ChemQuest 8

Structure of the Atom

Name: _____

Date: _____

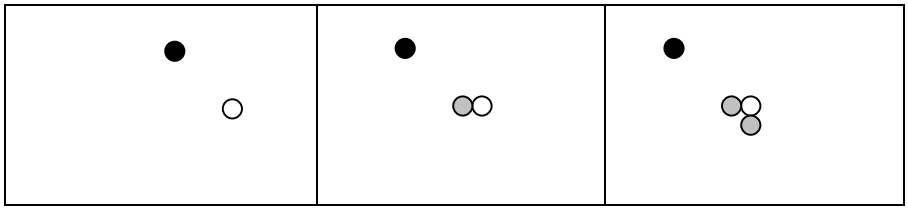
Hour: _____

Information: Structure of the Atom

Note the following symbols: (they are not to scale)

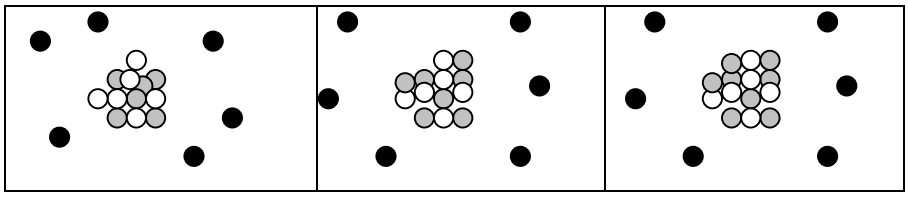
○ = proton (positive charge)
● = electron (negative charge)
◍ = neutron (no charge)

The following three diagrams are hydrogen atoms:



$^{1}_{1}H$ $^{2}_{1}H$ $^{3}_{1}H$

The following three diagrams are carbon atoms:



$^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$

(6 protons, 6 neutrons) (6 protons, 7 neutrons) (6 protons, 8 neutrons)

Notice the type of notation used for atoms: $^{A}_{Z}X$

X = chemical symbol of the element
Z = "atomic number"
A = "mass number"

$^{12}_{6}C$, $^{13}_{6}C$, and $^{14}_{6}C$ are notations that represent **isotopes** of carbon.

$^{1}_{1}H$, $^{2}_{1}H$ and $^{3}_{1}H$ are notations that represent **isotopes** of hydrogen.

The part of the atom where the protons and neutrons are is called the **nucleus**.

Critical Thinking Questions

1. How many protons are found in each of the following: ${}^{1}_{1}H$? in ${}^{2}_{1}H$? in ${}^{3}_{1}H$?

2. How many neutrons are found in each of the following: ${}^{1}_{1}H$? in ${}^{2}_{1}H$? in ${}^{3}_{1}H$?

3. How many electrons are found in each of the following: ${}^{1}_{1}H$? in ${}^{2}_{1}H$? in ${}^{3}_{1}H$?

4. What structural characteristics do all hydrogen atoms have in common?

5. What structural characteristics do all carbon atoms have in common?

6. What does the mass number tell you? Can you find the mass number of an element on the periodic table?

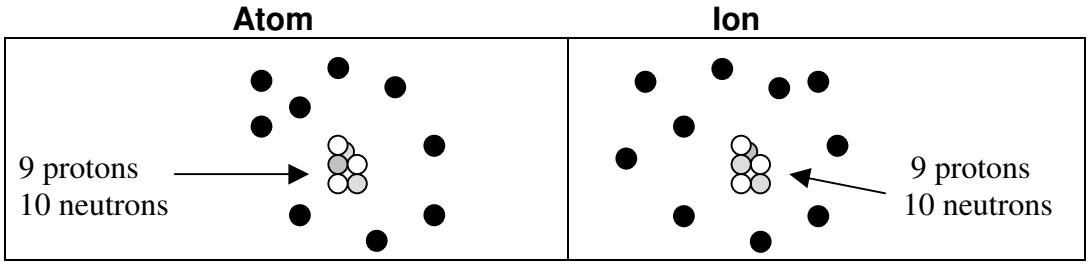
7. What does the atomic number tell you? Can you find the atomic number of an element on the periodic table?

8. Define the term **isotope**.

9. How does one isotope of carbon differ from another isotope of carbon?

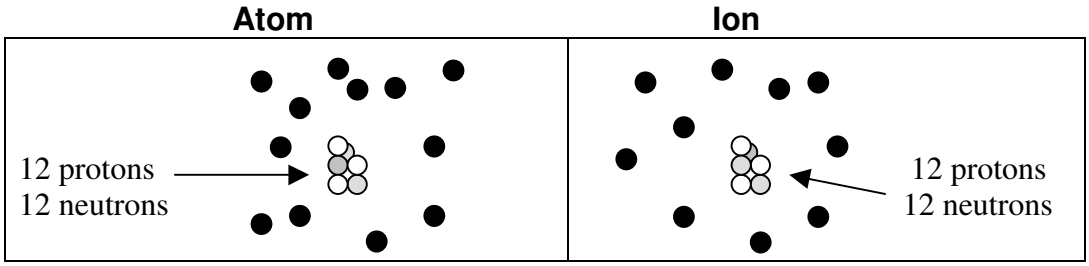
Information: Atoms, Ions, Masses of Subatomic Particles

The atomic mass unit (amu) is a special unit for measuring the mass of very small particles such as atoms. The relationship between amu and grams is the following: 1.00 amu = 1.66×10^{-24}g
Note the following diagrams comparing atoms and ions.



$^{19}_{9}F$
mass = 18.9980 amu

$^{19}_{9}F^{-1}$
mass = 18.9985 amu



$^{24}_{12}Mg$
mass = 23.9978 amu

$^{24}_{12}Mg^{+2}$
mass = 23.9968 amu

Critical Thinking Questions

10. What is structurally different between an atom and an ion? Note: This is the ONLY structural difference between an atom and an ion.

11. In atomic mass units (amu), what is the mass of an electron?

12. Is most of the mass of an atom located in the nucleus or outside the nucleus? How do you know?

13. If protons and neutrons have the same mass, what is the approximate mass of a proton and neutron in atomic mass units (amu)?

14. The mass of $^{14}_{6}C$ is about 14 amu. Does this agree with what you determined in questions 11 and 13?

15. The charge (in the upper right hand corner of the element symbol) is –1 for a fluorine ion. Why isn't it +1 or some other number?

16. What is the charge on every <u>atom</u>? Why is this the charge?

17. How do you determine the charge on an ion?

18. An oxygen ion has a –2 charge. (Use your periodic table if necessary)
    a) How many protons does the oxygen ion have?

    b) How many electrons does the oxygen ion have?