

1. A particle moves in the xy plane with constant acceleration given by $a = (4\mathbf{i} + 3\mathbf{j}) \text{ m/s}^2$. at time $t = 0$, the particle is at $x = 4$, $y = -3 \text{ m}$ and has velocity $v = (2\mathbf{i} - 9\mathbf{j}) \text{ m/s}$.
a. $14\mathbf{i} - 7\mathbf{k}$ B $16\mathbf{i} - 9\mathbf{k}$ c. $16\mathbf{i} + 9\mathbf{j}$ d. $7\mathbf{i} = 14\mathbf{j}$
2. A projectile is fired with an initial velocity of 30 m/s at 60° above the horizontal. At the highest points its velocity (in m/s) and acceleration (in m/s^2) are:
a. zero b. 26 , zero c. 15 , 10 downward d. zero, zero
3. Vector A has magnitude of 8 m at an angle of 37° with the X axis, $B = (3\mathbf{i} - 5\mathbf{j}) \text{ m}$, and $C = (6\mathbf{i} + 6\mathbf{j}) \text{ m}$ find the vector F such that $F = A - 2B + 3C$.
a. $-1.3\mathbf{i} + 2.9\mathbf{j}$ b. $-17\mathbf{i} + 32.8\mathbf{j}$ c. $-19.20 + 34.4\mathbf{j}$ d. $-5.6\mathbf{i} + 3.2\mathbf{j}$
4. If $A = 2\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ what is the angle (in degrees) between A and the X-axis.
a. 70.55 b. 63.4 c. 60 d. 26.6
5. A 40 kg object supported by a vertical rope (حبل) is initially at rest. Then it starts accelerating upward and reaches a velocity of 3.5 m/s in 0.7 sec . the tension in the rope during acceleration (in N) is:
a. 600 b. 200 c. 400 d. zero
6. A box weighing N is pushed along a horizontal floor at constant velocity with a horizontal force of 250 N . The coefficient of kinetic friction between the box and the floor is:
a. 0.0417 b. 0.5 c. 0.417 d. 0.05

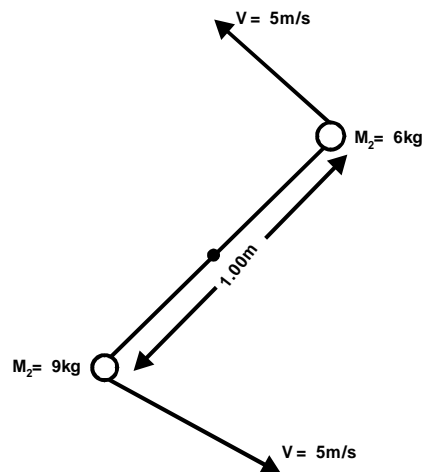
7. A horizontal force of magnitude 100 N pushes a 12 kg box up a frictionless incline that makes an angle of 25 with the horizontal. The normal force that the incline exerts on the block (in N) is:
- a. 151 b. 107 c. 65 d. 16
8. A force $F = (2\mathbf{i} - \mathbf{j} + \mathbf{j})$ N acts on a 2kg objects which undergoes a displacement of $(3\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})$ m along a straight line. The work (in J) done by F for this displacement is:
- a. 11 b. 5 c. 1 d. 7
9. The position of a 3.0kg object in one dimension is given by $x(t) = (5t + 5t^2)$ m. by finding the force and velocity =, what is the instantaneous power of the force on the object (in watt) at $t = 2$ sec.
- a. 250 b. zero c. 2100 d. 750
10. when two objects collide (without external force), which of the following is true.
- a. The force on each object is zero
- b. The momentum of each object stays the same.
- c. the direction of each momentum changes.
- d. none of the above.
11. A proton of mass m and velocity of 300m/s collides classically in one dimension with a stationary carbon nucleus of mass $12m$. The velocity of the center of mass of the system in m/s is:
- a. 23. 1 b. 25 c. 277 d. cannot be determined

12. A 0.3 kg object is dropped from a height of 5m. It hits the ground and stops. The magnitude of the impulse (in Ns) exerted by the ground on the brick is:
- a. 47 b. 3.0 c. zero d. 15
13. A 3kg bomb slides along a frictionless horizontal plane in the x direction with velocity of 6m/s. It explodes into two pieces with masses of 1kg and 2kg. The 1 kg mass moves in the y direction with a speed of 4m/s. The velocity of the 2kg mass in m/s is:
- a. $6i$ b. $18i - 4k$ c. $9i - 2j$ d. $-9i + 2j$
14. A 2.5 kg cylinder of radius 11 cm is initially at rest. A rope of negligible mass is wrapped around it and pulled with a force of 17N. The torque (in Nm) on the cylinder is:
- a. 154.5 b. 187 c. 1.87 d. cannot be determined
15. A disc of radius 8 cm rotates at a constant rate of 1200 rev. min about its central axis. The radial acceleration of a point on the rim (in m/s^2).
- a. 1.26 b. 5000 c. 0.81 d. 1272
16. A car accelerates uniformly from rest to a speed of 22m/s in 9 sec. If the diameter of the tire is 58 cm. The final rotational speed of the tire in rev/sec is:
- a. 4.21 b. 37.9 c. 6.03 d. 12.08
17. An object of mass M is rotating about a fixed axis with angular momentum L. If its moment of inertia about the axis is I then its kinetic energy is:
- a. $IL^2/2$ b. $L^2 / (2I)$ c. $ML^2/2$ d. $IL^2/(2M)$

Questions 18 and 19 are related to figure 1.

A mass less rod 1.00 m in length joins two particles ($m_1 = 4\text{kg}$ and $m_2 = 6\text{kg}$) as shown.

