

ST. GEORGE'S SCHOOL, ALAKNANDA
MID TERM EXAMINATION(2015-2016)
SUBJECT - PHYSICS
CLASS - XI

M:M : 70

TIME : 3HRS

DATE : 28.9.15

NO OF PAGES : 4

Question 1-4 carries 1 mark each.

Question 5-13 carries 2 marks each.

Question 14-21 carries 3 marks each.

Question 22 carries 4 mark .

Question 23-26 carries 5 marks each.

- Q1. If $x = a+bt+ct^2$, where x is in metre and t is in sec ; then what is the unit of c ?
- Q2. Read the statement and state reasons and examples , if it is true or false.A particle in one dimension motion :
- With constant speed must have zero acceleration
 - With positive value of acceleration must be speeding up.
- Q3. The distance travelled by a body is directly proportional to time. Is any external force acting on it ?
- Q4. If a block attached to a spring(whose other end is rigidly fixed) is pulled up to a distance x_0 and released,the amplitude of its motion cannot exceed $\pm x_0$.Why ?
- Q5. Find the dimensions of $(a \times b)$ in the equation : $E = b \cdot x^2 / at$; where E is energy , x is distance and t is time.
- Q6. Which of the following quantities are independent of the choice of the orientation of the coordinate axis : $\vec{a} + \vec{b}$, $3a_x + 2b_y$, $|\vec{a} + \vec{b} - \vec{c}|$, angle between \vec{b} and \vec{c} , $\lambda \vec{a}$, where λ is a scalar.
- Q7. A train runs along an unbanked circular track of radius 30m at a speed of 54km/hr.The mass of the train is 10^6 Kg.What provides the centripetal force for this purpose ? The engine or rails ?.The outer or the inner rail. Which rail will wear out faster ,the outer or the inner rail ?

- Q8. A body is moving unidirectionally under the influence of a source of constant power. Its displacement in time t is proportional to $t^{1/2}$, t , $t^{3/2}$, t^2 . Justify.
- Q9. Two bodies of masses m_1 and m_2 have equal K.E. What is the ratio of their linear momenta?
- Q10. Why do you feel giddy while moving on a merry-go-round?
- Q11. An elephant and an ant are to be projected out of earth into space. Do we need different velocities to do so? Justify.
- Q12. During adiabatic changes, the volume of a gas is found to depend inversely on the square of its absolute temperature. Find how its pressure will depend on the absolute temperature?
- Q13. Of what physical significance is the difference between the two principal specific heat capacities and their ratio?
- Q14. Derive by the method of dimensions, an expression for the volume of the liquid flowing out per second through a narrow pipe. Assume the rate of flow of liquid depends on coefficient of viscosity (η) of the liquid, the radius r of the pipe and the pressure gradient (p/l) along the pipe. Take $k = \pi/8$.
- Q15. (a) If \hat{i} and \hat{j} are unit vectors along X-axis and Y-axis respectively, then represent the direction of $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$ diagrammatically?
 (b) Find the components of $\vec{a} = 2\hat{i} + 3\hat{j}$ along the direction of vectors $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$.
- Q16. The velocity of a train increases at a constant rate α from 0 to V and then remains constant for some time interval and then finally decreases to zero at a constant rate β . If the total distance covered by the particle is x , then show the total time taken will be

$$T = \frac{x}{V} + \frac{V}{2} \left[\frac{1}{\alpha} + \frac{1}{\beta} \right]$$

- Q17. A batsman deflects a ball by an angle of 45° without changing its initial speed which is equal to 54 km/hr . What is the impulse imparted to the ball? Mass of the ball is 0.15 kg .
- Q18. A block of mass 15 kg is placed on a long trolley. The μ between the block and the trolley is 0.18 . The trolley accelerates from rest with 0.5 m/s^2 for 20 s then moves with uniform velocity. Discuss the motion of the block as viewed by (i) a stationary observer on the ground (ii) an observer moving with the trolley.

Q19. A trolley of mass 200kg moves with a uniform speed of 36km/hr on a frictionless track. A child of mass 20kg runs on the trolley from one end to the other (10m away) with a speed of 4m/s relative to the trolley in a direction opposite to the trolley's motion, and jumps out of the trolley. What is the final speed of the trolley? How much has the trolley moved from the time the child begins to run?

Q20. (a) Derive the expression for the escape velocity.

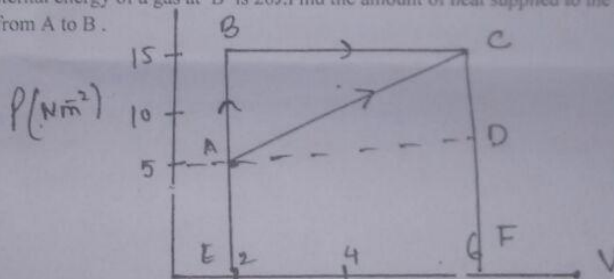
(b) Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the centre of the earth if it weighed 250N on the surface?

Q21. In the given fig, an ideal gas changes its state from state A to C by two paths ABC and AC.

a) Find the path along which the work done is least.

b) The internal energy of a gas at A is 10J and amount of heat supplied to change its state to C through the path AC is 200J. Calculate the internal energy at C.

c) The internal energy of a gas at B is 20J. Find the amount of heat supplied to the gas to go from A to B.



Q22. Sushil and his parents went to Nainital lake. One day they were enjoying boat ride on Nainital lake. Sushil observed that the boatman while rowing the boat, was pushing his oars opposite to the direction of the motion of the boat. He could not understand why the boatman was pushing the oars in opposite direction. Later on Sushil asked about his observation to his father. His father explained him the correct reason.

Answer the following questions :

- why the boatman was pushing the oars in opposite direction. Can you state the law and give two more examples related to it?
- What quality was exhibited by Sushil and what by his father?

- Q23. Define C_p and C_v . Why is $C_p > C_v$. For an ideal gas prove $C_p - C_v = R$.
- Q24. Define elastic collision and discuss it for two bodies in one dimension. Calculate the velocities of bodies after collision. Discuss special cases also.
- Q25. a) Deduce an expression for the angle of banking.
b) A 1000kg car rounds a curve on a flat road of radius 50m at a speed of 50km/hr. Will the car make the turn or will it skid if $\mu = 0.60$? Justify.
- Q26. a) Give analytical treatment to find the magnitude and direction of a resultant vector using triangle law of vector addition. State the law.
c) Show that a given gun will shoot three times as high when elevated at an angle of 60° as when fired at an angle of 30° but will carry the same distance on a horizontal plane.