EXAM 2-031

Q1 Two balls, with masses m and 2m, are dropped to the ground from the roof of a building. (Assume no air resistance.) Just before hitting the ground, the heavier ball has:

A1: two times as much kinetic energy as the lighter one.
A2: as much kinetic energy as the lighter one.
A3: half as much kinetic energy as the lighter one.
A4: four times as much kinetic energy as the lighter one.
A5: a kinetic energy that is impossible to determine.

Q2 An object is pushed by a variable force, plotted in Fig 1, as a function of position, x. How much work has the force done on the object when it has moved from x=0 to x=+6 m?

A1: 2 J
A2: 10 J
A3: -6 J
A4: 0 J
A5: 12 J

Q3 A helicopter lifts a 72 kg man 15 m vertically by means of a cable. The acceleration of the man is 1.20 m/s**2. How much work is done on the man by the tension of the cable?

A1: 12 kJ
A2: 10 kJ
A3: 0 kJ
A4: 14 kJ
A5: 16 kJ

Q4 A force acting on a particle is conservative if:

A1: its work is zero when the particle moves around any closed path.
A2: its work depends on the path between the end points of the motion.
A3: its work equals the change in linear momentum of the particle.
A4 it must be perpendicular to the velocity of the particle on which it acts.
A5 it is a frictional force.

Q5 A simple pendulum consists of a 2.0 kg mass attached to a string of length R=1.5 m. It is pulled up until the string is horizontal, and then released from rest (see Fig 3). Its speed (v) at the lowest point is:

A1: 5.4 m/s
A2: 4.1 m/s
A3: 9.8 m/s
A4: 8.5 m/s
A5: 2.0 m/s

Q6 A block of mass m=3.0 kg is kept at rest after it has compressed a horizontal mass less spring (k=500 N/m) by 0.15 m, as shown in Fig. 2. When the block is released, it travels a distance S on a horizontal rough surface (mu=0.4) before stopping.
Calculate the distance S.

A1: 0.48 m
A2: 2.1 m
A3: 3.2 m
A4: 1.9 m
A5: 0.15 m

Q7 Three particles are placed in the xy plane. A 40-g particle is located at (4,3) m, and a 50-g particle is located at (-2,-2) m. Where must a 20-g particle be placed so that the center of mass of the three-particle system is at the origin (0,0)?

A1: (-3, -1)   m
A2: (+3, -1)   m
A3: (+1, +3)   m
A4: (+1, -3)   m
A5: (-1, -1.5) m

Q8 A 2000-kg truck traveling at a speed of 6.0 m/s makes a 90 deg. turn in a time of 4.0 s and emerges from this turn with a speed of 4.0 m/s. What is the magnitude of the average resultant force on the truck during this turn?

A1: 3.6 kN
A2: 4.0 kN
A3: 5.0 kN
A4: 6.4 kN
A5: 1.0 kN

Q9 An 8.0 kg object moving at 4.0 m/s in the positive x direction makes a one-dimensional collision with a 2.0 kg object moving at 3.0 m/s in the opposite direction. The final velocity of the 8.0 kg object is 2.0 m/s in the positive x direction. What is the total kinetic energy of the two objects after the collision?

A1: 41 J
A2: 32 J
A3: 52 J
A4: 25 J
A5: 29 J

Q10 A 4.0 kg mass has a velocity of (4.0 i) m/s, when it explodes into two 2.0 kg masses. After the explosion, one of the masses has a velocity of 3.0 m/s making an angle of 60 degrees with the +x axis. What is the magnitude of the velocity of the other mass after the explosion?

A1: 7.0 m/s
A2: 7.9 m/s
A3: 8.9 m/s
A4: 6.1 m/s
A5: 6.7 m/s

Q11 A 3.0 kg steel ball strikes a wall with a speed of 10 m/s at an angle of 60 degrees with the surface. It bounces off with the same speed and angle (see Fig. 4). If the ball is in contact with the wall for 0.20 s, what is the average force exerted on the ball by the wall?

A1: (-260 i) N
A2: (-780 i) N
A3: (150 i) N
A4: (780 i) N
A5: zero

Q12 A 3.0 kg object with an initial velocity of (5 i) m/s collides with and sticks to a 2.0 kg object moving with an initial velocity of (-3 j) m/s. Find the final velocity of the composite body.

A1: (3.0 i - 1.2 j) m/s
A2: (15 i - 6.0 j) m/s
A3: (-3.0 i + 1.2 j) m/s
A4: (-15 i + 6.0 j) m/s
A5: (1.2 i - 3.0 j) m/s

Q13 Which of the following statements is TRUE for a collision of an isolated system of two particles:

A1: In any kind of collision linear momentum is conserved.
A2: In an elastic collision linear momentum is conserved
A2: but kinetic energy is not conserved.
A3: In a completely inelastic collision both linear momentum and
A3: kinetic energy is conserved.
A4: Momentum is not conserved in a completely inelastic collision.
A5: Kinetic energy is conserved in an inelastic collision.

Q14 A uniform disk of radius 50 cm and mass 4 kg is mounted on a frictionless axle, as shown in Fig 5. A light cord is wrapped around the rim of the disk and a steady downward pull of 10 N is exerted on the cord. Find the tangential acceleration of a point on the rim of the disk.

