



# पुण International School

Shree Swaminarayan Gurukul, Zundal

HALF YEARLY EXAMINATION (2020 – 2021)			
Student's Name:	Roll No.	Grade :	XI
Date : 03 / 11 / 2020	Time: 3hr	Subject:	Physics
Teachers sign:			Total Marks: 70

### General Instructions:

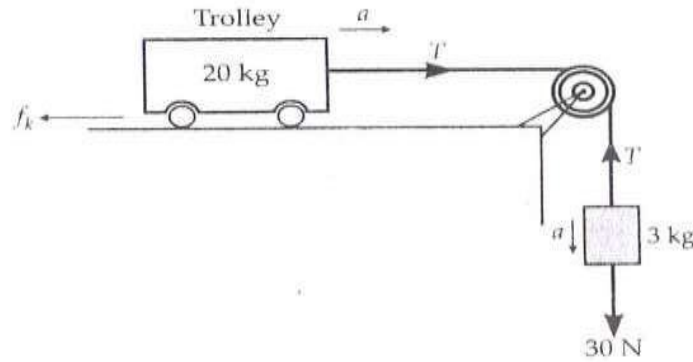
- All questions are compulsory.
- There are 26 questions in total. Questions 1 to 5 are very short answer type questions and carry one mark each.
- Questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each and questions 24 to 26 carry five marks each.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the choices in such questions.
- Question 23 is a value based question carrying four marks.
- Use of calculator is not permitted. However, you may use log tables if necessary.

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- The displacement time graphs for two particles A and B are straight lines inclined at an angles of  $30^\circ$  and  $45^\circ$  with the time axis. What is the ratio of the velocities  $v_A : v_B$ . 1
  - What is the rotational analogue of force? Give its S.I unit. 1
  - How the coefficient of friction between a body and a surface changes if the mass of the body is doubled. 1
  - State the theorem of parallel axes of moment of inertia. 1
  - What is a geostationary satellite? 1
  - If the errors involved in the measurements of a side and mass of a cube are 3% and 4% respectively, what is the maximum permissible error in the density of the material? 2
  - Why are the passengers thrown outwards when a car in which they are travelling suddenly takes a circular turn? 2

OR

Why do passengers fall in backward direction when a bus suddenly starts moving from the rest position?

8. A light body and a heavy body have the same momentum, which one will have greater kinetic energy? Explain. 2
9. Two particles of mass 2kg and 1kg are moving along the same line and same direction with speeds 2 m/s and 5 m/s respectively. What is the speed of centre of mass of the system? 2
10. The radii of two planets are R and 2R respectively and their densities  $\rho$  and  $\rho/2$  respectively. What is the ratio of acceleration due to gravity at their surfaces? 2
11. Assuming that mass M of the largest stone that can be moved by a flowing river depends upon the velocity 'v', the density of water ' $\rho$ ', and acceleration due to gravity 'g'. Using dimensional analysis Show that M varies with the sixth power of the velocity of flow. 3
12. The displacement (in metre) of a particle moving along x-axis is given by  
 $x = 18t + 5t^2$  : calculate 3  
 (i) The instantaneous velocity at t=4 sec  
 (ii) Average velocity between t=4 sec and t=5sec.  
 (iii) Instantaneous acceleration.
13. Two trains A and B are connected by a regular bus service with a bus leaving in either direction every T min. A man cycling with a speed of 20 km/h in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion, and every 6 min in the opposite direction. What is the period T of the bus service and with what speed (assumed constant) do the buses ply on the road. 3
14. Define unit vector. Determine a unit vector perpendicular to both  $\vec{A} = 2\mathbf{i} + \mathbf{j} + \mathbf{k}$  and  $\vec{B} = \mathbf{i} - \mathbf{j} + 2\mathbf{k}$  3
15. Define centripetal acceleration. Give its direction. Write the expression for the centripetal acceleration. If the time period of rotation of a body in a circular path is increased by three times then what is the effect on the centripetal acceleration. 3
16. Name and state the conservation principle on which the recoiling of a gun is based. Obtain the expression for the recoil velocity of the gun. 3
17. What is the acceleration of the block and the trolley system, if the coefficient of kinetic friction between the trolley and the surface is 0.04? What is the tension in the string? Neglect the mass of string. (take  $g = 10 \text{ m/s}^2$ ) 3



