1. Classify each of the following as a physical or chemical change:

<table>
<thead>
<tr>
<th>Physical Change</th>
<th>Chemical Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>ice melting</td>
<td>paper burning</td>
</tr>
<tr>
<td>Acid reacting with oxygen</td>
<td>gas under pressure</td>
</tr>
<tr>
<td>liquid evaporating</td>
<td>Magnesium being heated</td>
</tr>
</tbody>
</table>

2. What is a chemical change and what is a physical change?

3. Name three characteristics of most nonmetals. Where are they on the periodic Table?

4. Name three characteristics of metals. Where are they on the periodic table?

5. Name three characteristics of most metalloids.

6. Name two properties of noble gases.

7. What is the difference between an element and a compound?

8. Consider the burning of gasoline and the evaporation of gasoline. Which process represents a chemical change and which represents a physical change? Give a reason for your answer.

9. A single atom of platinum has a mass of $3.25 \times 10^{-22}$ g. What is the mass of $6.0 \times 10^{23}$ platinum atoms?

10. A sample thought to be pure lead occupies a volume of 15.0 mL and has a mass of 160.0 g.
    a.) Determine its density.

11. 84.01 g of baking soda, NaHCO₃, always contains 22.99 g of sodium, 1.01 g of hydrogen, 12.01 g of carbon, and 48.00 g of oxygen. What percentage by mass of each of these elements is present in baking soda?

<table>
<thead>
<tr>
<th>Element</th>
<th>Percentage</th>
<th>Element</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium</td>
<td></td>
<td>carbon</td>
<td></td>
</tr>
<tr>
<td>hydrogen</td>
<td></td>
<td>oxygen</td>
<td></td>
</tr>
</tbody>
</table>

a. Which law do these data illustrate?
14. The smallest unit of an element that can exist either alone or in combination with atoms of the same or different element is the __

15. A positively charged particle found in the nucleus is called a(n) __ __

16. A nuclear particle that has no electrical charge is called a(n) __ __

17. The subatomic particles that are least massive and most massive, respectively, are the __ __

18. A cathode ray produced in a gas-filled tube moves away from a negative field, such as one produced by a magnet. When a paddle wheel is installed inside the tube, the wheel moves down the tube in the same direction as the cathode ray. What properties of electrons do these two phenomena illustrate? Who did this experiment?

19. How would the electrons produced in a cathode ray tube filled with neon gas compare with the electrons produced in a cathode ray tube filled with chlorine gas?

20. Explain the difference between the mass number and the atomic number of a nuclide.

21. How many particles are in 1 mole of carbon? 1 mol of lithium? 1 mol of eggs? Will 1 mol of each of these substances have the same mass?

22. As the atomic masses of the elements in the periodic table increase, what happens to each of the following:
   a. the number of protons __
   b. the number of electrons __
   c. the number of atoms in 1 mol of each element __

23. What is the mass in grams of 2 mol of oxygen atoms? __

24. The element boron, B, has an atomic mass of 10.81 amu according to the periodic table. However, no single atom of boron has a mass of exactly 10.81 amu. How can you explain this difference?

25. How did the outcome of Rutherford's gold foil experiment indicate the existence of a nucleus?

26. A certain element exists as three natural isotopes as shown in the table below:

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Mass (amu)</th>
<th>Percent natural abundance</th>
<th>Mass number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19.99244</td>
<td>90.51</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>20.99295</td>
<td>0.27</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>21.99128</td>
<td>9.22</td>
<td>22</td>
</tr>
</tbody>
</table>

Calculate the average atomic mass of this element. ______________

27. What is the difference between the ground state and the excited state of an atom (its electrons)?
32. Write the electron configuration and orbital diagrams for each of the following atoms:
   a. Phosphorus:
   b. Nitrogen

33. Write the electron configuration of the following atoms:
   a. Carbon ________________
   b. Copper_______________________________

35. When an electron is added to a neutral atom, energy is ___
   (a) always absorbed                   (c)either absorbed or released
   (d) always released                    (d)burned away

36. The energy required to remove an electron from an atom is the atom's ___
   (a) electron affinity                   (c)electro negativity
   (b) electron energy                     (d) ionization energy

37. Moving from left to right across a period on the periodic table.
   a. electron affinity values tend to become __(more negative or more positive)
   b. ionization energy values tend to become __(larger or smaller)
   c. atomic radii tend to become __(larger or smaller)

38. a. Name the halogen with the least - negative electron affinity.
   b. Name the alkali metal with the highest ionization energy
   c. Name the element in Period 3 with the smallest atomic radius.
   d. Name the Group 14 element with the largest electro negativity.

39. a. Compare the size of the radius of a positive ion to its neutral atom.
   b. Compare the size of the radius of a negative ion to its neutral atom.

40. For metals and nonmetals, which tend to form positive ions? Which tend to form negative ions?

41. Explain the role of valence electrons in the formation of chemical compounds.

42. Consider a neutral atom with 53 protons and 74 neutrons to answer the following questions.
   a. What is atomic number? _________
   b. What is the mass in amus?__________
   c. Is the element's position in a modern periodic table determined by its atomic number or by its atomic mass?

43. Consider an element whose outermost electron configuration is 3d^{10}4s^{2}4p^{x}
   a. To which period does the element belong? _______ _
   b. If it is a halogen, what is the value of x?______________
   c. The group number will equal (10+2+x). True or false? _____________

44. a. Metalloids are found in which block, s,p,d, or f?
   b. The hardest, densest metals are found in which block, s, p, d, or f?
45. Referring only to the periodic table, answer the following questions on periodic trends.
   a. Which has the larger radius, Al or In?
   b. Which has the larger radius, Se or Ca?
   c. Which has a larger radius, Ca or Ca^{2+}?
   d. Which has greater ionization energies as a class, metals or nonmetals?
   e. Which has the greater ionization energy, As or Cl?
   f. An element with a large negative electron affinity is most likely to form a positive ion, a negative ion, or a neutral atom?

46. Explain why ionic bonds tend to form between metals and nonmetals.

47. Explain why the formula of glucose is written as C_{6}H_{12}O_{6} and not as CH_{2}O.

49. Explain why silicon tetrafluoride (SiF_{4}) has a square structural formula but a tetrahedral arrangement in space.

51. How many valence electrons does the sulfide ion have? The sulfur atom?

52. How many valence electrons are in the polyatomic ion HPO_{4}^{2-}?

53. How many electrons are shared among carbon atoms in the compound ethanol, CH_{3}CH_{2}OH?

54. Sulfur is the central atom in sulfur dichloride, SCl_{2}. What is the shape of this molecule? What are the approximate bond angles?

55. Describe the shape for a molecule of silane, SiH_{4}.

56. What is the shape of a molecule of nitrosyl chloride, NOCl, given that nitrogen is the central atom? What are the approximate bond angles?

57. A molecule has boron as its central atom and two chlorine atoms and one iodine atom, each connected by a single bond to boron. Determine if the molecule is polar, given the following electronegativities: B, 2.0; I, 2.5; and Cl, 3.0.

The final will include Stoichiometry but it’s not included in the review since it was recently taught.