Classical Mechanics vs Quantum Mechanics Quiz for UPSC Preparation

Here are some multiple-choice questions (MCQs) comparing and contrasting classical mechanics with quantum mechanics:

1. What is the fundamental difference between classical mechanics and quantum mechanics?

- A) Classical mechanics uses wave functions; quantum mechanics uses particles.
- B) Classical mechanics deals with macroscopic systems; quantum mechanics deals with microscopic systems.
- C) Classical mechanics uses probabilities; quantum mechanics uses deterministic equations.
- D) Classical mechanics incorporates wave-particle duality; quantum mechanics does not.

Answer: B) Classical mechanics deals with macroscopic systems; quantum mechanics deals with microscopic systems.

2. Which principle is central to quantum mechanics but has no counterpart in classical mechanics?

- A) Newton's laws of motion
- B) The principle of superposition
- C) The conservation of energy
- D) The principle of least action

Answer: B) The principle of superposition

3. In classical mechanics, the position and momentum of a particle can be known precisely. What is the analogous concept in quantum mechanics?

- A) The uncertainty principle
- B) The Schrödinger equation
- C) The Hamiltonian operator
- D) The principle of relativity

Answer: A) The uncertainty principle

4. Which of the following is a classical concept but is not directly applicable in quantum mechanics?

- A) Conservation of momentum

- B) Trajectories of particles
- C) Newton's second law of motion
- D) Kinetic energy

Answer: B) Trajectories of particles

5. In quantum mechanics, the energy levels of an electron in an atom are quantized. What does this mean?

- A) Electrons can have any energy value.
- B) Energy levels are continuous.
- C) Electrons can only occupy specific discrete energy levels.
- D) Energy levels are probabilistic.

Answer: C) Electrons can only occupy specific discrete energy levels.

6. Which of the following describes a quantum system's wave function?

- A) It represents the definite position of a particle.
- B) It provides the probability distribution of a particle's position and momentum.
- C) It is analogous to a classical trajectory.
- D) It describes the exact path of a particle.

Answer: B) It provides the probability distribution of a particle's position and momentum.

7. What phenomenon in quantum mechanics shows that particles can exhibit both wave-like and particle-like properties?

- A) Quantum entanglement
- B) Quantum tunnelling
- C) Wave-particle duality
- D) The photoelectric effect

Answer: C) Wave-particle duality

8. Which mathematical tool is commonly used in quantum mechanics but not in classical mechanics?

- A) Differential equations
- B) Matrices and operators
- C) Vectors
- D) Scalars

Answer: B) Matrices and operators

9. What is Heisenberg's uncertainty principle primarily concerned with?

- A) The speed of light in a vacuum
- B) The relationship between energy and mass
- C) The limits of precision in measuring certain pairs of physical properties
- D) The invariance of physical laws under transformations

Answer: C) The limits of precision in measuring certain pairs of physical properties