What Is the Difference Between Bohr and Quantum Mechanical Models?

Worksheet

Bohr model assumes electrons orbit like planets in fixed rings with defined energy levels. Quantum mechanics describes electrons as probability clouds (orbitals) where they're most likely to be found, without a fixed path.

Questions

1. Bohr model assumes electrons

A) move in fixed circular orbits
B) exist as probability clouds
C) have no definite energy
D) are located at random

2. Which model successfully predicts spectra for helium (He)?

A) Bohr model
B) quantum mechanical model
C) both equally
D) neither

3. Quantum mechanical orbitals represent

A) the exact path of an electron
B) the probability of finding an electron
C) the speed of an electron
D) the spin of an electron

4. Heisenberg's uncertainty principle implies

A) electrons have definite position
B) electrons are in fuzzy probability clouds
C) orbits are perfectly circular
D) energy is always zero

5. Why does the Bohr model fail for helium (He) with 2 electrons?

6. Bohr predicts a specific radius for hydrogen's first orbit. What quantum mechanics reveals instead.

7. Why can't we know both the position and momentum of an electron exactly?

8. Define: Bohr model: electron position?

9. Define: Quantum model: electron position?

10. Define: Which model works for all atoms?

Answer Key

1. A) move in fixed circular orbits - Bohr's key assumption: discrete orbits with fixed radii and energy levels.

2. B) quantum mechanical model - Bohr fails for multi-electron atoms due to electron-electron interactions.

3. B) the probability of finding an electron - An orbital is a region where there's high probability of finding the electron.

4. B) electrons are in fuzzy probability clouds - We cannot simultaneously know position and momentum precisely.

5. Bohr's model assumes one electron and predicts energy levels based on integer orbits. He has 2 electrons interacting electron-electron repulsion invalidates fixed orbits. Quantum mechanics handles multi-electron atoms via orbitals and probability.

6. Bohr: electron at exactly a = 0.53 (the Bohr radius). Quantum: electron has ~90% probability within ~0.53 but no fixed orbit. Orbital is a diffuse cloud, not a ring.

7. Heisenberg's uncertainty principle: x p /2. Bohr ignores this; quantum mechanics embraces probability. Electrons are waves-position is inherently fuzzy.

8. Fixed, definite orbit around nucleus (e.g., 1st shell = 0.53 from nucleus).

9. Probability cloud (orbital). Most likely region, but no fixed path.

10. Quantum mechanical model handles multi-electron atoms; Bohr works only for hydrogen.