



**Subject : Physics - 2012  
Theory**

Time : 3 Hrs

Class : XI

M.M. : 70

**General Instructions :**

1. All questions are compulsory.
2. There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.
3. There is no overall choice. However an internal choice has been provided in one question of 2 marks, one question of 3 marks and all of the three questions of 5 marks each. You have to attempt only one of the choices in such questions.
4. Use of calculator is not permitted.

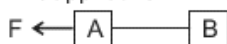
1. Write the dimensional formula for angular momentum.
2. Two bodies of masses  $m_1$  and  $m_2$  have equal momentum. Show which one has greater kinetic energy? Given  $m_1 > m_2$ .
3. State perpendicular axis theorem for a plane lamina.
4. State first law of thermodynamics.
5. Two vessels of equal capacity have gases at the same temperature and pressure. The first vessel contains neon (monoatomic) the second contains chlorine (diatomic) gas. Which one has greater root mean squared speed.
6. Define coefficient of thermal conductivity.
7. Two sound sources produce 12 beats in 4 seconds. By how much do their frequencies differ?
8. What is resonance phenomenon?
9. The escape speed  $V$  of a body depends upon
  - (i) acceleration due to gravity 'g' of the planet
  - (ii) the radius of the planet  $R$ .

Establish dimensionally the relationship in  $V$ ,  $g$  and  $R$ .

10. A player throws a ball upwards with an initial speed  $u$  m/s.
  - (i) What is the direction of acceleration during the upward motion of the ball?
  - (ii) What is the direction of velocity during the upward motion?
  - (iii) What are the velocity and acceleration of the ball at the highest point of its motion?
11. A body of mass 0.25 kg moving with velocity 12 m/s is stopped by applying a force of 0.6N. Calculate the time taken to stop the body.



Two bodies A and B of masses 10kg and 20kg 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 A. What is the tension on the string?



12. Two equal forces have their resultant equal to either. What is the inclination between them.
13. An elastic spring of spring constant  $k$  is compressed by an amount  $x$ . Obtain an expression for its potential energy.
14. State parallel axis theorem. What is the moment of inertia of a ring about an axis perpendicular to its plane and tangent to the ring.  
 $M \rightarrow$  mass of ring,  $r \rightarrow$  radius.
15. According to Newton's law of gravitation, the apple and the earth experience equal and opposite forces due to gravitation. But it is the apple that falls towards the earth and not vice versa. Why?
16. Draw energy distribution curve for a black body at two different temperatures  $T_1$  and  $T_2$  ( $T_1 > T_2$ ). Write two conclusion that can be drawn from these curves.
17. Define mean free path of molecules in a gas. Obtain an expression for it.
18. Molar volume is the volume occupied by one mole of an ideal gas at standard temperature and pressure. Show that it is 22.4 litres. (S.T.P. : Pressure = 1 atmosphere, Temperature =  $0^\circ\text{C}$ )
19. A particle starts from origin at  $t = 0$  with a velocity  $5.0 \hat{i}$  m/s and moves in  $xy$  plane under the action of a force which produces a constant acceleration of  $(3.0 \hat{i} + 2.0 \hat{j}) \text{ ms}^{-2}$ 
  - (i) What is the  $y$ -coordinate of the particles and the instant its  $x$ -coordinate is 84m?
  - (ii) What is the speed of the particle at this time?
20. Obtain an expression for maximum speed of a vehicle which can be achieved while taking a turn on a banked circular road.
21. Define the term "Coefficient of limiting friction between two surface." A body of mass 10kg is placed on an inclined surface at an angle of  $30^\circ$ . If the coefficient of limiting friction is  $\frac{1}{\sqrt{3}}$ , find the force required to just push the body up the inclined surface. The force is being applied parallel to the inclined surface.
22. Find the scalar and vector products of two vectors.

$$\vec{A} = 3\hat{i} - 4\hat{j} + 5\hat{k} \text{ and } \vec{B} = -2\hat{i} + \hat{j} - 3\hat{k}$$

23. Obtain an expression for kinetic energy of rotation of a body with angular velocity ' $\omega$ ' and hence define moment of inertia.



24. Discuss the variation of acceleration due to gravity 'g' by deriving correct mathematical expression with depth from the surface of Earth.

What is the value of 'g' at the centre of the Earth?

OR

State Kepler's laws of planetary motion.

Let the speed of a planet at the peritition be  $v_p$  and sun planet distance is  $r_p$ .  
Related  $(r_p, v_p)$  to the corresponding quantities at the aphelion  $(r_A, v_A)$ .

25. Define surface energy of a liquid. How much work will be done in increasing the radius of a soap bubble from 1 cm to 5 cm (Surface tension =  $73 \times 10^{-2}$  N/m).
26. What is an adiabatic process? Find an expression for the work done in an adiabatic process.
27. If velocity of sound in gas is  $V$  at temperature  $T$  and pressure is  $P$ . How does it change if
- temperature is doubled
  - Pressure is halved
  - Humidity in gas increases
28. Define circular motion. Derive an expression for velocity and acceleration (centripetal) for a body executing uniform circular motion.

OR

What is a projectile? Show that the path of a projectile is parabolic. Obtain an expression for

- maximum height
- Time of flight
- Horizontal range when the projectile is fired at an angle  $\theta$  with the horizontal.

29. State and prove Bemoulli's Theorem. Explain the following :

- Can Bernoulli's equation be used to describe the flow of water through a rapid river?
- Does it matter if one uses gauge pressure instead of absolute pressure by applying Bernoulli's equation.

OR

- What is the phenomenon of capillarity? Derive an expression for the size of liquid in a capillary tube.
- What will happen if the length of the capillary tube is smaller then the height to which the liquid rizes? Explain briefly.



30. What is doppler effect? Derive an expression for the apparent frequency.

- (i) When source is in motion and observer is stationary.
- (ii) Observer is in motion and source is at rest.

OR

Find the total energy of a particle executing S.H.M. and show graphically the variation of potential energy and kinetic energy with displacement. A body is executing S.H.M. at what distance from its mean position its energy is half kinetic and half potential.

$m$  → mass ( $\iota$ ) → angular frequency and  $a$  → amplitude.



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