What is Atomic Structure and Subatomic Particles?

Worksheet

An atom contains a nucleus (protons + neutrons) at its center, surrounded by electrons in orbitals. Protons (positive charge) and neutrons (neutral, same mass as protons) make up ~99.99% of atomic mass. Electrons (negative charge, ~1/2000th of proton mass) occupy most of the volume.

Questions

1. What defines the identity of an atom as a specific element?

A) Number of electrons
B) Number of neutrons
C) Number of protons
D) Total mass

2. Which subatomic particle is neutral?

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

3. Nitrogen-14 has 7 protons. How many neutrons?

A) 7
B) 14
C) 21
D) Cannot determine

4. Electrons are ~1/2000th the mass of protons but occupy most of the atom. Why?

A) They reproduce rapidly
B) They orbit at large distances
C) They are less dense
D) They repel protons

5. A carbon atom has 6 protons. What does this tell you?

6. An oxygen atom has 8 protons and 8 neutrons. What is its mass number?

7. An electron cloud occupies most of an atom's volume despite electrons being much lighter than protons. Why?

8. Define: What is the nucleus?

9. Define: Which subatomic particle defines an element?

10. Define: What charge do electrons have?

Answer Key

1. C) Number of protons - Atomic number (Z) = protons. All carbon atoms have 6 protons; all oxygen atoms have 8. Neutrons vary (isotopes).

2. C) Neutron - Neutrons have no charge. Protons are positive; electrons are negative.

3. A) 7 - Mass number A = protons + neutrons. 14 = 7 + neutrons 7 neutrons.

4. B) They orbit at large distances - Electrons stay far from the nucleus (Bohr radius ~0.5); nucleus is tiny (femtometers). Distance creates apparent size.

5. Atomic number (Z) = number of protons = 6 Therefore, this atom is carbon (C) All carbon atoms have 6 protons, defining the element

6. Mass number (A) = protons + neutrons A = 8 + 8 = 16 This is oxygen-16 (O-16 or O)

7. Electrons orbit at large distances from nucleus (Bohr radius ~0.5 ngstroms) Nucleus is tiny (femtometers, 10^-15 m) Electrons fill vast orbital space despite low mass Atom is mostly empty space

8. The tiny, dense center of an atom containing protons and neutrons. ~99.99% of atomic mass.

9. Proton. The number of protons (atomic number Z) uniquely identifies the element.

10. Negative charge (1 each). They orbit the nucleus and occupy most of the atom's volume.