Physics of Motion, Forces and Energy

Choose one answer per question. Circle A, B, C, or D.

1. Which description gives both the speed and the direction of a moving cart?
   A. 4 meters per second east
   B. 4 meters per second
   C. 4 meters from the wall
   D. 4 seconds after the start

2. Two people pull a crate horizontally with equal forces of 6 newtons in opposite directions. No other horizontal force acts. What is the net horizontal force?
   A. 12 newtons
   B. 6 newtons
   C. 0 newtons
   D. 36 newtons

3. A rolling marble has which form of energy because its center is moving?
   A. Gravitational potential energy
   B. Kinetic energy
   C. Chemical potential energy
   D. Elastic potential energy

4. The same book rests first on a low shelf and then on a higher shelf. Which energy is larger on the higher shelf?
   A. Chemical potential energy
   B. Kinetic energy
   C. Elastic potential energy
   D. Gravitational potential energy

5. A sled is already sliding east along level ground. In which direction does sliding friction from the ground act on the sled?
   A. East
   B. West
   C. Straight upward
   D. Straight downward

6. A toy train travels a total distance of 24 meters in 6 seconds. What is its average speed?

A. 4 meters per second
B. 6 meters per second
C. 18 meters per second
D. 144 meters per second

7. A cart’s eastward velocity increases from 2 to 8 meters per second in 3 seconds. What is its average acceleration?

A. 3 meters per second squared east
B. 2 meters per second squared west
C. 6 meters per second squared east
D. 2 meters per second squared east

8. A net force of 20 newtons acts on a 4-kilogram cart. What is the magnitude of its acceleration?

A. 16 meters per second squared
B. 4 meters per second squared
C. 5 meters per second squared
D. 80 meters per second squared

9. A cart is moving north at 3 meters per second on a level track. The net force becomes zero and stays zero. What happens next?

A. It keeps moving north at 3 meters per second.
B. It immediately stops.
C. It keeps moving north and steadily speeds up.
D. It slowly turns south without changing speed.

10. A runner’s shoe pushes backward on the track. What is the paired horizontal force under Newton’s third law?

A. The track pushes straight up on the shoe.
B. The track pushes backward on the shoe.
C. The runner’s other shoe pushes forward on the track.
D. The track pushes forward on the shoe.

11. A toy car circles a round track at constant speed. Which statement describes its acceleration?

A. It accelerates outward because its distance from the center increases.
B. It has zero acceleration because its speed is constant.
C. It accelerates toward the center because its velocity changes direction.
D. It accelerates forward along the track because its speed increases.

12. A 3-kilogram cart is pushed with 14 newtons east while friction exerts 5 newtons west. What is its horizontal acceleration?

A. 3 meters per second squared west
B. 3 meters per second squared east
C. 9 meters per second squared east
D. About 6.3 meters per second squared east

13. The same moving puck increases its speed from 3 to 6 meters per second. By what factor does its kinetic energy change?

A. It stays the same.
B. It becomes twice as large.
C. It becomes six times as large.
D. It becomes four times as large.

14. Two identical carts start from rest at the same height on differently shaped ramps. Both reach the same lower height without friction or air resistance. Treat both carts as sliding objects. How do their final speeds compare?

A. They have the same final speed.
B. The cart on the longer ramp is faster.
C. The cart on the steeper ramp is necessarily faster.
D. Both carts have zero speed at the bottom.

15. A 2-kilogram object starts from rest and falls 5 meters. Use a gravitational acceleration of 10 meters per second squared and ignore air resistance. What is its speed after the drop?

A. 20 meters per second
B. 5 meters per second
C. 10 meters per second
D. 50 meters per second