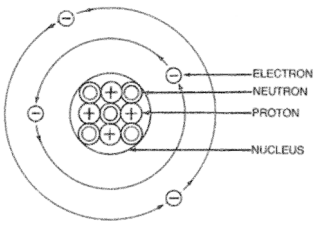
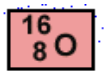
Chemistry Chapter 4 Study Guide

1. John Dalton's Atomic theory: - Element are made of tiny particles called atoms, All atoms of a given element are identical, The atoms of a given element are different from those of any other element , Atoms of one element can combine with atoms of other elements to form compounds. A given compound always has the same relative numbers and types of atoms, Atoms are indivisible in chemical processes. That is, atoms are not created or destroyed in chemical reactions. A chemical reaction simply changed the way the atoms are grouped together.
    a. Linked Law of Conservation of mass (Lavoisier) mass is neither created or destroyed through a chemical or physical change.
    b. Law of multiple Proportions (Dalton) ratio of elements are always small whole numbers
    c. And Law of Definite Proportions (Proust) compounds have the same elements in the same proportions by mass
2. Modern Atomic Theory All matter is composed of atoms; Atoms of one element differ in properties from atoms of another element
3. JJ Thomson
    a. Discovery of the electron--- an element can be made to emit tiny negative particles (repelled by negative end of electric field) -concluded subatomic particles that are negatively charged are called electrons -realized that there was a very large charge for such a small mass
4. William Thompson (Lord Kelvin)
    a. Plum pudding model- atom like a "pudding" of positive charge with enough negative electrons scattered within to counterbalance positive charge.
5. Robert Millikan - proved the mass of an electron to be about one two thousandth the mass of a H atom -famous experiment called the Millikan Oil Drop Experiment
6. Ernest Rutherford- Gold Foil Experiment; Atom is mostly empty space. Nucleus – positively charged, dense portion of atom that has almost all mass but only fraction of space (nuclear atom)
7. Composition of Nucleus- small, dense center of atom, contains (+) protons and (neutral) neutrons
8. Draw and label an atom with its parts and charges

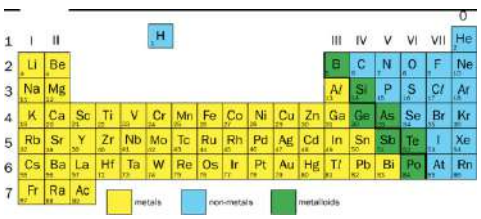


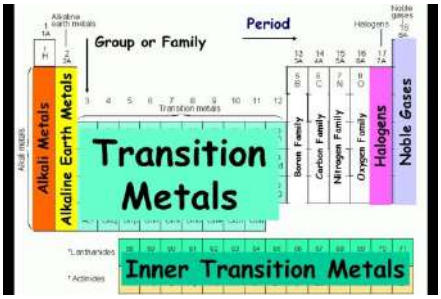
9. What is the atomic number? Where is it on YOUR Periodic Table? Atomic number tells number of protons; identifies an element; never changes! whole number (in order) in upper left of PT

10. What is the atomic Mass? Where is it on YOUR Periodic Table? tells number of protons + neutrons; decimal number in upper left of PT
11. What is an isotope? Same element (same # protons) but with a different mass (# neutrons)
12. How many protons, electrons and neutrons are there in an atom of chlorine-37? P: 17 E:17 N:20
13. How many protons, electrons and neutrons are there in an atom of carbon-13? P:6 E:6 N:7
14. Write the nuclear symbol of oxygen-16.



15. Write the hyphen notation for the element whose atoms contain 7 electrons and 9 neutrons. Nitrogen-16
16. What is average atomic mass? the weighted average of the atomic masses of the naturally occurring isotopes of an element
17. What is Avogadro's Number? The number of particles of any atom in a mole; 6.0221367×10^{23}
18. Who is the father of the Periodic Table? How was it originally arranged? Dimitri Mendeleev ; ordered by atomic mass
19. Who created the modern atomic theory? How is it arranged? Mosley; atomic number
20. Be able to label the Periodic Table with the following: *metals, nonmetals, metalloids* and each *family. (metals to right of staircase, nonmetals to left of staircase, metalloids: silicon, Germanium, Arsenic, Antimony, Selenium, Tellurium, Astatine, Polonium)*





21. Compare and contrast *metals, nonmetals* and *metalloids.* Provide an example of each.

- *Metals: lustrous, conductors of heat and electricity, react with acid, solid (Hg-exception), ductile, malleable etc. ex. Calcium, copper. Nonmetals: dull, brittle, poor conductors, low melting pts, no reaction with acid. Ex. Carbon, oxygen. Metalloids: show properties of both metals and nonmetals, poor conductors, ex. (see # 20) Comparison: all neutral elements, arranged by atomic number on periodic table.*

22. List the 5 major families of the periodic table, an example of each, and at least 3 properties of each.

    Alkali metals: very reactive! Very soft, stored in oil, solids etc. group 1 ex. Lithium

    Alkali earth Metals: not as reactive, not as soft, group 2, 2 valence electrons, gray-white luster ex. beryllium

    Transition metals: occur as uncombined elements, good conductors, form colored compounds, groups 3-12B ex. Silver

    Halogens: group7, very reactive, high electronegativity, some solids liquid, gas. Ex Chlorine

Noble Gases: all gases, unreactive with other elements. 8 valence electrons ex. Krypton

23. Identify the element in period 6 group 5. Bismuth
24. Identify the element in group 4 period 3. Silicon
25. What is an allotrope? different forms of the same element ex. Carbon – diamond, fullerene, graphite
26. What is the octet rule? How does this apply to the formation of ions? atoms are most stable with 8 electrons to fill their outer energy shell; Atoms bond or form ions to become stable (8valence e)
27. What are valence electrons? How do they apply to the formation of ions? E in the outermost e shell, available for bonding; gain, lose or share valence electrons to become stable.
28. What is an ion? Charged particle formed by gaining or losing an electron
29. What is a cation? How is it formed? What elements form cations? Positively charged ion, lost e; metals
30. What is an anion? How is it formed? What elements form anions? Negatively charged ions, gained e; nonmetals
31. How does an element's group number relate to the number of valence electrons it has? How does it relate to the ion (what charge) it forms? Group # (1-8) equals the number of valence electrons for each element in that group. See below for ion formed: