

Classical Mechanics

Newton's Laws and Energy Quiz

Instructions:

- Answer all questions.
- For Questions 1–5, choose the best option.
- For Questions 6–8, mark True or False.
- For Questions 9–10, write detailed answers showing derivations where appropriate.

1. A 5 kg object accelerates at 2 m/s^2 . What is the net force acting on it?

- (A) 2.5 N
- (B) 7 N
- (C) 10 N
- (D) 25 N

2. An object moving in a circle at constant speed experiences:

- (A) No acceleration
- (B) Tangential acceleration only
- (C) Centripetal acceleration toward the center
- (D) Acceleration away from the center

3. If the velocity of an object is doubled, its kinetic energy:

- (A) Doubles
- (B) Triples
- (C) Quadruples
- (D) Remains the same

4. Which of the following is a statement of Newton's Third Law?

- (A) $F = ma$
- (B) Objects at rest stay at rest unless acted upon
- (C) For every action, there is an equal and opposite reaction
- (D) Energy cannot be created or destroyed

5. A ball is thrown vertically upward. At the highest point, its:
- (A) Velocity and acceleration are both zero
 - (B) Velocity is zero but acceleration is g downward
 - (C) Velocity is maximum and acceleration is zero
 - (D) Velocity and acceleration are both g
6. The work done by a force perpendicular to displacement is zero. (True/False)
7. Momentum is conserved only in elastic collisions. (True/False)
8. An object in free fall near Earth's surface experiences constant velocity. (True/False)
9. Derive the work-energy theorem and explain its physical significance. Show how net work done on an object equals the change in its kinetic energy.
10. Explain the principle of conservation of mechanical energy. Under what conditions is mechanical energy conserved? Discuss with an example of a pendulum or roller coaster.