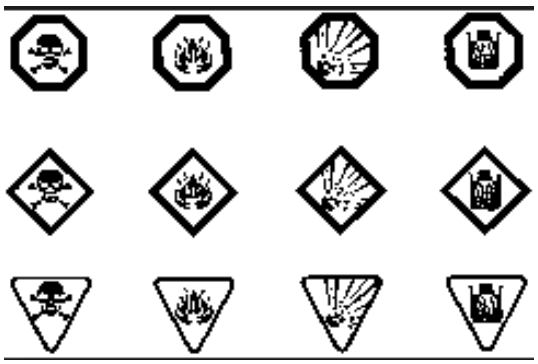
Chemistry 11 Final Exam Review

1. Label each symbol: 

2. What are the three things needed for combustion to occur?

3. Make sure you review your Safety Test from the beginning of the semester.

4. Change to scientific notation:
   a. 1020 b. 0.000034 c. 93 000 000

5. Change to standard notation:
   a. 8.25×10^{-4} b. 7.7×10^{5} c. 1.006×10^{-1}

6. Convert the following
   a. 0.0006 mm = ____ µm b.0.054 L = ____ ML
   c. 3.5 µg/L = ____ mg/mL d. 3.45 kg = ____ dg

7. Give the number of significant digits in each of the following numbers:

   a. 0.0023
   b. 3 953 000
   c. 1.0200×10^{5}
   d. 50020.0
   e. 3.2×10^{-4}
   f. 3450
   g. 2050
   h. 20.50
   i. 2.050×10^{2}
   j. 0.02050

8. Write the number one hundred with 1 sig fig, then with 2 sig figs, then with 3 sig figs.

9. Explain the difference between accuracy and precision.

10. How is precision for one measurement different than precision for multiple measurements?

11. Round the following numbers to 2 significant digits.

   a. 2 000 000 000
   b. 106 000
   c. 3.88945×10^{23}
   d. 0.000 000 789 5

12. Perform the following calculations and round the answers off to the correct number of significant digits as justified by the data. Assume all numbers are measurements.

a) 2.1500×0.31
b) $8.90 \times 10^{3} \div 4.400 \times 10^{-6}$
c) $0.05 + 394.7322$
d) $83.00 \div 1.2300 \times 10^{2}$
e) $4.905 \times 10^{6} \div 4 \times 10^{-2}$
f) $98.0076 - 2.195$
g) $(3.33 \times 9.52) + 13.983$
h) $0.00000200 \times 245.912$
i) $3.813 + 98.98 + 2.669$
j) $5.802 \div 6.21 + 2.41 \div 9.256$

13. The density of iron is 7860 g/L. Calculate the mass of a 3.2 mL sample of iron.

14. Manganese has a density of 7.20 g/mL. Calculate the volume occupied by a 4.0 kg piece of manganese.

15. A 0.0460 L piece of copper has a mass of 410.32 g. Calculate the density of copper in g/mL.

16. If a piece of aluminum (density 2.790 g/cm^3) foil measures 3.0 cm by 4.0 cm and has a mass of 1.62 g what is the thickness of the foil? (Remember the Al Foil lab?)

17. Define the following terms as they are used in Chemistry:

a. Property
b. Observation
c. Interpretation
d. Qualitative
e. Quantitative
f. Hypothesis
g. Law
h. Theory
i. Physical Property
j. Chemical Property
k. Physical Change
l. Chemical Change
m. Malleability
n. Ductility
o. Lustre
p. Viscosity

18. Draw a matter tree diagram to illustrate the classification of matter.

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

20. What is the difference between a compound and a mixture?

21. Can certain molecules be deemed as an element rather than a compound? Explain.

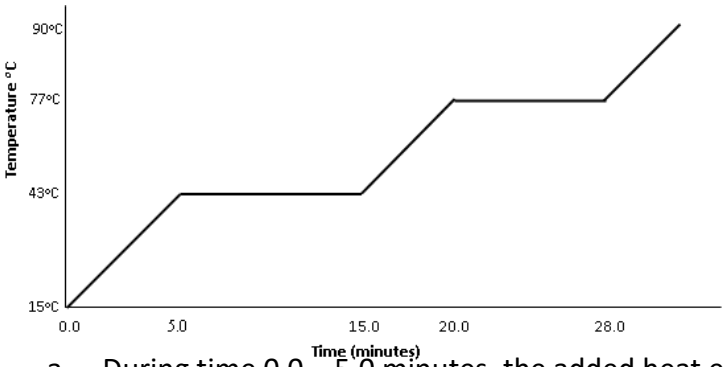
22. List three physical properties and two chemical properties.

