

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.