

Physics C: Mechanics Sample Multiple-Choice Questions

Most of the following sample questions have appeared in past exams. The answers are on page 66. Additional questions can be found in the 2009 *AP Physics B and Physics C Released Exams* book.

Note: Units associated with numerical quantities are abbreviated, using the abbreviations listed in the table of information included with the exams (see insert in this book). To simplify calculations, you may use $g = 10 \text{ m/s}^2$ in all problems.

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

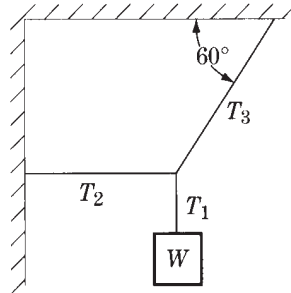
Questions 1–2

The speed v of an automobile moving on a straight road is given in meters per second as a function of time t in seconds by the following equation:

$$v = 4 + 2t^3$$

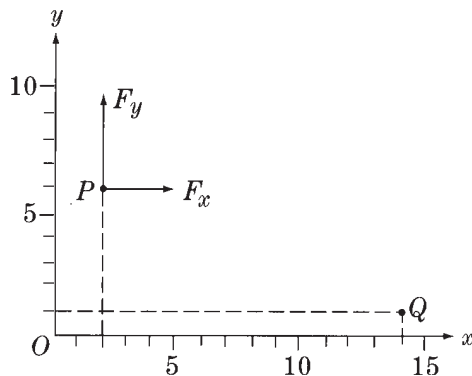
1. What is the acceleration of the automobile at $t = 2 \text{ s}$?
 - (A) 12 m/s^2
 - (B) 16 m/s^2
 - (C) 20 m/s^2
 - (D) 24 m/s^2
 - (E) 28 m/s^2
2. How far has the automobile traveled in the interval between $t = 0$ and $t = 2 \text{ s}$?
 - (A) 16 m
 - (B) 20 m
 - (C) 24 m
 - (D) 32 m
 - (E) 72 m

3. If a particle moves in a plane so that its position is described by the functions $x = A \cos \omega t$ and $y = A \sin \omega t$, the particle is
- (A) moving with constant speed along a circle
 - (B) moving with varying speed along a circle
 - (C) moving with constant acceleration along a straight line
 - (D) moving along a parabola
 - (E) oscillating back and forth along a straight line



4. A system in equilibrium consists of an object of weight W that hangs from three ropes, as shown above. The tensions in the ropes are T_1 , T_2 , and T_3 . Which of the following are correct values of T_2 and T_3 ?

- | $\frac{T_2}{T_3}$ | $\frac{T_3}{T_2}$ |
|-------------------------------|---------------------------|
| (A) $W \tan 60^\circ$ | $\frac{W}{\cos 60^\circ}$ |
| (B) $W \tan 60^\circ$ | $\frac{W}{\sin 60^\circ}$ |
| (C) $W \tan 60^\circ$ | $W \sin 60^\circ$ |
| (D) $\frac{W}{\tan 60^\circ}$ | $\frac{W}{\cos 60^\circ}$ |
| (E) $\frac{W}{\tan 60^\circ}$ | $\frac{W}{\sin 60^\circ}$ |

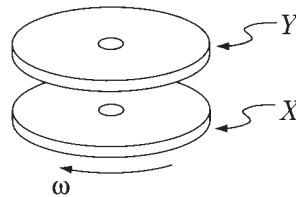


5. The constant force \mathbf{F} with components $F_x = 3 \text{ N}$ and $F_y = 4 \text{ N}$, shown above, acts on a body while that body moves from the point P ($x = 2 \text{ m}$, $y = 6 \text{ m}$) to the point Q ($x = 14 \text{ m}$, $y = 1 \text{ m}$). How much work does the force do on the body during this process?
- (A) 16 J
 (B) 30 J
 (C) 46 J
 (D) 56 J
 (E) 65 J
6. The sum of all the external forces on a system of particles is zero. Which of the following must be true of the system?
- (A) The total mechanical energy is constant.
 (B) The total potential energy is constant.
 (C) The total kinetic energy is constant.
 (D) The total linear momentum is constant.
 (E) It is in static equilibrium.

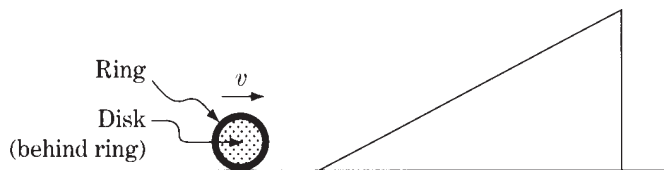


7. A toy cannon is fixed to a small cart and both move to the right with speed v along a straight track, as shown above. The cannon points in the direction of motion. When the cannon fires a projectile the cart and cannon are brought to rest. If M is the mass of the cart and cannon combined without the projectile, and m is the mass of the projectile, what is the speed of the projectile relative to the ground immediately after it is fired?

- (A) $\frac{Mv}{m}$
 (B) $\frac{(M + m)v}{m}$
 (C) $\frac{(M - m)v}{m}$
 (D) $\frac{mv}{M}$
 (E) $\frac{mv}{(M - m)}$



8. A disk X rotates freely with angular velocity ω on frictionless bearings, as shown above. A second identical disk Y , initially not rotating, is placed on X so that both disks rotate together without slipping. When the disks are rotating together, which of the following is half what it was before?
- (A) Moment of inertia of X
 (B) Moment of inertia of Y
 (C) Angular velocity of X
 (D) Angular velocity of Y
 (E) Angular momentum of both disks



9. The ring and the disk shown above have identical masses, radii, and velocities, and are not attached to each other. If the ring and the disk each roll without slipping up an inclined plane, how will the distances that they move up the plane before coming to rest compare?
- (A) The ring will move farther than will the disk.
 (B) The disk will move farther than will the ring.
 (C) The ring and the disk will move equal distances.
 (D) The relative distances depend on the angle of elevation of the plane.
 (E) The relative distances depend on the length of the plane.
10. Let g be the acceleration due to gravity at the surface of a planet of radius R . Which of the following is a dimensionally correct formula for the minimum kinetic energy K that a projectile of mass m must have at the planet's surface if the projectile is to escape from the planet's gravitational field?
- (A) $K = \sqrt{gR}$
 (B) $K = mgR$
 (C) $K = \frac{mg}{R}$
 (D) $K = m\sqrt{\frac{g}{R}}$
 (E) $K = gR$

Answers to Physics C: Mechanics Multiple-Choice Questions

1 - D	3 - A	5 - A	7 - B	9 - A
2 - A	4 - E	6 - D	8 - C	10 - B