23. Classify the following using the categories: element, compound, homogeneous mixture, heterogeneous mixture

a. Iced Tea
b. Sand
c. Water
d. Gold
e. Stainless steel
f. Oxygen

24. Distinguish between a physical and chemical change and give an example of each.

25. Use the following graph to answer the questions below.



a. During time 0.0 – 5.0 minutes, the added heat energy is being used to do what?
b. During time 5.0 – 15.0 minutes, the added heat energy is being use to do what?
c. During time 15.0 – 20.0 minutes, the added heat energy is being used to do what?
d. During time 20.0 – 28.0 minutes, the added heat energy is being used to do what?
e. The melting point of substance X is what?
f. The boiling point of substance X is what?
g. If a greater amount of substance X was used what would be the effect on the melting point?
h. What phase is substance X in at 90° C?

26. Describe each of the following phase changes in terms of changes of state: melting, evaporation, sublimation, condensation

27. Describe a chemical change in terms of particles and the atoms that make them up.

28. Give the formulas for the elements that are diatomic molecules as gases (there are 7).

29. What information can be indicated by the formula of a substance?

30. Explain the difference between an ionic and a covalent compound. What types of elements are involved in each, and explain how the bonds differ between the two.

31. Explain how metallic properties change as you move left across a period and down a family.

32. How are isotopes related to each other?

33. What is the identity of an isotope having 92 protons and 143 neutrons? Write the answer in chemical symbol notation.

34. Write chemical symbol notation for a tin particle that has 66 neutrons and 48 electrons.

35. Element X is composed of the following naturally occurring isotopes: 50.69 % ^{79}X and 49.31 ^{81}X. Calculate the average atomic mass for this isotope.

36. Write formulas for the following compounds:

a. Sodium sulphide
b. Iron (III) nitrate
c. Dinitrogen tetroxide
d. Sulphurous acid
e. Calcium hydroxide
f. ammonium chlorate
g. copper (II) sulphite
h. zinc carbonate tetrahydrate
i. nitric acid
j. phosphorus pentiodide
k. iron (III) thiocyanate
l. sulphuric acid
m. dinitrogen tetrafluoride

37. Write the name for each of the following compounds:

a. $Mn(SO_4)_2$
b. $PbCO_3 \bullet 6H_2O$
c. As_2O_3
d. CH_3COOH
e. NiC_2O_4
f. NF_3
g. $(NH_4)_2HPO_4$
h. $Ba(OH)_2 \bullet 10H_2O$

38. What is a mole?

39. What is Avagadro's number?

40. Make the following conversions, clearly showing your steps. Include proper units in all of your work and in your answer.

a. 133.44 grams of PCl_5 to moles of PCl_5
b. 0.00256 moles of $Li_2Cr_2O_7$ to grams of $Li_2Cr_2O_7$
c. 170.24 L of NO_2 at STP to moles NO_2
d. 570.625 g of PCl_3 gas = litres of PCl_3 at STP
e. 1030.4 mL of C_2H_6 gas at STP to grams C_2H_6
f. 5.00 kg of nitrogen gas to litres (STP) nitrogen gas
g. 0.5696 kg of $CH_{4(g)}$ at STP to mL $CH_{4(g)}$

41. What mass is needed to obtain 2.0 moles of potassium chlorate?

42. A sample contains 3.40 g of silver nitrate. This sample contains (a) how many molecules; (b) how many oxygen atoms?

43. What mass contain 0.0500 moles of calcium carbonate?

44. The density of liquid ethanol (C_2H_5OH) is 0.790 g/mL. Calculate the number of molecules in a 35.0 mL sample of liquid ethanol.

45. A 100.0 mL sample of liquid mercury contains 6.78 moles. Calculate the density of liquid mercury (in g/mL) from this data.

46. Find the percent composition (% by mass of each element) in the following compound: $Sr_3(PO_4)_2$.

47. Give the percent composition of sugar, $C_{12}H_{22}O_{11}$

48. A hydrocarbon contains 92.3% C and 7.7% H. Find its empirical formula. If the actual molar mass is 78.0 g/mole, what is the molecular formula?

49. A compound was analyzed and the following results were obtained:

    Molar mass: 270.4 g/mol Mass of sample: 162.24 g

    Mass of potassium: 46.92 g Mass of sulphur: 38.52 g

    Mass of oxygen: the remainder of the sample is oxygen

    a. Determine the mass of oxygen in the sample.
    b. Determine the empirical formula for this compound.
    c. Determine the molecular formula for this compound.

