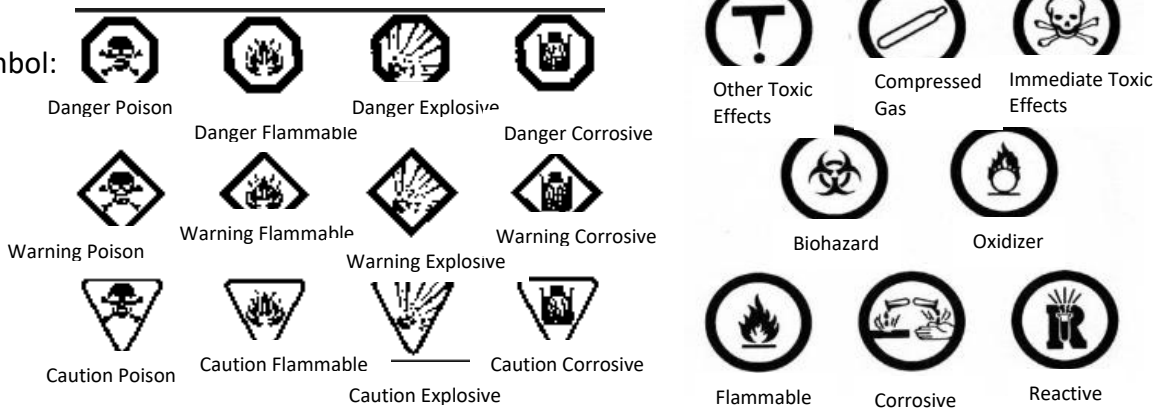
Chemistry 11 Final Exam Review

1. Label each symbol:



2. What are the three things needed for combustion to occur?
   Fuel, Oxygen, Ignition Source
3. Make sure you review your Safety Test from the beginning of the semester.
   Use a fire extinguisher, what to do if big fire, priority order to help others during accident etc.
4. Change to scientific notation:
   a. 1020 b. 0.000034 c. 93 000 000
   1.020×10^{3} *3.4×10^{-5}* *9.3×10^{7}*
5. Change to standard notation:
   a. 8.25×10^{-4} b. 7.7×10^{5} c. 1.006×10^{-1}
   0.000825 *770 000* *0.1006*
6. Convert the following
   a. 0.0006 mm = *0.6* μm b.0.054 L = *5.4×10^{-8}* ML
   c. 3.5 μg/L = *3.5×10^{-6}* mg/mL d. 3.45 kg = *3.45×10^{4}* dg

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

a.	0.0023	*2*	f.	3450	*3*
b.	3 953 000	*4*	g.	2050	*3*
c.	1.0200×10^{5}	*5*	h.	20.50	*4*
d.	50020.0	*6*	i.	2.050×10^{2}	*4*
e.	3.2×10^{-4}	*2*	j.	0.02050	*4*

8. Write the number one hundred with 1 sig fig, then with 2 sig figs, then with 3 sig figs.
   100 OR 1×10^{2}, 1.0×10^{2}, 1.00×10^{2}
9. Explain the difference between accuracy and precision.
   Accuracy is how close you are to the true value whereas the precision is the refinement in a measurement, indicated by the number of digits given
10. How is precision for one measurement different than precision for multiple measurements?
    Precision for one measurement described in #9, precision for multiple measurements is how clustered the measurements are to one another. The more clustered, the more precise.
11. Round the following numbers to 2 significant digits.

a.	2 000 000 000	*2.0×10^{9}*	c.	3.88945×10^{23}	*3.9×10^{23}*
b.	106 000	*1.1×10^{5}*	d.	0.000 000 789 5	*7.9×10^{-7}*

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 x 0.31 *0.67*
b) $8.90 \times 10^{3} \div 4.400 \times 10^{-6}$ *2.02×10^{9}*
c) 0.05 + 394.7322 *394.78*
d) $83.00 \div 1.2300 \times 10^{2}$ *0.6748*
e) $4.905 \times 10^{6} \div 4 \times 10^{-2}$ *1×10^{8}*
f) 98.0076 - 2.195 *95.813*
g) (3.33 x 9.52) + 13.983 *44.8*
h) $0.00000200 \times 245.912$ *4.92×10^{-2}*
i) 3.813 + 98.98 + 2.669 *105.46*
j) 5.802 ÷ 6.21 + 2.41 ÷ 9.256 *1.195*

