Review Sheet: Unit 3 **Name**_____*KEY*_____

I. Short Answer and Fill in the Blanks:

1. _____*Models*_____ are a familiar idea used to explain unfamiliar facts observed in nature while a _____*theory*_____ is an *explanation* of observable facts and phenomena.
2. To remain valid, models and theories must:
   a. *explain known facts*
   b. *make correct predictions*
3. The existence of the atom was proposed by the Greek philosopher _____*Democritus*_____. The word "atom" comes from the Greek word "atomos" which means _____*not to cut or indivisible*_____.
4. _____*Aristotle*_____ was a Greek philosopher who rejected the idea of the atom.
5. _____*John*_____ _____*Dalton*_____ was an English schoolmaster who explained the Law of Conservation of Mass, the Law of Definite Proportions, and the Law of Multiple Proportions using an atomic theory. His theory proposed that atoms:
   a. *are the building blocks of matter*
   b. *are indivisible*
   c. *of the same element are identical*
   d. *of different elements are different*
   e. *unite in small, whole-number ratios to form compounds*
6. The discovery of the atom's nucleus can be credited to _____*Rutherford*_____, whose _____*gold*_____-foil experiment provided experimental detail about the atom's structure. In his experiment, Rutherford aimed _____*alpha*_____ particles at a piece of _____*gold*_____ foil. _____*Most*_____ of the particles passed through the foil, but a few were _____*deflected*_____, and some even bounced back (were reflected). He concluded that most of the atom is _____*empty*_____ _____*space*_____. He also concluded that the atom has a dense, _____*positively*_____ charged core we call the nucleus.
7. The particles that make up the nucleus of the atom are called _____*nucleons*_____ and are comprised of the _____*protons*_____ and _____*neutrons*_____ in an atom.
8. Atoms are _____*neutral*_____ because the number of _____*positively*_____ charged protons equals the number of _____*negatively*_____ charged electrons.

9. ___Isotopes___ are atoms of an element that have different numbers of neutrons, and consequently, different atomic ___masses___.
10. The ___mass___ ___number___ of an atom is the sum of all the nucleons of an atom.
11. Rutherford's planetary model of the atom faced a major problem. Classical physics predicted that the electron, as it circled the nucleus, would ___lose___ energy so eventually the atom would collapse!
12. Bohr placed e^- in ___energy___ levels, assuming that the electron won't lose energy as long as it stays in the allowed level.
13. Bohr suggested that electrons can ___absorb___ a quantum or ___photon___ of energy, and then jump to a ___higher___ energy level. This is called the ___excited___ state. This is an unstable state, and the atom soon gives off the same amount of energy absorbed. Some of this energy is in the form of ___visible___ light.
14. The science of studying visible light through the use of a spectroscope is called ___spectroscopy___. The ___spectral___ lines identify an element and are called the element's ___bright___ ___line___ spectrum.
15. The modern view of light is that it has a ___dual___ nature, behaving as both a ___wave___ and a stream of ___particles___. It simply depends on the experiment!
16. Four ___quantum___ ___numbers___ are used to describe the location of an electron in an atom. They are ___n___, ___l___, ___m___, and ___s___. The principal quantum number, ___n___, represents the main ___energy___ level of the electron. The maximum number of electrons in this level is found using the formula: ___$2n^2$___. The second quantum number, ___l___, describes the ___orbital___ shape.
17. In the electron distribution $1s^2$, the "1" represents the ___main___ ___energy___ level, the "s" represents the ___sublevel___, and the "2" represents the number of ___electrons___ in the ___sublevel___.
18. ___Hund's___ Rule states that orbitals of equal energy are each occupied by ___one___ electron before any orbital is occupied by a ___second___ electron.
19. The ___Pauli___ Exclusion Principle states that no two electrons in the ___same___ atom can have the ___same___ set of four ___quantum___ ___numbers___.

II. Charts and Problems: Show all work if applicable.

1. Complete the following table:

Hyphen Notation	Nuclear Symbol	Atomic Number	Mass Number	# of Protons	# of Electrons	# of Neutrons
Carbon - 12	${}^{12}_{6}C$	6	*12*	*6*	*6*	*6*
Potassium-40	${}^{40}_{19}K$	*19*	*40*	*19*	*19*	*21*
Boron-11	${}^{11}_{5}B$	5	*11*	*5*	*5*	6

2. The relative abundance of the isotopes of oxygen are:
Oxygen-16: 99.760% Oxygen-17: 0.037% Oxygen-18: 0.204%
Calculate the average atomic mass of oxygen:

$(0.99760)(16\ u) + (0.00037)(17\ u) + (0.00204)(18\ u) = \boxed{16.00\ u}$

3. In a bright-line spectrum, the wavelength of a particular line is 6.0×10^{-7}m. What is the frequency of this color of light?

$c = \lambda f \quad 3.0 \times 10^{8}\ \frac{m}{s} = (6.0 \times 10^{-7}\ m) \times f \quad \boxed{f = 5.0 \times 10^{14}\ Hz}$

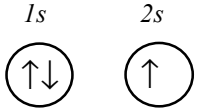
4. The maximum number of electrons in a main energy level is calculated using the formula _____$2n^2$_____. Therefore, the maximum number of electrons in the 5th main energy level is: $2n^2 = 2 \times 5^2 = 2 \times 25 = \boxed{50}$

5. How many sublevels are present in the 4th main energy level?_____4_____
What are they?_____s, p, d, f_____

6. The maximum number of electrons that can occupy an orbital is ____2____, if they have _____*opposite*_____ _____*spins*_____.

7. Do the electron distribution and the orbital notation for:

Li: $1s^2 2s^1$



O: $1s^2 2s^2 2p^4$