Unit 1…Measurement & Classification of Matter

1. Which of the following units express volume?
   - mL
   - mol
   - K
   - kJ
   - L
   - cm³

2. List the SI units for:
   - mass: ___kg___
   - temp.: ___K___
   - energy: ___J___
   - length: ___m___
   - time: ___s___
   - density: ___kg/L___
   - volume: ___L___

3. What is a conversion factor?
   - a fraction where the top and bottom are equal (ex: 1 ft /12 in)

4. What do these prefixes mean?
   a. a) kilo- 1000 b) centi 0.01 c) milli 0.001

5. How many seconds are in a year?
   31,536,000 s

6. Convert 62 hm to meters.
   62,000

7. Convert 800 mg to g.
   0.8 g

8. How many sig figs are in each number?
   a. ___4___7065 ___4___10.04 ___3___3.50 ___5___7.0200
   b. ___2___350 ___2___0.056 ___4___0.02030 ___1___200

9. Round the following to 3 sig figs.
   a. ___35.3___35.27 b. ___87.3___87.257
   c. ___7.54___7.535 d. ___56.4___56.45

10. Put these numbers in scientific notation.
    a. ___6.03 x 10^8___603000000 ___4.7 x 10^{-7}___0.00000047

11. Add the following numbers and report your answer to the correct # of sig figs.
    34.5678
    + 2.32148
    36.88928………36.8893

12. Multiply the following numbers and report your answer to the correct # of sig figs.
    12.5 x 3.241 = 40.5

13. Match the terms with appropriate examples.
    d) ability to burn  a) physical change
14. Match the items with the correct classification.
  _d___vegetable soup  a) element
  _a___mercury           b) compound
  _b___sugar             c) homogeneous mixture
  _c___lemonade          d) heterogeneous mixture

Unit 2 … Intro to Atomic Theory

1. List the 3 subatomic particles, their charges, location, and mass.
   a. Electron (-) electron cloud
   b. Proton (+) nucleus
   c. Neutron (0) nucleus

2. How many protons, neutrons, & electrons are in the isotope: \( ^{9}_{4}\text{Be} \)?
   \( p = 4 \quad e = 4 \quad n = 5 \) (9-4)

3. What is an isotope?
   Isotopes are atoms of the same element that vary in mass because they vary in the number of neutrons they have.

4. What are two ways to designate an isotope?
   A hyphen notation    Ex: carbon-14
   Nuclear symbol        Ex: \( ^{14}_{6}\text{C} \)

5. What is the atomic number of Nitrogen?
   7

6. What is the atomic mass of nitrogen?
   14.00 amu

7. Review the models of the atom and check them off as you go.
   a. _____Thompson plum pudding, equal distribution of electrons in positive pudding
   b. _____Rutherford electron cloud is mostly empty space, atom has a dense Positively charged center
   c. _____Bohr shows electron cloud being made of orbits or energy levels, electron location can be calculated, electrons orbit the nucleus
   d. _____Quantum electrons move randomly inside if orbitals 90% of the time, Electron location cannot be calculated
8. State the periodic Law. **The repeating properties of the elements are a function of the atomic numbers**

9. How many valence electrons do each of the following atoms have?
   - K __1__
   - b. Ca __2__
   - c. Ga __3__
   - d. Ge __4__

10. As __5__
    - f. Se __6__
    - g. Br __7__
    - h. Kr __8__

11. Horizontal rows on the table are called _____ **periods** while vertical columns are called _____ **groups** or _____ **families**.

12. Classify each of the following elements as a metal, nonmetal or metalloid.
   - a. Mo __m____
   - b. Cs __m____
   - c. Si __ml____
   - d. S __nm__

13. Find these groups on the periodic table and check them off as you go.
    - Lanthanides ___
    - actinides ___
    - transition elements ___
    - representative elements ___
    - Top of f block, bottom of f block, d block, s & p blocks

