ST. XAVIER'S SENIOR SECONDARY SCHOOL, DELHI – 110 054

Std. 11 Time : 3 hrs.

12-9-2014 Half Yearly Examination in **PHYSICS** M. Marks : 70

INSTRUCTIONS:

i) Q. Nos. 1 to 5 carry 1 mark each.
ii) Q. Nos. 6 to 10 carry 2 marks each.
iii) Q. Nos. 11 to 22 carry 3 marks each.
iv) Q. No. 23 carries 4 marks.
v) Q. Nos. 24 to 26 carry 5 marks each.
vi) Use pencil for the diagrams and graphs.
vii) Answers should be to the point.
viii) Use log tables if necessary.

1. Write a physical quantity which has SI unit but no dimension and a physical quantity which has a no unit and no dimension. (1)

2. What is the relative velocity of the two bodies having equal velocities? (1)

3. What is the direction of frictional force when a person walks on a rough surface? (1)

4. What is the angle of friction between the two surfaces in contact if the coefficient of friction is $\frac{1}{\sqrt{3}}$? (1)

5. Under what condition the magnitude of the sum of two vectors is equal to the magnitude of the difference of two vectors. (1)

6. By the method of dimensions, check the correctness of the relation:
$S_{nth}=u+\frac{a}{2}(2n-1)$ where S_{nth} is the distance covered by the object in n^{th} second, 'u' is the initial velocity and 'a' is the acceleration of the object. (2)

7. A tennis ball is thrown vertically upwards with a certain velocity and it hits back the ground after sometime. Show graphically (i) the variation of its position with time. (ii) the variation of its speed with time. (2)

8. Two vectors **A** and **B** are having magnitude 10 and 20 units respectively. **A** is inclined at an angle of 37º and **B** is inclined at an angle of 53º with the x-axis. Find **C** such that **A**+**B**+**C**=0 (2)

9. A car of mass 1000kg travelling with speed of 32m/s dashes into the rear of a truck of mass 8000kg moving in the same direction with velocity of 4m/s. After collision the car bounces back with the velocity of 8m/s. What is the velocity of truck after collision? (2)

(OR)

A 30kg shell is flying at 48m/s. When it explodes, its one part of 18kg stops while the remaining part flies on. Find the velocity of the later? (2)

10. Find the angle between the vectors **A**=**i**+2**j**-**k** and **B**= -**i**+**j**-2**k** (2)

11. If we kick a football, it flies a long way whereas if we kick a stone of same size, it hardly moves away, why? (2)

12. i) Show that the maximum relative error in the product of two quantities is the sum of relative errors in the individual quantities.
ii) Find the % error in Z, if the physical quantity Z is calculated as: $Z=A^4B^{1/3}/CD^{3/2}$ Given that percentage of errors in A, B, C, D are 1%, 3%, 2% and 2% respectively. (3)

13. i) Give any two limitations of dimensional analysis using appropriate examples.
ii) If momentum (p), area (A) and time (T) are taken as fundamental quantities, then find the dimensions of energy. (3)

14. The time period of oscillation of simple pendulum was recorded in an experiment. The successive readings turned out to be 2.63s, 2.56s, 2.42s, 2.71s, 2.80s. Calculate the percentage error in the measurement. (3)

15. a) On a 60km track, a train travels the first 30km with uniform speed of 30km/h. How fast must the train travel the next 30km so as to average 40km/h for the entire trip?
b) Under what condition average speed is equal to average velocity? (3)

16. a) Draw position-time graph for two objects moving along a straight line in positive x direction when their relative velocity is positive.
b) A car A is travelling on a straight road with a speed of 60km/h. It is followed by another car B which is moving with speed of 70km/h. When the distance between them is 2.5km, the car B is given deceleration of $20kmh^{-2}$. In what time will the car B catch up with car A? (3)

