) MOI and angular momentum

(c) torque and MOI

42. Obtain the expression for the linear acceleration of a cylinder rolling down an inclined plane and hence find the condition for the cylinder to roll down without slipping.

43. Prove the result that the velocity v of translation of a rolling body (like a ring, disc, cylinder or sphere) at the bottom of an inclined plane of a height h is given by

$$v^2 = \frac{2gh}{1 + \frac{k^2}{R^2}}$$

using dynamical consideration (i.e., by consideration of forces and torques). Note k is the radius of gyration of the body about its symmetry axis, and R is the radius of the body. The body starts from rest at the top of the plane.

CH: 7 Gravitation

44. Variation of acceleration due to gravity with height.

45. Variation of g with depth.

46. What do you understand by gravitational potential energy of a body? Derive an expression for it, when a body of mass'm' is situated at a distance 'r' from the centre of earth of mass M.

47. Derive a formula for escape velocity in terms of parameters of a planet.

48. Derive expression for the orbital velocity of a satellite and its time period. What is a geostationary satellite? Obtain the expression for the height of the geostationary satellite.

49. Find the expression of total energy of a satellite revolving around the surface of the earth.

50. State and prove Kepler's laws of planetary motion.

CH: 8 Mechanical Properties of Solids

51. State Hooke's law and hence define modulus of elasticity.

52. Which is more elastic – iron or rubber? Why?

53. Define the terms young's modulus, bulk modulus and modulus of rigidity.

54. What is the value of bulk modulus for an incompressible liquid?

55. What is the value of modulus of rigidity for an incompressible liquid?

56. Draw stress-strain curve for a loaded wire. On the graph mark
(a) Hooke's limit
(b) Elastic limit
(c) Yield point
(d) Breaking point

57. Derive an expression for Energy stored in a wire due to extension.

58. Determine the poisson's ratio of the material of a wire whose volume remains constant under an external normal stress.

CH: 09 Mechanical Properties of Fluids

59. State Stoke's law. Deduce it on the basis of dimensional considerations.

60. State Poiseuille's formula. Deduce it on the basis of dimensional considerations.

61. What is terminal velocity? Derive and expression for the terminal velocity of a body falling freely in a viscous medium. On what factors does it depend.

62. Derive equation of continuity.

63. State and prove Bernoulli's principle or Bernoulli's theorem.

64. Derive an expression for excess pressure inside a liquid drop and soap bubble.

65. Discuss how a liquid rise or fall in a capillary tube hence derive ascent formula.

CH: 10 Thermal properties of Matter

66. What is meant by coefficient of linear expansion, superficial expansion and cubical expansion? derive the relation between them.

67. Prove that the coefficient of cubical expansion of an ideal gas at constant pressure is equal to the reciprocal of its absolute temperature.

68. Define coefficient of thermal conductivity. Write its S.I unit.

69. Define Newton's law of cooling, write the expression.

70. State Wein's displacement law.

CH: 11 Thermodynamics

71. Zeroth law of thermodynamics.

72. First law of thermodynamics.

73. Second law of thermodynamics.

74. Derive and expression for work done in an isothermal process by an ideal gas.

75. Derive a formula for the work done by an ideal gas in an adiabatic process.

76. Derive a relation between two principle specific heats of a gas or derive Mayer's formula.

77. Show that slope in adiabatic process is γ times the slope in isothermal process.

CH: 12 Kinetic Theory

78. Derive an expression for the pressure due to an ideal gas.

79. Kinetic interpretation of temperature.

80. State the law of equipartition of energy.

81. Defines degree of freedom. Calculate the degrees of freedom of monoatomic, diatomic and triatomic gas molecules.

82. What is meant by mean free path of a gas molecule? Derive an expression for it. On which factors does it depend?

CH: 13 Oscillations

83. Derive an expression for displacement, velocity, acceleration, energy and time period of a particle executing SHM.

84. One end of a U-tube containing mercury is connected to a suction pump and the other end to atmosphere. A small pressure difference is maintained between the two columns. Show that, when the suction pump is removed, the column of mercury in the U-tube executes simple harmonic motion and find the time period of SHM.

85. A cylindrical piece of cork of density of base area A and height h floats in a liquid of density ρ .The cork is depressed slightly and then released. Show that the cork oscillates up and down simple harmonically with a period

$$T = 2\pi\sqrt{\frac{h\sigma}{\rho g}}$$

where σ is the density of cork. (Ignore damping due to viscosity of the liquid).

86. Derive an expression for time period of a simple pendulum.

87. Find an expression for the total energy of a particle executing S.H.M.

CH: 14 Waves

88. Write Newton's formula for the speed of sound in air. What is Laplace correction.

89. Discuss the formation of standing waves in a string fixed at both ends and the different modes of vibrations.

90. Discuss the formation of standing waves in open and closed organ pipes.

91. What are beats?