50. Balance the following equations:

    a. $NH_3 + O_2 \rightarrow NO + H_2O$
    b. $(NH_4)_2C_2O_4 + AlCl_3 \rightarrow Al_2(C_2O_4)_3 + NH_4Cl$
    c. $C_{14}H_{30} + O_2 \rightarrow CO_2 + H_2O$
    d. $Fe + HNO_3 \rightarrow Fe(NO_3)_3 + H_2$
    e. $P_4 + Cl_2 \rightarrow PCl_3$
    f. $Na_2Cr_2O_7 + HCl \rightarrow NaCl + CrCl_3 + H_2O + Cl_2$
    g. $H_3PO_4 + Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + H_2O$
    h. $Ba(ClO_4)_2 \rightarrow Ba + Cl_2 + O_2$
    i. $C_7H_{15}OH + O_2 \rightarrow CO_2 + H_2O$
    j. $MgSO_4{\cdot}5H_2O \rightarrow MgSO_4 + H_2O$

51. Write the correct chemical formula for each compound and balance the equation.
   a. sodium carbonate + calcium hydroxide → sodium hydroxide + calcium carbonate
   b. carbon dioxide + water → carbonic acid
   c. phosphorus + oxygen → phosphorus pentoxide
   d. sodium + water → sodium hydroxide + hydrogen
   e. zinc + sulfuric acid → zinc sulfate + hydrogen
   f. aluminum sulfate + calcium hydroxide → aluminum hydroxide + calcium sulfate
   g. calcium oxide + water → calcium hydroxide
   h. iron + copper(I) nitrate → iron(II) nitrate + copper
   i. iron(II) sulfide + hydrochloric acid → hydrogen sulfide + iron(II) chloride
   j. potassium oxide + water → potassium hydroxide
   k. carbon + ferric oxide → iron + carbon dioxide *ferric is iron (III)
   l. sulfur tetrafluoride + water → sulfur dioxide + hydrofluoric acid
   m. calcium hydroxide + phosphoric acid → calcium phosphate + water
   n. aluminum sulfate + ammonia + water →aluminum hydroxide + ammonium sulfate

52. Write a balanced equation for each of the following and classify each reaction as a synthesis, decomposition, single replacement, double replacement, neutralization, or combustion reaction.
   a. potassium sulphate is mixed with cobalt (III) nitrate
   b. liquid propanol (C_3H_7OH) is burned in air
   c. ammonium nitrate is decomposed into its elements
   d. a piece of zinc is placed in a test-tube containing a solution of silver nitrate
   e. bromine reacts with sodium iodide
   f. bromine reacts with aluminum
   g. rubidium reacts with chlorine gas
   h. hydrochloric acid reacts with strontium hydroxide

53. State whether each of the following are ***exothermic*** or ***endothermic***.

   a. $2HCl + 432\ kJ \rightarrow H_2 + Cl_2$
   b. $C_{12}H_{22}O_{11} + 12\ O_2 \rightarrow 12CO_2 + 11H_2O \quad \Delta H = -5638\ kJ$
   c. $H_2O_{(s)} \rightarrow H_2O_{(l)}$

54. Draw a potential energy graph for an endothermic and an exothermic reaction.

55. Write an equation including energy that shows that 107 kJ of energy is released when 1 mole of carbon is completely burned (product is carbon dioxide).

56. Hydrogen and nitrogen react to form ammonia: $3\ H_2 + N_2 \rightarrow 2\ NH_3$. What mass of ammonia forms if 2.60 g of hydrogen is used in the reaction?

57. If 24 molecules of H_2 and 18 molecules of N_2 are mixed and allowed to react, how many molecules of H_2, N_2 and NH_3 would be present at the end.

58. Given the following balanced equation, answer the questions following it:

$$2NF_{3(g)} + 3H_{2(g)} \rightarrow N_{2(g)} + 6HF_{(g)}$$

a. If 5.5 moles of H_2 are reacted, how many moles of NF_3 will be consumed?
b. In order to produce 0.47 moles of HF, how many moles of NF_3 would be consumed?
c. If you needed to produce 180.6 g of N_2, how many moles of H_2 would you need to start with?
d. If you completely react 17.04 g of NF_3 , what mass of HF will be produced?