14. Who is the “father” of the periodic table
    **Dmitri Mendeleev**

15. Which block is lead in on the periodic table?
    **Pb is in the p block**

Unit 3…Modern Atomic Theory

1. Draw electron dot formulas for the atoms below.
   - a) K
   - b) S
   - c) Ca
   - d) Si
   - e) Xe

   **K has 1 dot**
   **S has 2 pairs and 2 singles**
   **Ca has 2 singles**
   **Si has 4 singles**
   **Xe has 4 pairs**

2. Write electron configurations for the elements below.
   - a) Na $1s^22s^22p^63s^1$
   - b) Li $1s^22s^1$
   - c) P $1s^22s^22p^63s^23p^3$
   - d) F $1s^22s^22p^5$

3. What is the electron configurations for:
   - a. Na $1s^22s^22p^63s^1$
   - b. Ar $1s^22s^22p^63s^23p^6$
   - c. Cu $1s^22s^22p^63s^23p^64s^23d^9$

4. 4. How many principle energy levels are there and how many electrons can each hold? (2n²)
   1…2 2…8 3…18 4…32 5…50 6…72 7…98

5. How many sublevel types are there and how many can each hold?
   4 s…2  p…6  d…10  f…14

6. What is the difference between a 2p orbital and a 3p orbital?
A 3p orbital would be higher in energy and further from the nucleus.

7. How does the ground state of an electron differ from the excited state?
   The ground state is closer to the nucleus and lower in energy.

8. What are the 4 quantum numbers?
   Principle (1-7), orbital (s,p,d,f), magnetic (p), spin (↑)

9. If a wavelength of a band of light is known to be 3.45 x 10⁻⁷ m, what is the frequency of this band? (c = 3.0 x 10⁸ m/s)
   \[ c = \lambda \nu \]
   \[ 3.00 \times 10^8 = 3.45 \times 10^{-7} \nu \]
   \[ \nu = 8.69 \times 10^{14} \]

10. Do atoms get bigger or smaller as you read from left to right on the periodic table? ____smaller__________

11. Which element would be bigger, Ba or Ca?
   Ba

12. Which element would have the higher ionization energy, Cl or Na?
   Cl

Unit 4…Nuclear Chemistry

1. List the 3 types of radiation and what substance can block each.
   a. alpha…paper
   b. beta…aluminum
   c. gamma…lead

2. If phosphorous-32 has a half-life of 14.3 days, how many days will it take for a radioactive sample to decay to 1/8 its size? 42.3 days (It takes 3 half lives to decay to 1/8)

3. Complete the nuclear equations.
   a. \( ^{238}_{92}U \rightarrow ^{234}_{90}Th + \rightarrow ^{4}_2He \)
   b. \( ^{210}_{83}Bi \rightarrow ^{210}_{84}Po + ^{0}_{-1}e \)

Unit 5… Ionic Compounds

1. How does bond length relate to bond energy?
   The longer the bond the less energy it takes to break them.

2. What are the 2 types of covalent bonds and how do they differ?
   In polar bonds atoms share electrons unequally. In nonpolar bonds atoms share electrons equally
3. What type of bond will a molecule have? **A covalent bond**

4. What type of bond will a formula unit have? **An ionic bond**

5. What properties are shared by metals? **Good conductors of heat and electricity**

6. What do the terms, ductility and malleability mean?  
   - Ductility = can be pulled into a wire  
   - Malleability = can be pounded into a shape

8. Is Al$^{3+}$ a **cation** or an anion?

9. If S were to ionize, would it lose or **gain** electrons? How many? 2

10. How many valence electrons do elements need to be stable 8

11. Name the isoelectric partners of the following ions. (Which element has the same electron configuration as this ion?)  
   - a. Ca$^{+2}$ _Ar____  
   - b. I$^{+1}$ _Xe____  
   - c. Al$^{+3}$ _Ne____  
   - d. O$^{2-}$ _Ne____

12. Name the following compounds:  
   - a. KCl **potassium chloride**  
   - b. MgI$_2$ **magnesium iodide**  
   - c. AgI **silver(I)iodide**  
   - d. CaBr$_2$ **calcium bromide**  
   - e. Li$_2$O **lithium oxide**  
   - f. CuCl **copper chloride**  
   - g. SnF$_2$ **tin(II)fluoride**  
   - h. FeBr$_3$ **iron(III)bromide**

