Brain International School

Vikas Puri, New Delhi

REVISION SHEET

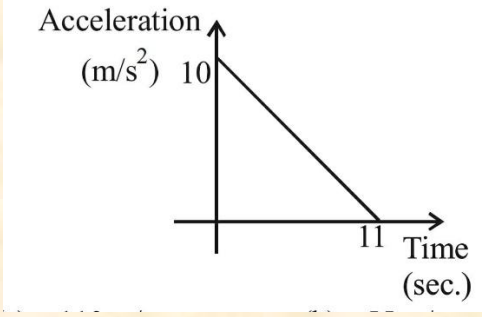
SUBJECT: PHYSICS **CLASS-XI** **TERM II**

Chapter: 1 Units and Measurement

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 a straight line

8. A body starts from rest at time t = 0, the acceleration time graph is shown in the figure. The maximum velocity attained by the body will be



(a) 110 m/s (b) 55 m/s (c) 650 m/s (d) 550 m/s

9. If a car at rest accelerated uniformly to a speed of 144 km/hour in 20 second it covers a distance:

(a) 400 m (b) 1440 m (c) 2880 m (d) 25 m

10. The numerical ratio of displacement to distance is

(a)always less than 1 (b) always greater than 1

(c)always equal to 1 (d) may be less than or equal to 1

11. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}ms^{-2}$ in the third second is

(a) $\frac{10}{3}m$ (b) $\frac{19}{3}m$ (c) 6m (d) 4m

12. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 m/s to 20 m/s while passing through a distance 135 m in t second. The value of t is

(a) 12 (b) 9 (c) 10 (d) 1.8

13. A particle covers half of its total distance with speed $v_1$and the rest half distance with speed v_2. It's average speed during the complete journey is

(a) $\frac{v_1+v_2}{2}$ (b) $\frac{v_1v_2}{v_1+v_2}$ (c) $\frac{2v_1v_2}{v_1+v_2}$ (d) $\frac{v_1^2v_2^2}{v_1^2+v_2^2}$

14. **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.

15. **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.

16. **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.

17. **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.

18. **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.

19. 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

1. $\vec{A} = 4\hat{\imath} + 4\hat{\jmath} - 4\hat{k}$ and $\vec{B} = 3\hat{\imath} + \hat{\jmath} + 4\hat{k}$,then angle between vectors $\vec{A}$ *and* $\vec{B}$ is

$(a)180^0$ (b) 90^0 (c) 45^0 (d) 0^0

2. If a vector $2\hat{\imath} + 3\hat{\jmath} + 8\hat{k}$ is perpendicular to the vector $4\hat{\jmath} - 4\hat{\imath} + \alpha\hat{k}$,then the value of α is

(a) 1/2 (b) -1/2 (c) 1 (d) -1

3. A projectile can have the same range 'R' for two angles of projection. If 'T_1' and 'T_2' to be time of flights in the two cases, then the product of the two time of flight is directly proportional to.

   (a) R (b) $\frac{1}{R}$ (c) $\frac{1}{R^2}$ (d) R^2

4. The maximum range of a projectile is 22 m. When it is thrown at an angle of 15° with the horizontal, its range will be-

   (a) 22 m (b) 6 m (c) 15 m (d) 11 m

5. A projectile is given an initial velocity of $(\hat{\imath} + 2\hat{\jmath})$ m/s, where $\hat{\imath}$ is along the ground and $\hat{\jmath}$ is along the vertical. If g $= 10\ m/s^2$, the equation of its trajectory is :

   (a) $y = x - 5x^2$ (b) $y = 2x - 5x^2$ (c) $4y = 2x - 5x^2$ (d) $4y = 2x - 25x^2$

6. State triangle law of vector addition and derive a formula for magnitude of resultant of two vectors.
7. State parallelogram law of vector addition and derive a formula for magnitude of resultant of two vectors.
8. 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

9. Derive various parameters in horizontal projectile motion

   (a) Equation of path (trajectory)

   (b) Time of flight

   (c) Horizontal range

   (d) Velocity at any instant

10. Show that there are two angles of projection for which the horizontal range is same for a projectile.
11. Find the angle of projection at which the horizontal range and maximum height of a projectile are equal.
12. 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

1. A man of mass 90 kg is standing in an elevator whose cable broke suddenly. If the elevator falls, apparent weight of the man is:

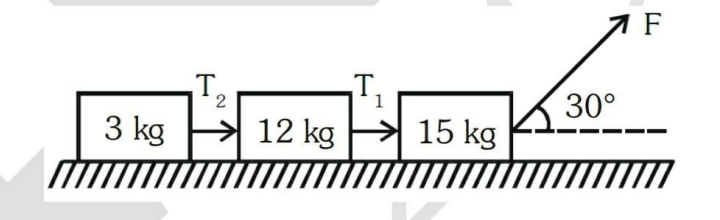
   (a) 90 N

   (b) 90g N

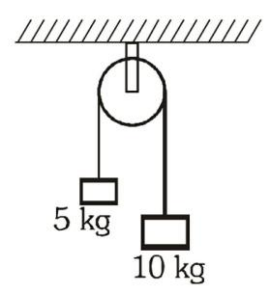
   (c) 0 N

   (d) any negative value

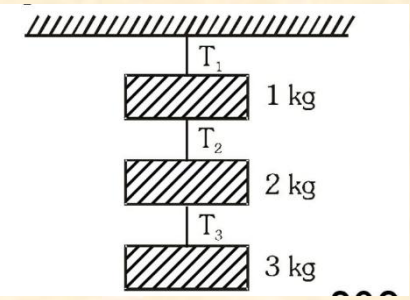
2. The surface is frictionless, the ratio of T_1 and T_2 is

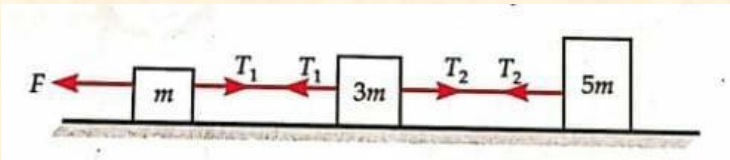


3. Show that newton's second law of motion is the real law of motion.
4. Define angle of repose and angle of friction. Establish a relation between them.
5. Derive an expression for acceleration of a body down a rough inclined plane? (Sliding only)



6. Two blocks of masses 5 kg and 10 kg are connected to a pulley as shown. What will be their acceleration if the pulley is set free? (g = 10 ms^{-2})
7. Explain why it is easier to pull a lawn roller than to push it.
8. Discuss the concept of apparent weight of a man in an elevator.
9. Discuss the banking of roads and railway tracks and derive a formula for safe turning on a rough banked road.
10. Why does a cyclist bend while taking a circular turn? Explain with the help of necessary calculations.
11. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over a frictionless pulley. Find the acceleration of the masses, and the tension in the string when the masses are released.
12. Two bodies of masses 10 kg and 20 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light string. a horizontal force F = 600 N is applied to (i) A, (ii) B along the direction of string. What is the tension in the string in each case?
13. Find the tension T_2 for the system shown in fig.





14. As shown in fig, three masses m, 3m and 5m connected together lie on a frictionless horizontal surface and pulled to the left by a force F. The tension T_1 in the first string is 24 N. Find (i) acceleration of the system (ii) tension in the second string (iii) force F.

CH:5 Work, Energy and Power

1. The change in kinetic energy of a particle is equal to the
   a) work done on it by some force.
   b) work done on it by the net force.
   c) work done on it by the aerodynamic force.
   d) loss in ambient kinetic energy
2. If the linear momentum is increased by 50%, then kinetic energy will increase by
   a) 125%
   b) 25%
   c) 50%
   d) 100%
3. State and prove the work energy theorem for a variable force.
4. What are conservative and non-conservative forces? give one example of each.
5. Obtain an expression for minimum velocity of projection of a body at the lowest point for looping a vertical loop.
6. Discuss elastic collision in one dimension. Derive an expression for velocities of two bodies after such a collision.
7. Prove that two identical particles move at right angles to each other after elastic collision in two dimensions.
8. Show that there is loss of kinetic energy during one dimensional inelastic collision.
9. Derive an expression for the elastic potential energy of a stretched spring.
10. Assertion (A): Graph between potential energy of a spring versus the extension or compression of the spring is a straight line.
    Reason (R): Potential energy of a stretched or compressed spring is proportional to square of extension or compression.