59. Given the following balanced equation, answer the questions following it:

$$HBrO_3 + 5\ HBr \rightarrow 3\ H_2O_{(l)} + 3\ Br_{2(g)}$$

a. If 3.56 moles of HBr are reacted, how many Litres of Br_2 will be formed at STP?
b. In order to produce 3.311×10^{24} molecules of Br_2, what mass of HBr is needed?

60. Given the following balanced equation, answer the questions below it.

$$3\ Cu_{(s)} + 8HNO_{3(l)} \rightarrow 3\ Cu(NO_3)_{2(aq)} + 2NO_{(g)} + 4\ H_2O_{(l)}$$

a. If 317.5 grams of Cu are placed into 756.0 grams of HNO_3, determine which reactant is in excess.
b. If the reaction in (a) is carried out, what mass of NO will be formed?

61. Given the balanced equation: $2BN + 3F_2 \rightarrow 2BF_3 + N_2$,

When 161.2 grams of BN are added to an excess of F_2, a reaction occurs.

a. Calculate the *mass* of BF_3 produced.
b. Calculate the *volume* of N_2 gas produced at STP.

62. Explain the Pauli exclusion principle.

63. Give the full electron configuration for each of the following:

a. C
b. Na
c. Y
d. Hg

64. Give the core notation for each of the following:

a. P
b. Mo
c. Se
d. Rb
e. Cl^-
f. Al^{3+}
g. Fe^{3+}
h. S^{2-}
i. Cu^+

65. The principal quantum number is represented by what letter and gives information about what?

66. What aspect of an atom's structure largely determines its chemical behavior?

67. State the main trends in the periodic table for:
   a. Ionization energy
   b. Metallic behavior
   c. Electronegativity
   d. Atomic radius

68. Bonds can be classified as non-polar covalent, polar covalent or ionic. Explain each of these types of bonds and how a given bound would be classified as one versus the others.

69. Explain how a molecule may have polar bonds but as a whole is a non-polar molecule. Can you give an example?

70. Put the following kinds of intermolecular forces in order of decreasing strength: London Forces, hydrogen bonds, dipole-dipole forces. Give an example of substances exhibiting each of the kinds of forces.

71. Is an ion a polar or non-polar particle?

72. Draw Lewis Structures for and identify the shape(s) of each:
   a. CO_2
   b. C_3H_8
   c. NH_3
   d. CO_3^{2-}
   e. CN^-
   f. BF_3
   g. CH_3COO^-

73. Write dissociation equations for:
   a. $MgCl_{2(s)}$
   b. $(NH_4)_2CO_{3(s)}$

74. Which of the following are soluble in water?
   a. PbS
   b. $(NH_4)_2CO_3$
   c. $Mg(OH)_2$
   d. $BaSO_4$
   e. SrS

75. 123.11 g of zinc nitrate, $Zn(NO_3)_2$ are dissolved in enough water to form 650.0 mL of solution. Calculate the $[Zn(NO_3)_2]$ in Molarity.

76. Calculate the mass (in g) of potassium sulphite (K_2SO_3) needed to make 800.0 mL of a 0.200 M solution of K_2SO_3.
77. What volume (in L) of 2.50 M Li_2CO_3 would need to be evaporated in order to obtain 47.232 g of solid Li_2CO_3?

78. 150.0 mL of water are added to 400.0 mL of 0.45 M HNO_3 . Calculate the final [HNO_3].

79. What volume of water needs to be added to 150.0 mL of 4.00 M H_2SO_4 in order to bring the concentration down to 2.50 M?

80. Give directions on how to make 5.00 L of 0.020 M $Ca(ClO)_2$ using solid $Ca(ClO)_2$ and water. Include proper units in your work and in your answers.

81. What mass of NaOH is needed to make up 200 mL of 0.20 M Solution?

82. 250 mL of 3.00 M HCl is diluted by adding 350 mL of water. What is the new concentration?

83. A stock solution having a concentration of 3.00 M is available. How many mL of the stock solution must be used to make 500 mL of 0.050 M solution?

84. Find the concentration of each ion when 25.0 mL of 0.40 $MgCl_2$ is mixed with 45.5 mL of 0.80 M K_2S.

85. What is a saturated solution?

86. Write the formula, complete ionic, and net ionic equation for the following:
    a. $CaCl_{2(aq)} + K_2SO_{4(aq)}$
    b. $Sr(OH)_{2(aq)} + MgSO_{4(aq)}$

87. Draw a flowchart to separate a solution that may contain one or more of Cl^-, CO_3^{2-}, SO_4^{2-}.