A1: 5.0 m/s**2
A2: 4.0 m/s**2
A3: 3.0 m/s**2
A4: 2.0 m/s**2
A5: 1.0 m/s**2

Q15 At t=0, the motor of a turntable (radius = 10 cm) rotating at 33.33 rev/ min is turned off. It slows down uniformly and stops at t=2 min. What is the magnitude of the angular acceleration of the turntable?

A1: 0.029 rad/s**2
A2: 0.123 rad/s**2
A3: 0 rad/s**2
A4: 0.107 rad/s**2
A5: 0.003 rad/s**2

Q16 The angular position of a point on the rim of a rotating wheel is given by THETA = 4.0t -3.0t**2 + t**3, where THETA is in radians and t is in seconds. What is the average angular acceleration for the time interval that begins at t = 0 s and ends at t = 1.0 s?

A1: -3.0 rad/s**2
A2: +3.0 rad/s**2
A3: +2.5 rad/s**2
A4: -2.5 rad/s**2
A5: +1.4 rad/s**2

Q17 The four particles in Fig. 6 are connected by rigid rods of negligible mass. Find the rotational inertia of the four particles about the y-axis.

A1: 18 kg.m**2
A2: 20 kg.m**2
A3: 38 kg.m**2
A4: 12 kg.m**2
A5: 45 kg.m**2

Q18 A star of radius R is spinning with an angular velocity w. If it shrinks till its radius becomes R/2, find the ratio of the final angular momentum to its initial angular momentum.

A1: 1
A2: 2
A3: 4
A4: 1/2
A5: 1/4

Q19 Mohammed (M) and Salim (S) (have the same mass) are riding on a merry-go-round rotating at a constant rate. Salem is half way in from the edge, as shown in Fig 7. The angular momenta of Salem and Mohammed about the axis of rotation are Ls and Lm respectively. Which of the following relations is correct?

A1: Lm = 4 Ls
A2: Lm = Ls
A3: Lm = Ls/4
A4: Lm = 2 Ls
A5: Lm = Ls/2

Q20 A particle located at the position vector r=(1.2 i+ 1.2 j) m has a force F=(150 i) N acting on it. The torque (in N.m) of the force about the origin is:

A1: -180 k
A2: 180 k
A3: 180 i
A4: 180 (i+j)
A5: -180 j

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FIGURE-1

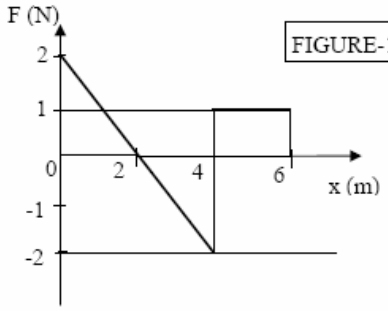


FIGURE-2

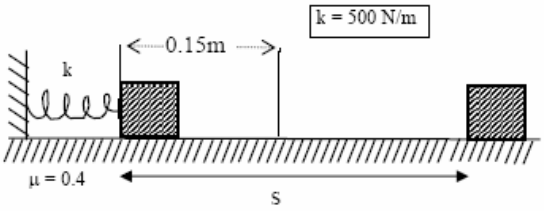


FIGURE-3

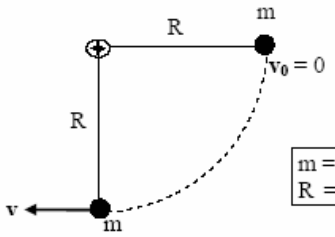


FIGURE-4

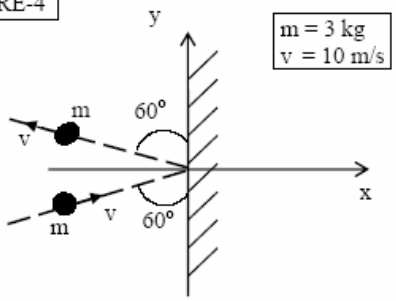


FIGURE-5

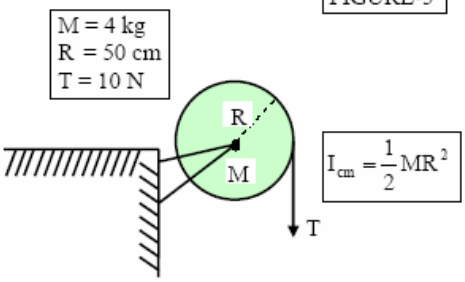


FIGURE-6

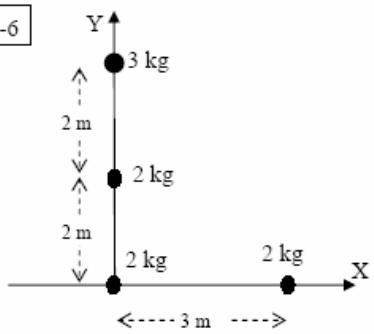
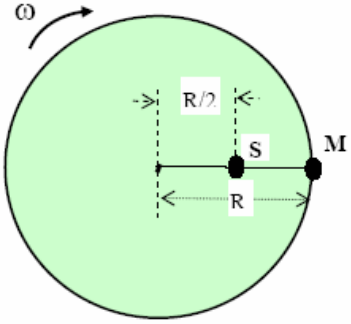


FIGURE-7



M and **S** have the same mass