Quantum Mechanics Fundamentals

Quantum Physics · Answer Key · 25 Questions

1. What is the smallest indivisible unit of energy according to quantum theory?

A) Atom
B) Molecule
C) Quantum
D) Electron

2. Which principle states that a particle's position and momentum cannot be known with perfect accuracy simultaneously?

A) Superposition Principle
B) Uncertainty Principle
C) Exclusion Principle
D) Correspondence Principle

3. What phenomenon describes a particle existing in multiple states at once until measured?

A) Entanglement
B) Quantum Tunneling
C) Superposition
D) Wave-Particle Duality

4. What does wave-particle duality suggest about particles like electrons?

A) They are only waves.
B) They are only particles.
C) They can behave as both waves and particles.
D) They exist only in our imagination.

5. What is it called when two or more particles become linked, sharing the same fate no matter the distance?

A) Quantum Superposition
B) Quantum Entanglement
C) Quantum Tunneling
D) Quantum Leap

6. In quantum mechanics, what happens when you measure a quantum system in superposition?

A) It remains in all states.
B) It collapses into a single definite state.
C) It disappears.
D) It starts vibrating faster.

7. What is a fundamental difference between classical physics and quantum physics regarding energy?

A) Classical physics says energy is continuous, quantum says it's discrete.
B) Quantum physics says energy is continuous, classical says it's discrete.
C) Both agree energy is discrete.
D) Both agree energy is continuous.

8. What is a quantum state often described by?

A) A speed
B) A temperature
C) A wave function
D) A color

9. What does the term 'quantization' mean in physics?

A) Making things bigger
B) Dividing into smaller parts
C) Restricting values to discrete levels
D) Combining things

10. Which subatomic particle is often used to demonstrate wave-particle duality in experiments?

A) Proton
B) Neutron
C) Electron
D) Photon

11. What is the name of the phenomenon where particles can pass through a barrier even if they don't have enough energy classically?

A) Quantum Jumping
B) Quantum Entanglement
C) Quantum Tunneling
D) Quantum Resonance

12. In quantum mechanics, what is the 'spin' of a particle?

A) Its speed of rotation.
B) A fundamental intrinsic property, like charge.
C) Its direction of travel.
D) Its temperature.

13. What is the primary implication of the photoelectric effect for quantum theory?

A) Light is always a wave.
B) Light consists of discrete energy packets called photons.
C) Electrons are not affected by light.
D) Energy is always continuous.

14. What determines the probability of finding a particle in a certain location, according to its wave function?

A) The particle's color
B) The square of the wave function's amplitude
C) The particle's temperature
D) The speed of light

15. Which of these is NOT a fundamental concept in quantum physics?

A) Quantization
B) Determinism
C) Superposition
D) Uncertainty

16. What is the minimum energy a photon can have?

A) Zero
B) One electron-volt
C) It depends on its frequency
D) It's always a fixed value.

17. When two entangled particles are measured, what is observed about their properties?

A) They are always unrelated.
B) They are always correlated, regardless of distance.
C) One changes its state randomly.
D) They become identical.

18. What does the Bohr model of the atom propose about electron orbits?

A) Electrons can orbit at any distance.
B) Electrons can only orbit at specific, quantized energy levels.
C) Electrons are stationary.
D) Electrons move in random paths.

19. What is a key feature of a quantum computer compared to a classical computer?

A) It uses bits that are always 0 or 1.
B) It uses qubits that can be 0, 1, or both simultaneously.
C) It is much slower.
D) It relies on mechanical switches.

20. The concept of a 'quantum leap' in an atom refers to:

A) An electron falling out of orbit.
B) An electron instantly changing energy levels.
C) An atom splitting in half.
D) An atom fusing with another atom.

21. What is the uncertainty principle primarily a consequence of?

A) Measurement limitations
B) The wave nature of particles
C) The electric charge of particles
D) The mass of particles

22. In quantum field theory, what are fundamental particles considered to be?

A) Tiny solid balls
B) Excited states of fields
C) Holes in space
D) Waves of light

23. What is the role of a catalyst in a chemical reaction from a quantum perspective?

A) It destroys the reactants.
B) It provides an alternative reaction pathway with lower activation energy.
C) It adds energy to the system.
D) It slows down the reaction.

24. What does the Pauli Exclusion Principle state?

A) Two electrons in the same atom can have the same set of quantum numbers.
B) Two identical fermions cannot occupy the same quantum state simultaneously.
C) Particles always repel each other.
D) Energy is always conserved.

25. Which of these is a direct technological application of quantum mechanics?

A) Steam engine
B) Lever
C) Laser
D) Magnifying glass