St. Mary's School, Dwarka
First Term Examination
Class XI
Subject: Physics

Reading Time : 15 mins.   M.M: 70
Writing Time: 3 Hrs
No. of questions: 26
General instructions:

1. All questions are compulsory.
2. Question no 1 to 5 are very short answer type questions of 1 mark each.
3. Question no 6 to 10 are short answer type questions of 2 marks each.
4. Question no 11 to 22 are short answer type questions of 3 marks each.
5. Question no 23 is a value based question of 4 marks .
6. Question no 24 to 26 are long answer type questions of 5 marks each

Q1. What is the sign of work done by a man in lifting a bucket out of a well by means of a rope tied to the (1)
bucket? Justify your answer.

Q2.A body of mass 0.1 kg hung from the ceiling of a room by a string 2m long is set into oscillations. The
speed of the bob at its mean position is 1 m/s. What will be the trajectory of the bob if the string is cut when the (1)
bob is (i) at one of the extreme positions (b) at its mean position. (1)

Q3.How does the kinetic energy of a body change if its momentum is doubled ? Justify.

Q4. Two bodies are projected at angles θ and $(90-\theta)$ to the horizontal with the same speed. Find the ratio of (1)
their time of flight. (1)

Q5. Define conservative forces. Give one example.

Q6.(i) An elastic spring of force constant K is stretched horizontally by an amount x. Obtain an expression for
the potential energy stored in it.(ii) The spring is stretched horizontally and released to oscillate . Draw a graph
to show variation in potential energy , kinetic energy and total energy of the spring with extension /compression (2)
from the mean position .

Q7.(i)The displacement time graphs for two particles A and B are straight lines inclined at an angles of 30° and
45° with the time axis. What is the ratio of the velocities $V_A : V_B$.(ii)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 (2)
of the material?

Q8.A solid sphere of mass 20 kg rotates about its axis with angular speed 100 rad/s. The radius of sphere is
0.25. What is the kinetic energy associated with the rotation of the sphere? What is the magnitude of angular (2)
momentum of the sphere about its axis?

Q9.A cricket ball of mass 150 g is moving with a velocity of 2 m/s , and it is hit by a bat so that the ball is
turned back with a velocity of 20 m/s . The force of the blow acts for 0.01 second on the ball. Find the average (2)
force exerted by the bat on the ball.

Q10. Name and state the conservation principle on which the recoiling of a gun is based. Obtain the expression (2)
for the recoil velocity of the gun.

Q11. A man can swim with a speed of 4 km/hr in still water. How long does he take to cross a river 1 km wide
if the river flows steadily at 3 km/hr and he makes his strokes normal to the river current. How far down the (3)
river does he go when he reaches the other bank? Draw the diagram as well.

OR

Q11. On a certain day rain was falling vertically with a speed of 30 m/s. Suddenly wind starts blowing from east to west with a speed of 10 m/s. In which direction should a girl waiting at a bus stop turn her umbrella? Explain with the diagram. (3)

Q12 Define center of mass of a system. Derive an expression for center of mass of a two particle system and extend it to n particle system. (3)

Q13. A cricket ball is thrown at a speed of 60 m/s in a direction 60° above the horizontal . Calculate (i) the maximum height,(ii) the time taken by the ball to return to the same level   (iii) the distance from the thrower to the point where the ball returns to the same level.   (Take g=10m/s^2) (3)

Q14. Define unit vector. Determine a unit vector perpendicular to both $A = 2i + j + k$ and $B = i - j + 2k$ (3)

Q15 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).

Q16.What is meant by banking of road? What is the need of banking? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle θ. The coefficient of friction between the wheels and the road is μ. (3)

Q17. 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= 10m/s^2)

(a)
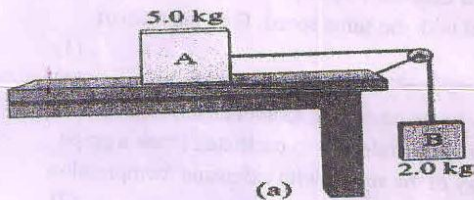
Q18.(i)Define a zero vector. List its two important properties. (ii) For any two vectors A and B , prove that $(A \times B)^2 = A^2B^2 - (A.B)^2$. (1.5+1.5=3)

Q19.(i) Calculate the work done in moving the object from x=2m to x=3m from the following graph:
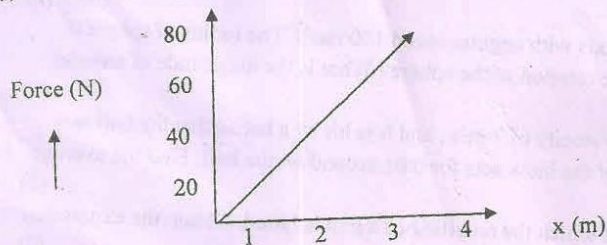
(ii) State work energy theorem and derive it mathematically for work done by a variable force.   (1.5+1.5=3)

Q20 (i). Draw position time graphs of two objects with unequal velocities in same direction and show the time of their meeting as well.(ii)A planet moves around the sun in a circular orbit. The time period of revolution T of the planet depends on radius of orbit R, mass of the sun M and gravitational constant G. Derive , by method of dimensions , an expression for time period of the planet. (1.5+1.5=3)

21.(i) Calculate the duration of the day , if the earth suddenly shrinks to 1/64 of its original volume , mass remaining unchanged . (ii) If ice on the polar caps of earth melts , How will it affect the duration of the day ? Explain. (2+1=3)

Q22 In an experiment , the value of two resistances were measured to be $R_1= 5 \pm 0.2$ ohm ; $R_2 = 10 \pm 0.1$ ohm. .Find the total value of resistance in (i) series (ii) parallel with limits of possible percentage error in each case . (1.5+1.5=3)

Q23 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. i). What values does Suraj possess? ii). 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 m/s2 (iv) upwards with a uniform acceleration of 5 m/s^2 What would be the reading on the scale in each case?(Take g= 10 m/s^2) (4)

Q24(a) State theorem of parallel and perpendicular axes and express them mathematically . Draw their respective diagrams also (b)Find center of mass of the given system . (2.5+2.5=5)
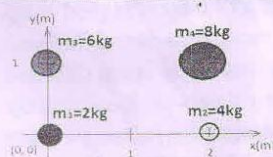
Q25. (i) Torques of equal magnitude are applied to a hollow cylinder and a solid sphere, both having same mass and radius. The cylinder is free to rotate about its axis of symmetry and the sphere is free to rotate about an axis passing through its center. Which of the two will acquire greater angular speed? Explain. (ii) A particle performing uniform circular motion has angular momentum L. What will be the new angular momentum , if its angular frequency is doubled and kinetic energy is halved . (5)

Q26.(i) Define the term elastic collision and inelastic collision. (ii) Show that in the 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. (iii) Prove that bodies of identical masses exchange their velocities after head-on collision. (1+2+2=5)

OR

Q26.State law of conservation of linear momentum.(ii) Three blocks are connected as shown on a horizontal frictionless table, and pulled to the right with a force of T_3=60 N. If m_1=10 kg,m_2= 20 kg and m_3 = 30 kg. Prove that T_1/T_2= 1/3. (1+4=5)