13. The density of iron is 7860 g/L. Calculate the mass of a 3.2 mL sample of iron. *25 g*

14. Manganese has a density of 7.20 g/mL. Calculate the volume occupied by a 4.0 kg piece of manganese. *560 mL*

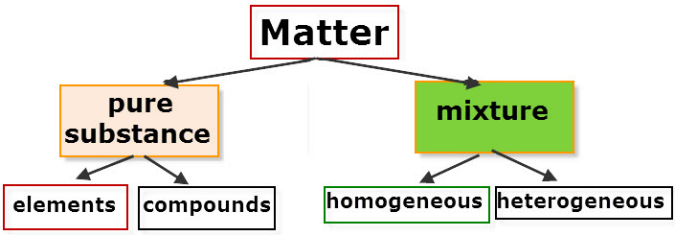
15. A 0.0460 L piece of copper has a mass of 410.32 g. Calculate the density of copper in g/mL. *8.92 g/mL*

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?) *4.8×10^{-2} cm*

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

a) Property- *a characteristic*
b) Observation- *using the senses to notice something*
c) Interpretation- *trying to make sense of an observation*
d) Qualitative – *a non-numerical property*
e) Quantitative- *a numerical property*
f) Hypothesis – *a possible explanation as a starting point for further investigation*
g) Law – *a statement supported by copious experimentation about an aspect of the universe (the 'what')*
h) Theory – *a well substantiated explanation of some aspect of the universe (the 'why')*
i) Physical Property – *a characteristic of something that does not involve a chemical reaction*
j) Chemical Property – *a characteristic of something that has to do with its reactivity*
k) Physical Change – *a change that does not result in a different substance*
l) Chemical Change – *a change that does result in a different substance*
m) Malleability- *bendable*
n) Ductility- *able to stretch into wires*
o) Lustre- *shiny*
p) Viscosity- *thickness of a liquid*

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

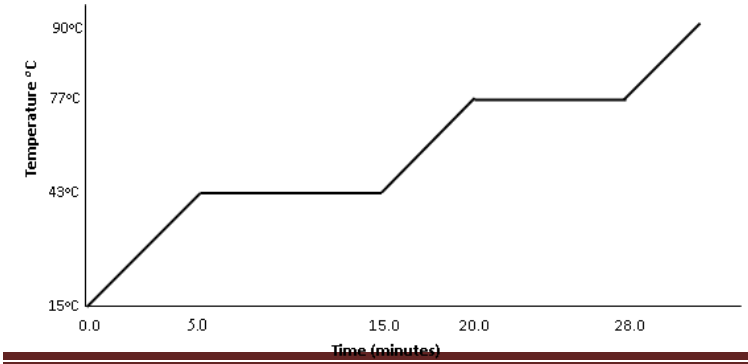


19. What is the difference between an element and a compound?
An element is one type of atom, a compound is two or more types of atoms but only one type of particle
20. What is the difference between a compound and a mixture? *A compound is one type of particles whereas a mixture is two or more types of particles*
21. Can certain molecules be deemed as an element rather than a compound? Explain. *Yes, all diatomic elements (for example, H_2) are molecules that are compounds. There are others too, like phosphorus (P_4) and Sulphur (S_8)*
22. List three physical properties and two chemical properties.
Physical: density, colour, mass, volume, state etc. *Chemical: flammable, corrosive etc.*
23. Classify the following using the categories: element, compound, homogeneous mixture, heterogeneous mixture

a. Iced Tea *homogeneous mixture*
b. Sand *heterogeneous mixture*
c. Water *compound*
d. Gold - *element*
e. Stainless steel – *homogneous mixture*
f. Oxygen - *element*

24. Distinguish between a physical and chemical change and give an example of each.
A physical change is a change that doesn't involve a chemical reaction and the making of a new substance. For example, a change of state is physical. A chemical change involves the formation of a new substance. Physical changes are usually easier to reverse.

