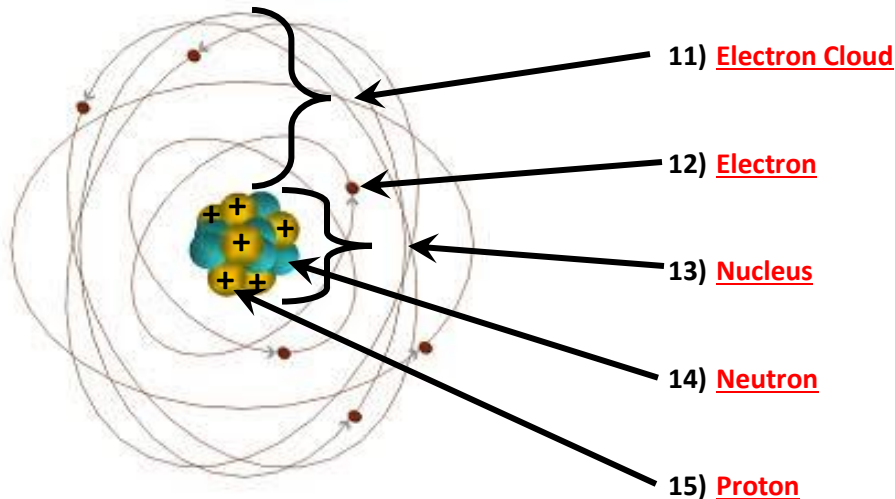


**Atoms Study Guide**

**VOCAB** – Match each term with its definition by drawing a line between them.

- |                   |  |
|-------------------|--|
| 1) Atom           | - a negatively charged (-) particle that occupies the space in an atom outside the nucleus |
| 2) Element        | - a positively charged (+) particle in the nucleus of an atom                              |
| 3) Electron       | - a substance made of only one kind of atom  |
| 4) Nucleus        | - the region at the center of an atom that contains most of the mass of the atom           |
| 5) Proton         | - a small particle that is the building block of matter                                    |
| 6) Atomic Number  | - an uncharged ( $\emptyset$ ) particle in the nucleus of an atom                          |
| 7) Neutron        | - the number of protons in the nucleus of an atom of an element                            |
| 8) Electron Cloud | - atoms of an element with the same number of protons but a different number of neutrons   |
| 9) Isotope        | - an atom that has a charge because it has gained or lost electrons                        |
| 10) Ion           | - the region surrounding an atom's nucleus where electrons are most likely to be found     |

**DIAGRAM** – Use the diagram to identify the parts of the atom based on the modern electron cloud model.



**SUB-ATOMIC PARTICLES** – Identify whether each statement refers to electrons (“e”), protons (“p”), or neutrons (“n”) by writing the corresponding letter on the line.

- 16) e the only sub-atomic particle that is NOT found in the nucleus
- 17) n the only sub-atomic particle that does NOT have a charge
- 18) n the last sub-atomic particle discovered when James Chadwick explained the “extra” mass in atoms
- 19) p has a positive charge
- 20) e first sub-atomic particle discovered when JJ Thomson bent the beam in a cathode ray tube with a magnet
- 21) p discovered by Ernest Rutherford when he realized alpha particles were hydrogen nuclei
- 22) e by far the LEAST massive of the sub-atomic particles
- 23) e has a negative charge
- 24) n has the same mass as a proton
- 25) p determines the type of atom, or the element

**ELEMENTS** – Use the information provided about each element to answer the questions below.

|                                  |                                   |                                     |                                   |                                     |                                   |
|----------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|
| boron<br>5<br><b>B</b><br>10.811 | carbon<br>6<br><b>C</b><br>12.011 | nitrogen<br>7<br><b>N</b><br>14.007 | oxygen<br>8<br><b>O</b><br>15.999 | fluorine<br>9<br><b>F</b><br>18.998 | neon<br>10<br><b>Ne</b><br>20.180 |
|----------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|

- 26) What makes a carbon atom different from a nitrogen atom? **Carbon has 6 protons & nitrogen has 7 protons**
- 27) Which of the elements shown above has the most particles in its nucleus? **Neon has an average of 20 particles in its nucleus**
- 28) How many protons are in the nucleus of a fluorine atom? **9**
- 29) What is boron's atomic mass? **10.811**
- 30) What is the atomic number for oxygen? **8**
- 31) Carbon<sup>12</sup> has 6 neutrons, carbon<sup>13</sup> has 7 neutrons, and carbon<sup>14</sup> has 8 neutrons. What is the term for these atoms? **Isotopes – atoms of the same element with different numbers of neutrons**
- 32) Sometimes a fluorine atom will gain a tenth electron, causing it to have a negative charge. What is the term for this type of atom? **Ion – a charged atom (due to gaining or losing electrons)**

**HISTORY** – Provide a short answer for each question about the history of atomic theory.

- 33) The modern word, "atom", comes from the latin word, "atomos", used by Democritus to describe the smallest individual particle of matter. What does "atomos" mean?  
**"atomos" means "UNCUTTABLE"**
- 34) What sub-atomic particle did JJ Thomson discover when he placed the negative end of a magnet next to a cathode ray tube and observed the beam repel away from the magnet?  
**electron**
- 35) Inspired by the Sun at the center of the solar system, what feature of an atom was first proposed by Hantaro Nagaoka and later confirmed by Ernest Rutherford's alpha-particle cannon & gold foil experiment (when some of the alpha particles bounced back)?  
**nucleus**
- 36) Which sub-atomic particle was discovered by Ernest Rutherford when he realized that alpha particles are the nuclei of hydrogen atoms?  
**proton**
- 37) Which sub-atomic particle was discovered by James Chadwick when he explained the existence of a third sub-atomic particle in the nucleus with the same mass as a proton?  
**neutron**