17. Displacement–time relation of a particle moving along x-axis is X (t) = (t^3-12t+20) m
Find the position and velocity of the particle at t=0.
State whether the motion is uniformly accelerated or not and why?
Find the position of the particle when the velocity of the particle is zero. (3)

18. Derive s = ut + ½at^2 relation for a uniformly accelerated object using calculus method. (3)

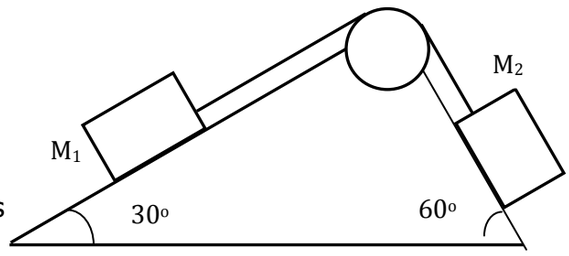
19. What is projectile motion? A projectile is fired at an angle θ with the horizontal. Show that it has parabolic trajectory. Prove that time of ascent for a projectile is equal to time of descent.

(OR)

Projectile is an example of two dimension motion with acceleration in one dimension, explain.
A projectile is fired at an angle θ with the horizontal, find its range. Show that for a given velocity there are two angles of projection for which the horizontal range remains the same. (3)

20. Rain is falling vertically with the speed of 35m/s. A woman rides a bicycle with the speed of 12m/s in east to west direction. What is the direction in which she should hold the umbrella to protect herself from rain? Give the proper vector diagram for the given problem. (3)

21. Two blocks of M_1 and M_2 of masses 50kg and 30kg respectively are connected to mass less string pass over a light frictionless pulley and rest on two smooth planes inclined at an angle of 30° and 60° respectively with the horizontal. Determine the acceleration of the two blocks and the tension on the string.(g=10m/s^2)



(3)

22. State work– energy theorem. How is kinetic energy related to momentum? If kinetic energy of a body is increased by 300%, by what % will the linear momentum of the body increase? (3)

23. Once Rahul visited his uncle's garment factory. His uncle was discussing with his manager about the electricity bill of last month. The bill amount was more than previous months. Rahul happened to hear the conversation and the machines were making screeching noise. Then he suggested his uncle to change the old parts of machineries and to oil the machineries with good quality of lubricant.
a) What could be the reason for changing the parts of the machineries?
b) What are the benefits of oiling the parts of the machineries?
c) What are the moral values shown by Rahul?

24. a) "Negative acceleration is retardation always." Is this statement true or false? Support your answer with proper velocity-time graphs.
b) A balloon is ascending at the rate of 9.8m/s at a height of 39.2m above the ground when a food packet is dropped from the balloon. After how much time and with what velocity does it reach the ground? (g=9.8m/s^2) (2+3)

(OR)

Which of the two: velocity or acceleration decide the direction of motion? Explain.
A body is falling freely under the action of gravity passes through two points 30m apart in 1 second. Find from what point above the upper point it began to fall? (g=9.8m/s^2) (2+3)

25. a) What is centripetal acceleration? Derive an expression for the centripetal acceleration of a uniform circular motion. Show that it acts towards the center of the circle, along the radius.
b) An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100s.What is the angular speed and linear speed of the motion? (3+2)

(OR)

a) Define angular velocity and give its dimensions. Derive how linear velocity is related to angular velocity. Show that linear velocity is tangential to the circle.
b) Find the magnitude of the centripetal acceleration of a particle on the tip of fan blade, 30cm in diameter, rotating at 1200 rpm. (3+2)

26. What is friction? Explain the roles played by Dynamic and Static friction. Which of these two a self-adjusting friction? Draw the graph to show the variation of frictional force with the applied force. Explain why μ_k is less than μ_s? (5)

(OR)

What is impulse? State and prove impulse –momentum theorem.
A ball moving with a momentum of 5kgm/s strikes against the wall at an angle of 45° with x-axis and is reflected at the same angle. Calculate the change in momentum and hence write its impulse vector. (3+2)

-x-x-x-x-x-x-