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?
Raise temperature

b. During time 5.0 – 15.0 minutes, the added heat energy is being use to do what?
Change state from solid to liquid

c. During time 15.0 – 20.0 minutes, the added heat energy is being used to do what?
Raise temperature

d. During time 20.0 – 28.0 minutes, the added heat energy is being used to do what?
Change state from liquid to gas

e. The melting point of substance X is what?
43 degrees

f. The boiling point of substance X is what?
77 degrees

g. If a greater amount of substance X was used what would be the effect on the melting point?
Nothing – melting point is an intensive property

h. What phase is substance X in at 90° C?
gas

26. Describe each of the following phase changes in terms of changes of state: melting, evaporation, sublimation, condensation
Melting: solid to liquid Evaporation: liquid to gas Sublimation: solid to gas (or gas to solid) Condensation: gas to liquid

27. Describe a chemical change in terms of particles and the atoms that make them up.
Atoms are neither created nor destroyed, they are simply rearranged to make different type(s) of particles compared to the original particles

28. Give the formulas for the elements that are diatomic molecules as gases (there are 7).
H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2

29. What information can be indicated by the formula of a substance?
Which and how many of each (subscript) atom contribute to making up the 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.
Ionic compound made up on ions that exist due to a transfer of electrons. Bonds between atoms are simply electrostatic attraction and made up generally of a metal cation and a non-metal anion. Covalent compounds made up of non-metals that share electrons. The composition of the bonds are the shared electrons.

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

32. How are isotopes related to each other?
They have the same amount of protons, and are therefore the same element, but differ in the amount of neutrons.

33. What is the identity of an isotope having 92 protons and 143 neutrons? Write the answer in chemical symbol notation. $^{235}_{92}U$

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

$^{116}_{50}Sn$

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.
(0.5069)(79) x (0.4931)(81) = 79.99 = 8.0 x 10^1

36. Write formulas for the following compounds:

a. Sodium sulphide *Na_2S*
b. Iron (III) nitrate *$Fe(NO_3)_3$*
c. Dinitrogen tetroxide *N_2O_4*
d. Sulphurous acid *H_2SO_3*
e. Calcium hydroxide *$Ca(OH)_2$*
f. ammonium chlorate *NH_4ClO_3*
g. copper (II) sulphite *$CuSO_3$*
h. zinc carbonate tetrahydrate *$ZnCO_3*4H_2O$*
i. nitric acid *HNO_3*
j. phosphorus pentiodide *PI_5*
k. iron (III) thiocyanate *$Fe(SCN)_3$*
l. sulphuric acid *H_2SO_4*
m. dinitrogen tetrafluoride *N_2F_4*

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

a. $Mn(SO_4)_2$ *manganese (IV) sulphate*
b. $PbCO_3 \bullet 6H_2O$ *lead(II) carbonate hexahydrate*
c. As_2O_3 *diarsenic trioxide*
d. CH_3COOH *acetic acid*
e. NiC_2O_4 *nickel (II) oxalate*
f. NF_3 *nitrogen trifluoride*
g. $(NH_4)_2HPO_4$ *ammonium monohydrogen phosphate*
h. $Ba(OH)_2 \bullet 10H_2O$ *barium hydroxide decahydrate*

38. What is a mole? *6.02 x 10^{23} of anything. The number of carbon-12 atoms in 12g carbon*

39. What is Avagadro's number? *6.02 x 10^{23}*

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 *0.6400 mol*
b. 0.00256 moles of $Li_2Cr_2O_7$ to grams of $Li_2Cr_2O_7$ *0.588 g*
c. 170.24 L of NO_2 at STP to moles NO_2 *7.60 mol*
d. 570.625 g of PCl_3 gas = litres of PCl_3 at STP *93.0 L*
e. 1030.4 mL of C_2H_6 gas at STP to grams C_2H_6 *1.38 g*
f. 5.00 kg of nitrogen gas to litres (STP) nitrogen gas *4.00 x 10^3 L*
g. 0.5696 kg of $CH_{4(g)}$ at STP to mL $CH_{4(g)}$ *7.97 x 10^5 mL*

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

2.5×10^2 g

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

Molecules: 1.20×10^{22} Oxygen Atoms: 3.61×10^{22}

43. What mass contain 0.0500 moles of calcium carbonate?

5.01 g

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.

3.62×10^{23} molecules

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.

13.6 g/mL

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

%Sr = 58.04% %P = 13.7% %O = 28.3%

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

%C = 42.11% %H = 6.43% %O = 51.46%

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?

