



OXFORD PUBLIC SCHOOL, RANCHI
HALF YEARLY EXAMINATION
SESSION 2016-2017

Class – XI
Sub - Physics

Time : 3 Hrs

F.M.: 70

Name _____

Class & Sec _____

Roll No _____

General Instructions:

- (i) All questions are compulsory.
 - (ii) There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to 10 carry 2 marks each, questions 11 to 22 carry 3 marks each, question 23 carries 4 marks & the questions 24 to 26 carry 5 marks each.
 - (iii) There is no overall choice, however, an internal choice has been provided in one question of two marks, one question of three marks and all questions of five marks. You have to attempt only one of the given choices in such questions.
 - (iv) Use of calculators is not permitted.
1. Give the SI unit and dimension for ‘solid angle’.
 2. State the rule for determining the significant figures in the sum or difference of two numbers.
 3. Two balls of different masses (one lighter and the other heavier) are thrown vertically upwards with the same initial speed. Which one will rise to the greater height and why?
 4. Give the magnitude and direction of the net force acting on a drop of rain falling with a constant speed.
 5. In a tug-of-war game, team A wins against team B. Identify which of the two teams performs negative work done?
 6. (i) How can we estimate the error in multiplication or quotient of different measured physical quantities?
(ii) A physical quantity P is related to four observables a, b, c and d as:
$$P = a^3 b^2 / c \sqrt{d}.$$
The percentage errors in the measurement of a, b, c and d are 3%, 2%, 1% and 4% respectively. What is the percentage error in the quantity P?
 7. Write the dimensions of ‘a’ and ‘b’ in the relation: $F = a \sqrt{x} + bt^2$ where, F is force, x is distance and t is time.

OR

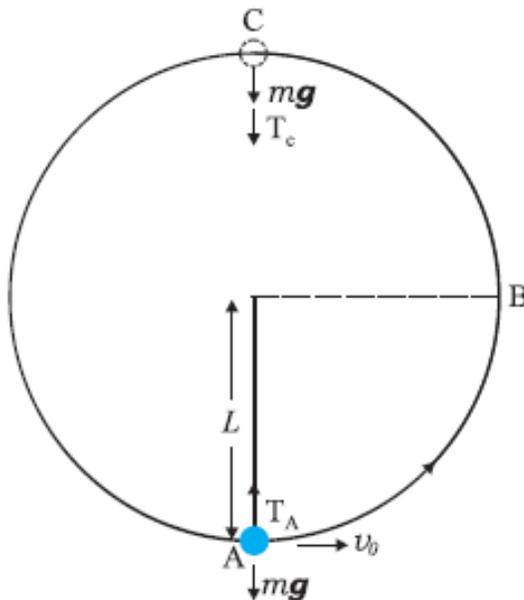
The Young’s modulus of steel is $1.9 \times 10^{11} \text{ N/m}^2$. Find its value in cgs unit using method of dimensions.
 8. Rain is falling vertically with a speed of 35 m/s. Winds starts blowing after sometime with a speed of 12 m/s in east to west direction. In which direction should a boy waiting at a bus stop hold his umbrella?
 9. Shows that the projection angle Θ for a projectile launched from the origin is given by

$$\Theta = \tan^{-1}(4H/R)$$

where, H = maximum height attained by the projectile and R = horizontal range covered by the projectile.

10. (a) Define Power. Give its SI unit.
 (b) Prove that, instantaneous power $P = \vec{F} \cdot \vec{v}$
 where, \vec{F} = Force and \vec{v} = instantaneous velocity
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 the 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 (T) using the method of dimensions.
12. (a) Define 1 parsec.
 (b) Discuss in brief how distance of nearby astronomical objects like planets can be determined using parallax method.
13. (a) What are 'relative error' and 'least count error' ?
 (b) The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{L/g}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 80 s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g?
14. (i) Define average speed.
 (ii) A cyclist goes to the market from his home riding at a speed of 'P' km/h. Finding the market closed, he immediately returns back to his home at a speed of 'Q' km/h. Find the average speed of the cyclist.
15. A car moving along a straight highway with a speed of 126 km/h is brought to a stop with distance of 200 m. What is the retardation of the car (assumed uniform), and how long does it take for the car to stop?
16. For the motion of an object under free fall, show the variation of (i) acceleration with time (ii) velocity with time and (iii) distance with time.
17. Derive an expression for centripetal acceleration.
- OR
- An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 s.
 (a) What are the angular speed and the linear speed of the motion?
 (b) What is the magnitude of the acceleration vector?
18. The position of a particle is given by
 $r = 3t \hat{i} + 2t^2 \hat{j} + 5 \hat{k}$
 where, r is in meters and t is in seconds.
 (i) Find v (t) and a (t) of the particle.
 (ii) Find the magnitude and direction of the v (t) at t = 1 s.
19. Two masses M and m ($M > m$) are connected to 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.

20. (i) State the law of conservation of linear momentum.
(ii) A shell of mass 20 gm is fired by a gun of mass 100 kg. If the muzzle speed of the shell is 80 m/s, what is the recoil velocity of the gun?
21. (a) Which is greatest out of static friction, limiting friction and kinetic friction?
(b) What is the SI unit of coefficient of limiting friction?
(c) How is the limiting friction affected when the area of contact is doubled?
22. A bob of mass m is suspended by a light string of length L . It is imparted a horizontal velocity ' v_0 ' at the lowest point A such that it completes a semi-circular trajectory in the vertical plane with the string becoming slack only on reaching the topmost point C. Obtain an expression for (i) ' v_0 ' (ii) the speeds at points B and C.



23. Ravi used to live in a remote village of Rajasthan which didn't have electricity. He was a good student and studied very hard to become an engineer in spite of all hardships. While studying, he came to know that solar energy can be converted to electrical energy by using specially designed devices. He went to his village and discussed it with villagers. He also told them that government also gives subsidy for using solar devices. All villagers agreed and contacted the government officials who obliged their request and the village became the model village which used solar energy for electricity.

- (a) Write any two values exhibited by Ravi.
(b) Give any two reasons, why solar energy is a better source of energy?

24. Graphically prove that:

- a) $v = u + at$
b) $S = ut + \frac{1}{2}at^2$
c) $v^2 = u^2 + 2aS$

where, symbols have their usual meanings.

OR

Using calculus, prove that:

a) $v = u + at$

b) $S = ut + \frac{1}{2}at^2$

c) $v^2 = u^2 + 2aS$

where, symbols have their usual meanings.

25. Give an analytical treatment to determine the magnitude and direction of the resultant vector of addition of two vectors using triangle law of vector addition.

OR

A projectile is fired with an initial velocity u at a projection θ . Derive

a) expression for the time of flight

b) expression for maximum height

c) expression for horizontal range

26. Draw a neat diagram showing different forces and their components acting on vehicle acting on a banked circular road. Hence derive an expression for maximum speed of a vehicle on a banked circular road.

OR

State Newton's second law of motion. Prove that Newton's second law of motion is the real law of motion.