The system rotates around an axis through the middle perpendicular to the line joining the two particles. The linear speed of each particle is 5m/s.



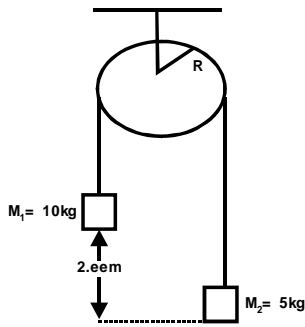
18. What is the moment of inertia (in kg m^2) of the system about the axis of rotation?

- a. 10 b. 5 c. 2.5 d. 6

19. What is the angular momentum of the system (in $\text{kg m}^2/\text{s}$):

- a. 100 b. 250 c. 125 d. 25

Questions 20 and 21 are related to figure 2. the string connecting m_1 and m_2 is massless and the pulley rotates without friction. The system starts moving from rest with an initial separation of $2m$ (at $t = 0$) of the masses, as shown?



Note : Acceleration due to gravity, $g = 9.8\text{m/s}^2$.

1. The position of a particle moving along the x axis is given by $x = (21 + 221t - 6.0t^2)\text{m}$, where t is in s. what is the average velocity during the time interval $t = 1.0\text{s}$ to $t = 3.0$?
 - a. -6.0 m/s
 - b. 4.0m/s
 - c. -2.0 m/s
 - d. 48.0 m/s

2. At $t = 0$, a particle is located at $x = 25$, and has a velocity of 15m/s in the positive x direction. The acceleration of the particle varies with time as shown in the diagram. What is the position of the particle at $t = 5.0\text{ s}$?
 - a. 175m
 - b. 125m
 - c. 138 m
 - d. 48.0 m/s
 - e. 165m

3. Vectors A and B are shown. What is the magnitude of a vector C if $C = A - B$?
 - a. 46
 - b. 10
 - c. 30
 - d. 78
 - e. 90

4. A race car moving with a constant speed of 60m/s a complete one lap around a circular track in 50s . what is the magnitude of the acceleration of the race care?
 - a. 46
 - b. 10
 - c. 30
 - d. 78
 - e. 90

- a. 8.8m/s^2 b. 7.5m/s^2 c. 9.4m/s^2 d. 6.3m/s^2 e. 5.3m/s^2

5. If $M = 2.0$ kg what is the tension in string 1 shown?

- a. 1.2 N.
 b. 11 N
 c. 34 N.
 d. 3.5 N.
 e. 40N.

6. A 1.5 kg mass has an acceleration of $(4.0\text{ i} - 3.0\text{ k})\text{ m/s}^2$. only two forces act on the mass. If one of the forces is $(2.0\text{ i} - 1.4\text{ j})\text{ N}$, what is the magnitude of the other force?

- a. 4.1N b. 6.1 N c. 5.1 N d. 7.1 N e. 2.4 N

7. In the figure, the coefficient of kinetic friction between the surface and the larger block is 0.20, and the coefficient of kinetic friction between the surface and the smaller block is 0.30. if $F = 10$ N and $M = 1.0$ kg, what is the tension in the connecting string?

- a. 8.0 N b. 6.0 N c. 6.7 N d. 8.7 N e. 3.0 N

8. A single conservative force $F_x = (6.0x - 12)\text{ N}$ (x is in m) acts on a particle moving along the x axis. The potential energy associated with this force is assigned a value of $+20$ J at $x = 0$.

What is the potential energy at $x = 3.0$ m?

- a. $+11\text{ J}$ b. $+29\text{ J}$ c. $+9.0\text{ J}$ d. -9.0 e. $+20\text{ J}$

9. A 6.0 kg object moving 2.0 m/s in the positive x direction has a one dimensional elastic collision with a 4.0kg object moving 3.0 m/s in

the opposite direction. What is the total kinetic energy of the two-mass system after the collision?

- a. 30J b. 62J c. 20J d. 44J e. 24J

10. A 20-kg mass is fastened to a light spring ($k = 380 \text{ N/m}$) what passes over a pulley as shown. The pulley is frictionless, and the mass is released from rest when the spring is unscratched. After the mass has dropped 0.40m, what is its speed ?

- a. 2.2m/s b. 2.5m/s c. 1.9m/s d. 1.5m/s e. 3.6m/s

11. Three particles are placed in the xy plane. A 40g particle is located at (3, 4) m, and a 50g- particle is positioned at (-2, 06)m. where must be 20-g particle be placed so that the center of mass of this three- particle system is located at the origin.

- a. (-1, 03)m b. (-1, 3)m c. (-1, 12)m d. (-1, 7) e. (-1, 3)m

12. At the instant a 2.0-kg particle has a velocity of 4.0 m/s in the positive x direction, a 3.0-kg particle has a velocity of 5.0m/s in the positive y direction. What is the speed of the center of mass of the two – particle system?

- a. 3.8m/s` b. 3.4m/s c. 5.0/s d. 4.4m/s e. 4.6m/s

13. At $t = 0$, a wheel rotating about a fixed axis a constant angular acceleration has an angular velocity of 2.0 rad/s. two seconds later it has turned through 5.0 complete revolutions, What is the angular acceleration of this wheel?

- a. 17 rad/s^2 b. $14 \text{ rad} / \text{s}^2$ c. 20 rad/s^2 d. 23 rad/s^2 e. 13 rad/s^2

14. The figure below shows a graph of angular velocity as a function of time for a car driving around a circular track. Through how many radians does the car travel in the first 10 minutes?

- a. 30' b. 50 c. 70' d. 90 e. 100