Empirical Formula: CH Molecular Formula: C_6H_6

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. *76.80 g oxygen*
b. Determine the empirical formula for this compound. *KSO_4*
c. Determine the molecular formula for this compound. *$K_2S_2O_8$*

50. Balance the following equations:

a. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
b. $3(NH_4)_2C_2O_4 + 2AlCl_3 \rightarrow Al_2(C_2O_4)_3 + 6NH_4Cl$
c. $2C_{14}H_{30} + 43O_2 \rightarrow 28CO_2 + 30H_2O$
d. $2Fe + 6HNO_3 \rightarrow 2Fe(NO_3)_3 + 3H_2$
e. $P_4 + 6Cl_2 \rightarrow 4PCl_3$
f. $Na_2Cr_2O_7 + 14HCl \rightarrow 2NaCl + 2CrCl_3 + 7H_2O + 3Cl_2$
g. $2H_3PO_4 + 3Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + 6H_2O$
h. $Ba(ClO_4)_2 \rightarrow Ba + Cl_2 + 4O_2$
i. $2C_7H_{15}OH + 21O_2 \rightarrow 14CO_2 + 16H_2O$
j. $MgSO_4{\cdot}5H_2O \rightarrow MgSO_4 + 5H_2O$

51. Write the correct chemical formula for each compound and balance the equation.

a. sodium carbonate + calcium hydroxide → sodium hydroxide + calcium carbonate
   $Na_2CO_3 + Ca(OH)_2 \rightarrow 2NaOH + CaCO_3$
b. carbon dioxide + water → carbonic acid
   $CO_2 + H_2O \rightarrow H_2CO_3$
c. phosphorus + oxygen → phosphorus pentoxide
   $P_4 + 10O_2 \rightarrow 4PO_5$ *Phosphorus is P_4 in elemental form (you're not expected to know this)*
d. sodium + water → sodium hydroxide + hydrogen
   $2Na + 2H_2O \rightarrow 2NaOH + H_2$
e. zinc + sulfuric acid → zinc sulfate + hydrogen
   $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
f. aluminum sulfate + calcium hydroxide → aluminum hydroxide + calcium sulfate
   $Al_2(SO_4)_3 + 3Ca(OH)_2 \rightarrow 2Al(OH)_3 + 3CaSO_4$
g. calcium oxide + water → calcium hydroxide
   $CaO + H_2O \rightarrow Ca(OH)_2$
h. iron + copper(I) nitrate → iron(II) nitrate + copper
   $Fe + 2CuNO_3 \rightarrow Fe(NO_3)_2 + 2Cu$
i. iron(II) sulfide + hydrochloric acid → hydrogen sulfide + iron(II) chloride
   $FeS + 2HCl \rightarrow H_2S + FeCl_2$
j. potassium oxide + water → potassium hydroxide
   $K_2O + H_2O \rightarrow 2KOH$
k. carbon + ferric oxide → iron + carbon dioxide *ferric is iron (III)
   $3C + 2Fe_2O_3 \rightarrow 4Fe + 3CO_2$
l. sulfur tetrafluoride + water → sulfur dioxide + hydrofluoric acid
   $SF_4 + 2H_2O \rightarrow SO_2 + 4HF$
m. calcium hydroxide + phosphoric acid → calcium phosphate + water
   $3Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6H_2O$
n. aluminum sulfate + ammonia + water →aluminum hydroxide + ammonium sulfate
   $Al_2(SO_4)_3 + 6NH_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3(NH_4)_2SO_4$

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
   $3K_2SO_4 + 2Co(NO_3)_3 \rightarrow 6KNO_3 + Co_2(SO_4)_3$ *Double Replacement*
b. liquid propanol (C_3H_7OH) is burned in air
   $2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$ *Combustion*
c. ammonium nitrate is decomposed into its elements
   $2NH_4NO_3 \rightarrow 2N_2 + 4H_2 + 3O_2$ *Decomposition*
d. a piece of zinc is placed in a test-tube containing a solution of silver nitrate
   $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$ *Single Replacement*
e. bromine reacts with sodium iodide
   $Br_2 + 2NaI \rightarrow 2NaBr + I_2$ *Single Replacement*
f. bromine reacts with aluminum
   $3Br_2 + 2Al \rightarrow 2AlBr_3$ *Synthesis*