13. Write formulas for the following compounds:  
   - a. lead(IV)chloride **PbCl$_4$**  
   - b. sodium fluoride **NaF**  
   - c. cesium sulfide **Cs$_2$S**  
   - d. beryllium nitride **Be$_3$N$_2$**  
   - e. magnesium oxide **MgO**  
   - f. potassium oxide **K$_2$O**

14. How many atoms of each element type are in the formula: **Mg(C$_2$H$_3$O$_2$)$_2$**  
   - Mg = 1  C=4  H=6  O=4

15. Write the formulas for:  
   - a. iron (III)sulfate **Fe$_2$SO$_4$**  
   - b. copper(II)sulfite **CuSO$_3$**
c. tin(II)iodate $\text{Sn(II)O}_3$  

d. calcium nitite $\text{Ca(NO}_2\text{)}_2$

16. Name these ternary compounds:
   a. $\text{SrClO}_3$ strontium chlorate  
   b. $\text{AgClO}_3$ silver(I)chlorate
   c. $\text{NH}_4\text{NO}_2$ ammonium nitrite  
   d. $\text{Cu}_3(\text{PO}_4)_2$ copper(II)phosphate

Unit 6… Covalent Compounds

1. Name the following covalent compounds.
   a. $\text{CO}_2$ carbon dioxide  
   b. $\text{N}_2\text{O}$ dinitogen monoxide
   c. $\text{PCl}_3$ phosphorous trichloride  
   d. $\text{CS}_4$ carbon tetrasulfide
   e. $\text{CS}_2$ carbon disulfide  
   f. $\text{OF}_2$ oxygen difluoride

8. Draw a Lewis structure for $\text{PCl}_3$.

\[
\begin{array}{c}
: \overline{\text{Cl}} : \\
: \overline{\text{P}} : \\
: \overline{\text{Cl}} : \\
\end{array}
\]

9. Draw a structural formula for $\text{C}_2\text{H}_4$.

\[
\begin{array}{c}
\text{H} \\
\text{C} : \text{C} \\
\text{H} \\
\end{array}
\]

10. What is the molecular geometry of $\text{PCl}_3$? triangular pyramidal

11. What is the molecular geometry for $\text{CH}_4$? tetrahedral

12. List the 3 intermolecular forces. London Dispersion, H. bonding, dipole-dipole

10. Which intermolecular force is the weakest? __________________

   London Dispersion

Unit 7 Phases of Matter

1. List the 4 phases of matter.  
   solid, liquid, gas, plasma

2. The particles of a solid are…
   a) packed closely together  
   b) very far apart  
   c) constantly moving past each other  
   d) in few numbers per unit space
3. To find the volume of a regular object, one multiplies length times width. How could you find the volume of an irregular object, such as a pencil? Water displacement

4. If 40 g of a liquid occupies 16 mL, what is its density?
\[
\frac{\text{g}}{\text{mL}} = \frac{40 \text{ g}}{16 \text{ mL}} = 2.5 \text{ g/mL}
\]

5. When solids convert to liquids this is called _______________. melting

6. When liquids convert to solids this is called _______________. freezing

7. When gases convert to liquids this is called _______________. vaporization

8. When liquids convert to gases this is called _______________. condensation

9. When gases convert to solids this is called _______________. sublimation

10. When solids convert to gases this is called _______________. deposition

11. What is the opposite of each phase change?
   a. condensation ________________ vaporization
   b. melting ________________ freezing
   c. sublimation ________________ deposition

12. When a strong acid is mixed rapidly with a strong base, the resulting solution gives off heat. Is this reaction exothermic or endothermic?

13. Convert 345 K to °C. ________________ 72 °C.

14. Convert 23 °C to K. ________________ 296 K

15. Write one of the specific heat formulas and define each symbol?
   \[ Q = m \times \Delta T \times c_p \]
   \( Q = \) heat lost or gained
   \( M = \) mass
   \( \Delta T = \) change of temperature
   \( c_p = \) specific heat

16. What units are used to express the symbols in the specific heat equation?
   \[ Q = \text{Joules} \quad m= \text{grams} \quad \Delta T = ^\circ \text{C} \quad c_p = \frac{\text{Joules}}{\text{g} \cdot ^\circ \text{C}} \]