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# INDIAN SCHOOL SOHAR
# FIRST TERM EXAM- 2013
# PHYSICS – THEORY

**CLASS: XI** **MARKS: 70**
**DATE: 6/10/2013** **TIME: 3Hrs**

**General Instructions:**

**1. All questions are compulsory**.

**2. There are 26 questions in all .Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each. Question 23 is a value based question carrying four marks and questions 24 to 26 carry five marks each.**

**3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each.**

**4. You have to attempt only one of the given choices in such questions.**

**5. Use of calculator is not permitted.**

**6. You may use the following physical constants wherever necessary.**

1. Name the field with which microscopic domain of physics deals. Which theory explains this phenomena? (1)

2. When a body accelerates by "$\beta$t", what is its velocity after time "t". (1)

3. A retarding force is applied to stop a motor car. If the speed of the motor car is doubled , how much more distance will it cover before stopping under the same retarding force. (1)

4. Draw the variation of potential energy stored in a spring as a function of extension. (1)

5. What is the torque provided by a force acting through the center of mass of a sphere. (1)

6. Check whether the equation $F.S = \frac{1}{2} mv^2 - \frac{1}{2} mu^2$ is dimensionally correct, where m is mass of the body, v its final velocity,u its initial velocity, F is force applied and S is the distance moved. (2)

7. An object moving on a straight covers first half of the distance at sped v and second half of the distance at 2v. Find (i) average speed (ii) mean speed. (2)

8. A monkey is descending from the branch of a tree with constant acceleration. If the breaking strength is 75% of the weight of the monkey, what is the minimum acceleration with which monkey can slide down without breaking the branch. (2)

9. Define torque. Derive an expression to show the relation between torque and angular acceleration of a rotating body. (2)

10. State the Newton's law of gravitation. Write an expression with the help of diagram. (2)

OR

10. Describe an experiment to find the value of gravitational constant G with the help of a diagram. (2)

11. 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 simple pendulum depends on its length (l), mass of the bob (m) and acceleration due to gravity (g). Derive the expression for its time period using method of dimensions. (3)

12. (a) Define instantaneous and average acceleration. Write down its mathematical expression. (b) Draw a position time graph for motion a body with (i) positive acceleration (ii) negative acceleration. (3)

13. (a) Explain the term relative velocity.
(b) Two cars A and B are running at velocities of 60 km/hr and 45 km/hr respectively. Calculate the relative velocity of car A if: (i) they are both travelling eastwards and (ii) car A is travelling eastwards and car B is travelling westwards. (3)

14. Define instantaneous velocity. Write down its mathematical expression. Describe the graphical method of obtaining the direction of velocity. (3)

15. The position of a particle is given by: $\mathbf{r} = 3.0\,t\,\mathbf{i} - 2.0\,t^2\mathbf{j} + 4\mathbf{k}$ meters. Where t is in seconds, **r** is in meters (a) Find the velocity v and acceleration a. (b) What is the magnitude of velocity of the particle at t = 2s ? (3)

16. State and explain the Kepler's laws of gravitation. (3)

OR.

16. Obtain an expression for acceleration due gravity of the earth. (3)

17. Define impulse. A cricket ball of mass 150 gm moving with speed of 12 m/s is hit by a bat so that the ball is turned back with a velocity of 20 m/s. Calculate the impulse received by the ball. (3)

18. Explain with the help of diagram the condition to be obtained for a body to be in equilibrium when (i) two forces (ii) three forces (iii) n forces are applied on the body. (3)

19. State work energy theorem. Prove the theorem for variable forces. (3)

2o. Define elastic and inelastic collision. A bullet is fired into a wooden block. If it gets totally embedded in it and the system moves together as one entity, then find the final velocity of the system and find ratio between final kinetic energy and initial energy of the system. (3)

21. A solid sphere of mass m and radius r is rolling on a horizontal surface. Find the total energy of the sphere. What fraction of total energy of the sphere is:
(a) kinetic energy of rotation ? (b) kinetic energy of translation. (3)

22. Obtain an expression for kinetic energy of a rotating body and hence define moment of inertia. (3)

23. Rohit went to the bank to deposit money. As, his turn to deposit money came, suddenly there was commotion in the bank and sound of a bullet was heard. Two masked men came

in to the bank and held the cashier at the gunpoint. They were asking for whole of cash. Everyone in the bank became afraid and silent, masked men looted the bank and ran away on their bike. Rohit immediately followed them on his bike but gunmen had crossed the turning. But after a long chase, he was able to nab the thieves and he handed them over to police at check post.
(a) What are the values exhibited by Rohit.
(b) The gunmen's motorbike crosses the turning at a speed of 72 km/h and Rohit follows it at a speed of 108 km/h crossing the turning 10 seconds later than first bike. Assuming that they travel at a constant speed, how far from the turning will Rohit catch the thieves? (4)

24. (a) With the help of a diagram obtain an expression for the maximum possible speed that can be obtained by a car on a leveled road.
(b) A circular race track of radius 400 m is banked at an angle of $10^\circ$. If the coefficient of friction between the wheels of a race car and the road is 0.2, what is the
(i) optimum speed of the race car to avoid wear and tear on its tyres.
(ii) maximum permissible speed to avoid slipping ? (5)

OR

24. (a) With the help of diagram obtain an expression for the maximum possible speed that can be obtained by a car on a banked road.
(b) Find the angle through which a cyclist bends when he covers a circular path 34.3 m long in $\sqrt{22}$ sec. Given g = 9.8 $ms^{-2}$. (5)

25. (a) What is coefficient of restitution. What is its value for a perfectly elastic collision in one dimension.
(b) Derive an expression for final velocities of two balls A and B after collision in one dimension and hence find their final velocities if their masses are equal. (5)

OR

25. (a) Derive an expression for the loss of kinetic energy for a completely inelastic collision in one dimension.
(b) Explain the terms angle of scattering and angle of recoil with the help of diagram.
(c) Obtain the expression for conservation of kinetic energy and linear momentum along x-axis and y-axis for a elastic collision in two dimension. (5)

26. State the theorem of perpendicular axis with the help of diagram.
(a) What is the moment of inertia of a disc about one of its diameters. Derive with the help of diagram.
(b) What is the moment of inertia of a ring with axis of rotation along the diameter. Derive with the help of diagram. (5)

OR

26. State the theorem of parallel axis with the help of diagram.
(a) What is the moment of inertia of a rod of mass M. length l about an axis perpendicular to it through one end.
(b) What is the moment of inertia of a ring about a tangent to the circle of the ring? (5)