CH: 6 System of Particles and Rotational Motion

1. Three masses are placed on the x - axis: 300 g at origin, 500 g at x = 40 cm and 400 g at x = 70 cm. The distance of the centre of mass from the origin is
   a) 30 cm
   b) 40 cm
   c) 45 cm
   d) 50 cm
2. The moment of the force, $\vec{F} = 4\vec{\imath} + 5j - 6\vec{k}$ at (2,0,-3) about the point (2,-2,2) , given by

(a) $-8\vec{\imath} - 4j - 7\vec{k}$ (b) $-4\vec{\imath} - j - 8\vec{k}$ (c) $-7\vec{\imath} - 8j - 4\vec{k}$ (d) $-7\vec{\imath} - 4j - 8\vec{k}$

3. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere?

   (a) Angular velocity

   (b) Moment of inertia

   (c) Rotational kinetic energy

   (d) Angular momentum

4. Derive a formula for centre of mass of a 2-particle system.
5. A rod is hinged at one end and released from rest in a horizontal position. What happens to the linear acceleration of the free end as it falls?

   A. It remains constant
   B. It increases and then becomes zero
   C. It is always greater than g
   D. It is equal to g

6. When does a rigid body said to be in equilibrium? State the necessary condition for a body to be in equilibrium.
7. Derive the relation between angular momentum and torque.
8. Derive a formula for moment of inertia.
9. Derive an expression for the rotational kinetic energy of a body.
10. State theorem of perpendicular axes and theorem of parallel axes on moment of inertia.
11. Relation between

    (a) torque and angular acceleration

    (b) MOI and angular momentum

    (c) torque and MOI

12. 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.
13. 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

1. Variation of acceleration due to gravity with height.
2. Variation of g with depth.
3. 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.
4. Derive a formula for escape velocity in terms of parameters of a planet.
5. 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.
6. Find the expression of total energy of a satellite revolving around the surface of the earth.
7. State and explain Kepler's laws of planetary motion.

CH: 8 Mechanical Properties of Solids

1. State Hooke's law and hence define modulus of elasticity.
2. Which is more elastic – iron or rubber? Why?
3. Define the terms young's modulus, bulk modulus and modulus of rigidity.
4. What is the value of bulk modulus for an incompressible liquid?
5. What is the value of modulus of rigidity for an incompressible liquid?
6. 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
7. Derive an expression for Energy stored in a wire due to extension.
8. Determine the poisson's ratio of the material of a wire whose volume remains constant under an external normal stress.

CH: 9 Mechanical Properties of Fluids

1. State Stoke's law. Deduce it on the basis of dimensional considerations.
2. 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.
3. Derive equation of continuity.
4. State and prove Bernoulli's principle or Bernoulli's theorem.
5. Derive an expression for excess pressure inside a liquid drop and soap bubble.
6. Discuss how a liquid rise or fall in a capillary tube hence derive ascent formula.

CH: 10 Thermal properties of Matter

1. What is meant by coefficient of linear expansion, superficial expansion and cubical expansion? derive the relation between them.
2. Anomalous Expansion of water.
3. Define coefficient of thermal conductivity. Write its S.I unit.
4. Stefan-Boltzmann's law.

5. Prove that the coefficient of cubical expansion of an ideal gas at constant pressure is equal to the reciprocal of its absolute temperature.
6. State Wein's displacement law.

CH: 11 Thermodynamics

1. Zeroth law of thermodynamics.
2. First law of thermodynamics.
3. Second law of thermodynamics.
4. Derive and expression for work done in an isothermal process by an ideal gas.
5. Derive a formula for the work done by an ideal gas in an adiabatic process.
6. Derive a relation between two principle specific heats of a gas or derive Mayer's formula.
7. Show that slope in adiabatic process is γ times the slope in isothermal process.
8. Carnot's Heat Engine.

CH: 12 Kinetic Theory

1. Derive an expression for the pressure due to an ideal gas.
2. Kinetic interpretation of temperature.
3. State the law of equipartition of energy.
4. Defines degree of freedom. Calculate the degrees of freedom of monoatomic, diatomic gas molecules.
5. 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

1. Derive an expression for displacement, velocity, acceleration, energy and time period of a particle executing SHM.
2. 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.
3. 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).
4. Derive an expression for time period of a simple pendulum.
5. Find an expression for the total energy of a particle executing S.H.M.

CH: 14 Waves

1. Discuss the formation of standing waves in open and closed organ pipes.
2. What are beats? Prove that the beat frequency is equal to the difference in frequencies of the two superposing waves.

3. Write Newton's formula for the speed of sound in air. What is Laplace correction.
4. Discuss the formation of standing waves in a string fixed at both ends and the different modes of vibrations.
5.