



IIT-JAM PHYSICS-PH TEST : MECHANICS

Time: 00:50 Hour

Date : 29-06-2017
M.M. : 30

Instructions:

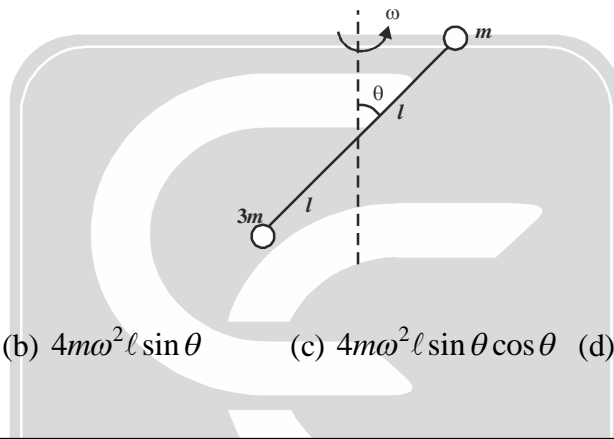
- **Part-A** contains **10** Multiple Choice Questions (MCQ). Each question has 4 choices (a), (b), (c) and (d), for its answer, out of which **ONLY ONE** is correct. For each correct answer you will be awarded **2 marks**. For each incorrect answered **0.5 mark** will be deducted.
- **Part-B** contains **2** Multiple Select Questions (MSQ). Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which **ONE or MORE than ONE** is/are correct. For each correct answer you will be awarded **2 marks**, there is no negative marking in this section.
- **Part-C** contains **3** Numerical Answer Type (NAT) questions which contain **2 Marks** for each, and there is no negative marking.

Part - A

1. A particle of mass 10 gm is thrown at 60° with horizontal with initial speed 10 m/s. Angular momentum about point of projection after 1 sec is
(a) $0.5 \text{ kg m}^2/\text{s}$ (b) $1 \text{ kg m}^2/\text{s}$ (c) $0.25 \text{ kg m}^2/\text{s}$ (d) $0.1 \text{ kg m}^2/\text{s}$
2. A particle of mass m makes elastic headon collision with another particle of mass $3m$ initially at rest. What % of kinetic energy is transferred to second particle
(a) 25% (b) 50% (c) 60% (d) 75%
3. Four particle each of mass m are placed at the corners of a square of side 'a'. If one particle is moved from corner to a point 'a' distance above the centre of square then displacement of centre of mass of system of four particles will be
(a) $\frac{a}{4}$ (b) $a\sqrt{\frac{3}{32}}$ (c) $a\sqrt{\frac{3}{8}}$ (d) $\frac{a}{8}$
4. A ball weighing 100 gm, released from a height of 5 m, bounces perfectly elastically off a plate. The collision time between the ball and the plate is 0.5 s. The average force on the plate is approximately
(a) 3 N (b) 2 N (c) 5 N (d) 4 N
5. A particle is undergoing small oscillation in a potential $V(x) = \frac{1}{2}kx^{2n}$. Time period of oscillation τ satisfies
(a) $\tau \propto k^{1/n}$ (b) $\tau \propto k^{1/2n} E^{\frac{1-n}{2n}}$ (c) $\tau \propto k^{1/2n} E^{\frac{n-2}{2n}}$ (d) $\tau \propto k^{\frac{1}{n}} E^{\frac{1+n}{2n}}$
6. A non-relativistic particle is moving in a potential $V(x) = -\frac{1}{2}kx^2$. The momentum versus x graph for the particle will be
(a) parabola (b) hyperbola (c) circle (d) ellipse



7. Two particles of masses m and $2m$ are connected by a light spring of force constant k . The angular frequency of small oscillation is
- (a) $\sqrt{\frac{k}{m}}$ (b) $\sqrt{\frac{3k}{2m}}$ (c) $\sqrt{\frac{2k}{3m}}$ (d) $\sqrt{\frac{k}{4m}}$
8. Polar coordinates of a particle moving on a plane are $r = t^2 - t$, $\theta = 2t$. The radial and transverse acceleration of particle are equal at time
- (a) $t = 1$ (b) $t = \sqrt{5} - 1$ (c) $t = \sqrt{7} - 1$ (d) $t = \sqrt{3} - 1$
9. A particle of mass 1 kg is thrown from ground with speed 10 m/s at 30° with horizontal. Impulse on the particle during the time $t = 0$, $t = 0.5$ sec is
- (a) 2 kg m/s (b) 4 kg m/s (c) 2.5 kg m/s (d) 5 kg m/s
10. Two particles are connected by light rod and rotated with uniform angular velocity ω as shown in figure. The torque applied on system is



- (a) 0 (b) $4m\omega^2 l \sin \theta$ (c) $4m\omega^2 l \sin \theta \cos \theta$ (d) $2m\omega^2 l \sin \theta \cos \theta$

Part - B

11. A particle of mass m is thrown from earth (mass M , radius R) with speed $\sqrt{\frac{GM}{2R}}$ in radially outward direction. Which of the following statements is/are correct
- (a) Acceleration of the particle at highest point is $\frac{9GM}{16R^2}$
- (b) Time taken by particle in returning to earth is proportional to $R^{3/2}$
- (c) Impulse on particle during the time it returns to earth is $m\sqrt{\frac{2GM}{R}}$
- (d) Maximum height attained above earth surface is $R/3$
12. Two particles of masses m and $2m$ move in concentric circles under their mutual attraction of gravitation. If separation between the particle is r then
- (a) Ratio of kinetic energy of m to $2m$ is 2
- (b) Ratio of angular momentum of m to $2m$ is 2
- (c) Ratio of radius of circle of m to $2m$ is 2
- (d) Centre of mass of system also moves in circle

Part - C

13. A particle of mass 1 kg is dropped from a height of 5 meter on a horizontal surface. If coefficient of restitution is 0.5 then impulse on floor due to first collision is _____ kg m/s.
14. A particle of mass m is placed on a smooth sphere of radius R . When displaced slightly it slides on sphere and then loses contact. If angular momentum of particle is $km\sqrt{gR}$ about centre of sphere, at the moment it leaves the sphere then value of k is _____
15. A bead of mass m slides on a wire $y = bx^2$ with constant speed $\sqrt{\frac{2g}{b}}$. If y is vertical and x is horizontal then normal reaction on particle at $x = 0, y = 0$, is Nmg , value of N is _____





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Part - A

1. (c) 2. (d) 3. (b) 4. (d) 5. (b) 6. (b) 7. (b)
8. (c) 9. (d) 10. (c)

Part - B

11. (a),(b), (c),(d) 12. (a), (b), (c)

Part - C

13. (15) 14. (0.81 to 0.83) 15. (5)

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