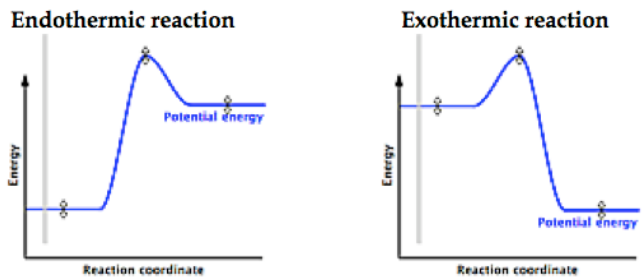
g. rubidium reacts with chlorine gas
$2Rb + Cl_2 \rightarrow 2RbCl$ Synthesis

h. hydrochloric acid reacts with strontium hydroxide
$2HCl + Sr(OH)_2 \rightarrow SrCl_2 + 2H_2O$ Neutralization

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

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

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).
$C + O_2 \rightarrow CO_2 + 107kJ$

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?

2.60g H_2	1 mol H_2	2 mol NH_3	17.0 g NH_3
	2.0g H_2	3 mol H_2	1 mol NH_3

= 15 g NH_3

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.
H_2 is limiting reactant as you need 3 H_2 molecules to react with 1 N_2 molecule:
So, <u>zero molecules of H_2</u> would be present at the end.
24/3 = 8 N_2 molecules needed, so 18 – 8 = <u>10 molecules N_2 leftover</u>.
24 molecules H_2 x $\frac{\text{2 molecules } NH_3}{\text{3 molecules } H_2}$ = <u>16 molecules NH_3</u> produced and present at 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?

5.5 mol H_2	2 mol NF_3
	3 mol H_2

= 3.7 mol NF_3

b. In order to produce 0.47 moles of HF, how many moles of NF_3 would be consumed?

0.47 mol HF	2 mol NF_3
	6 mol HF

= 0.16 mol NF_3

c. If you needed to produce 180.6 g of N_2, how many moles of H_2 would you need to start with?

180.6g N_2	1 mol N_2	3 mol H_2
	28.0g N_2	1 mol N_2

= 19.4 mol H_2

d. If you completely react 17.04 g of NF_3 , what mass of HF will be produced?

17.04g NF_3	1 mol NF_3	6 mol HF	20.0 g HF
	71.0g NF_3	2 mol NF_3	1 mol HF

= 14.4 g HF

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?

3.56mol HBr	3 mol Br_2	22.4 L Br_2
	5 mol HBr	1 mol Br_2

= 47.8 L Br_2

b. In order to produce 3.311 x 10^{24} molecules of Br_2, what mass of HBr is needed?

3.311 x 10^{24} molec Br_2	1 mol Br_2	5 mol HBr	80.9g HBr
	6.02 x 10^{23} molec Br_2	3 mol Br_2	1 mol HBr

= 742 g HBr

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.

317.5g Cu	1 mol Cu	2 mol NO
	63.5g Cu	3 mol Cu

= 3.33 mol NO

756.0g HNO_3	1 mol HNO_3	2 mol NO
	63.0g HNO_3	8 mol HNO_3

= 3.00 mol NO

HNO_3 is the limiting reactant, therefore, Cu is in excess.

b. If the reaction in (a) is carried out, what mass of NO will be formed?

3.00 mol NO	30.0g NO
	1 mol NO

= 90.0 g NO

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.

161.2g BN	1 mol BN	2 mol BF_3	67.8 g BF_3
	24.8g BN	2 mol BN	1 mol BF_3

= 441 g BF_3

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

161.2g BN	1 mol BN	1 mol N_2	22.4 L N_2
	24.8g BN	2 mol BN	1 mol N_2

= 72.8 L N_2

62. Explain the Pauli exclusion principle.
When electrons are filling orbitals, one electron will occupy each equal energy orbital before a second electron fills any one of those orbitals

63. Give the full electron configuration for each of the following:
a. C: $1s^2 2s^2 2p^2$
b. Na: $1s^2 2s^2 2p^6 3s^1$
c. Y: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^1$
d. Hg: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10}$