18. Define the term work. Name and define SI unit of work. 3  
 Give the sign of the work done by the force in the following case with explanation. (i) Work done by gravitational force in lifting a bucket out of a well by means of a rope tied to the bucket.  
 (ii) Work done by an applied force on a body moving on a rough horizontal plane with uniform velocity.
19. Derive a relation between torque applied and angular acceleration  $\alpha$  produced in a rigid body and hence define moment of inertia. 3
20. A solid cylinder of mass 20 kg rotates about its axis with angular speed 100 rad/s. The radius of cylinder is 0.25. What is the kinetic energy associated with the rotation of the cylinder? What is the magnitude of angular momentum if the cylinder about its axis? 3
21. Define escape velocity. Obtain an expression for the escape velocity of a body from the surface of the earth. 3  
 OR  
 Define orbital velocity. What is the ratio of escape velocity of a body from the earth's surface to the orbital velocity for a satellite revolving near the earth's surface? Why is it that there is no atmosphere on the moon? Explain.
22. Plot a graph showing the variation of acceleration due to gravity with the distance from the centre of the earth. 3  
 The weight of a body on the surface of earth is 250 N. Calculate its weight at distance equal to half of the radius of earth below the surface of earth. (Radius of earth = 6400 km)
23. Suraj went to Big Bazaar to purchase certain goods. There he noticed an old lady struggling with her shopping. Immediately he showed her the lift and explained to her how it carries the load from one floor to the next. Even then the Old lady was not convinced. Then Suraj took her in the lift and showed her how to operate it. That old lady was very happy. 4  
 a). What values does Suraj possess?  
 b). A man of mass 80 kg stands on a weighing machine in a lift

which is moving

- (i) upwards with uniform speed of 10 m/s.
- (ii) downwards with a uniform acceleration of  $5 \text{ m/s}^2$
- (iii) upwards with a uniform acceleration of  $5 \text{ m/s}^2$

What would be the reading on the scale in each case? (Take  $g = 10 \text{ m/s}^2$ )

24. (a) A body starts accelerating uniformly with acceleration 'a' with a initial velocity 'u' and travels in a straight line. Derive an equation for the distance covered by it in  $n^{\text{th}}$  second of its motion. 5
- (b) A ball is dropped from the roof of a tower of height h. The total distance covered by it in the last second of its motion is equal to the distance covered by it in first three seconds, what is the value of h? ( $g = 10 \text{ m/s}^2$ )

OR

- (a) A body is projected at an angle  $\theta$  with the horizontal with velocity 'u'. Derive an expression for its (i) time of flight (ii) horizontal range.
- (b) Show that there are two angles of projection for which the horizontal range is same.

25. What is meant by banking of road? What is need the of banking? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle  $\theta$ . The coefficient of friction between the wheels and the road is  $\mu$ . 5

OR

- (a) What do you mean by impulse of force? Show that impulse of a force is equal to the change in momentum produced by the force.
- (b) A ball of mass 200 g hits a wall at an angle of  $45^\circ$  with a velocity of 15 m/s. If the ball rebounds at  $90^\circ$  to the direction of incidence, calculate the impulse received by the ball.

26. (a) Define elastic and inelastic collision. 5
- (b) Show that in case of one dimensional elastic collision of two bodies, the relative velocity of separation after the collision is equal to the relative velocity of approach before the collision.

OR

- (a) Define conservative forces. Give one example.
- (b) An elastic spring of force constant K is stretched by an amount x. Obtain an expression for the potential energy stored in it

