



- Q1. C. Answer all of the following in brief : (2x4)
- A body moving over circular track of radius 2m with a tangential acceleration of  $2 \text{ m/s}^2$ . If the instantaneous speed is  $2 \text{ ms}^{-1}$ , then find the absolute acceleration and also its direction.
  - Curved roads are generally banked. Why?
  - A particle of mass 'm' moves with constant velocity v
    - along the x-axis
    - parallel to x-axis at a distance 'a' what is its angular momentum with respect to origin.
  - Why there is no atmosphere on moon? Explain.

PART II (Answer all the questions)

- Q2. The measured mass and volume of a body are  $2.42 \text{ g}$  and  $4.8 \text{ cm}^3$  respectively with possible errors  $0.01 \text{ g}$  and  $0.1 \text{ cm}^3$ . What is the maximum error in density of the object. (2)
- Q3. If we select unit of acceleration as  $980 \text{ cm/s}^2$  and unit of velocity as  $3 \times 10^{10} \text{ cm/s}$ . What will be the unit of time? (2)

OR

if length (L), mass (M) and force (F) are taken as fundamental unit then what is the dimension of time.

- Q4. Find a vector whose magnitude is 3 and which is perpendicular to each of the vectors (2)
- $$\vec{a} = 3\vec{i} + \vec{j} - 4\vec{k} \quad \text{and} \quad \vec{b} = 6\vec{i} + 5\vec{j} - 2\vec{k}$$
- Q5. A particle starts its motion with acceleration  $a = 2s$  where  $s$  is its displacement measured from fixed origin. Find its velocity when displacement is 4m. (2)
- Q6. From the top of 25m high tower a particle is thrown with a velocity  $5 \text{ ms}^{-1}$  at an angle  $30^\circ$  below horizontal. Find the time after which it hits the ground. (2)
- Q7. In weight lifting, the weight-lifter try to lift the weight as rapidly as possible, why? (2)
- Q8. Define elastic & inelastic collision with suitable examples. (2)
- Q9. Assuming that velocity 'v' of waves in a stretched string is given by  $v = K F^\alpha q^\beta r^\gamma$  where K = constant F = tension, q = mass per unit volume and r is the radius. Find  $\alpha$ ,  $\beta$  &  $\gamma$  using dimension. (2)
- Q10. Why a cyclist bends towards the centre of circular track while moving over this track. Also find the angle with which he bends. (3)
- Q11. What do you mean by gravitational potential? Derive the expression for grav. potential due to point mass. (3)

OR

Define escape velocity. Derive the expression for escape velocity.

- Q12. Explain for a rough surface. Why pulling is easier than pushing? (3)
- Q13. A circular disc in sliding down an inclined plane achieves a velocity 'v' at the bottom of the plane. If the same disc rolls down the same plane, what will be the speed achieved by it?

Q14. What do you mean by parking satellite? Find the expression for its height above the earth surface. (3)

Q15. Eight rain drops each of radius 1 mm, falling downward with a terminal velocity of  $0.05 \text{ ms}^{-1}$ . Stick to form a big drop. Find the terminal velocity of this big drop. (3)

OR

An air bubble of radius 5 mm rises through a vat of syrup at a steady speed of  $2 \text{ mm s}^{-1}$ . If the syrup has density of  $1.5 \times 10^3 \text{ kg/m}^3$ . What is its viscosity. Neglect density of air compared to density of syrup.

Q16. What is centripetal force? Derive an expression for centripetal force. (5)

OR

Explain the variation of 'g' due to rotation of earth. For what value of angular velocity of rotation of earth compared to the present the objects at equator tends to fly off.

Q17. What is moment of inertia of a point particle about an axis. Establish the expression for M.I. of a circular disc about its diameter. (5)

OR

Define centre of mass. Derive the position of C.M. of a semicircular ring of radius 'r' with respect to its centre. Two particles A & B initially at rest, move towards each other under a mutual force of attraction. At the instant when the speed of A is v and the speed of B is 2v. What is the speed of centre of mass of the system?

Q18. Find the maximum and minimum velocity for a vehicle moving over banked track. With coefficient of friction between tyre of vehicle and road as  $\mu$ . There should be no skidding of the vehicle. (5)

OR

Explain the stokes law and hence derive the stokes formula for the coefficient of viscosity of a viscous liquid.