64. Give the core notation for each of the following:
a. P $[Ne]3s^2 3p^3$
b. Mo $[Kr]5s^1 4d^5$ *(s to d elevation)*
c. Se $[Ar]4s^2 3d^{10} 4p^4$
d. Rb $[Kr]5s^1$
e. Cl^- $[Ne]3s^2 3p^6$ *OR* $[Ar]$
f. Al^{3+} $[Ne]$
g. Fe^{3+} $[Ar]3d^5$
h. S^{2-} $[Ne]3s^2 3p^6$ *OR* $[Ar]$
i. Cu^+ $[Ar]3d^{10}$

65. The principal quantum number is represented by what letter and gives information about what? *Represented by the letter 'n' and gives the energy level of the electron*

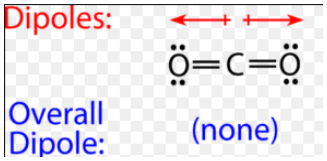
66. What aspect of an atom's structure largely determines its chemical behavior?

Valence electrons

67. State the main trends in the periodic table for:
    a. Ionization energy: *increases left to right, decreases top to bottom*
    b. Metallic behavior: *decreases left to right, increases top to bottom*
    c. Electronegativity: *increases left to right, decreases top to bottom*
    d. Atomic radius: *decreases left to right, increases top to bottom*

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.
    Ionic: Transfer of electrons, occurs when electronegativity difference exceeds 1.7
    Polar Covalent: unequal sharing of electrons, occurs when electronegativity difference is between 0.2 and 1.7
    Non-Polar Covalent: equal sharing of electrons, occurs when electronegativity difference is below 0.2

69. Explain how a molecule may have polar bonds but as a whole is a non-polar molecule. Can you give an example?
    If the polar bonds all cancel each other out in terms of orientation and strength, you will have a non-polar molecule. CO_2 is an example

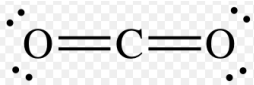


70. Put the following kinds of intermolecular forces in order of decreasing strength: London Forces, hydrogen bonds, dipole-dipole forces. Give an example of substances exhibiting each of the kinds of forces.
    1) Hydrogen Bonding: water, ammonia
    2) Dipole-Dipole: PCl_3, $SiBr_4$
    3) London Forces: H_2, PH_3, Ne, Ar

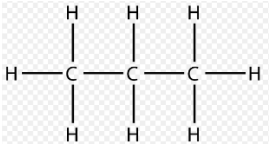
71. Is an ion a polar or non-polar particle?
    An ion is a polar particle as it has a net charge.

72. Draw Lewis Structures for and identify the shape(s) of each:

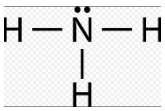
    a. CO_2



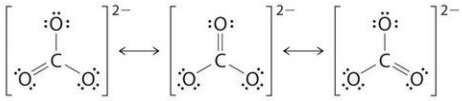
    b. C_3H_8



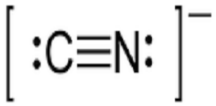
    c. NH_3



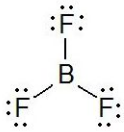
d. CO_3^{2-}



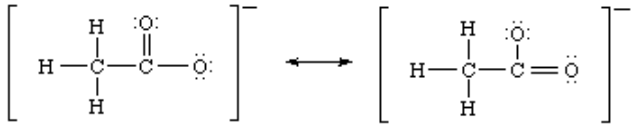
e. CN^-



f. BF_3



g. CH_3COO^-



73. Write dissociation equations for:
   a. $MgCl_{2(s)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^-_{(aq)}$

   b. $(NH_4)_2CO_{3(s)} \rightarrow 2NH_4^+{}_{(aq)} + CO_3^{2-}{}_{(aq)}$

74. Which of the following are soluble in water? *Use your Solubility Table*
   a. PbS: *Low Solubility*
   b. $(NH_4)_2CO_3$: *Soluble*
   c. $Mg(OH)_2$: *Low Solubility*
   d. $BaSO_4$: *Low Solubility*
   e. SrS: *Soluble*

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.
   $\frac{123.11g}{189.4\ g/mol} = 0.6500\ mol\ Zn(NO_3)_2$ $\quad [Zn(NO_3)_2] = \frac{0.6500\ mol}{0.6500\ L} = 1.000\ M$

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.
   (0.200 M)(0.8000 L) = 0.160 mol K_2SO_3 $\quad$ *0.160 mol x 158.3 g/mol = 25.3 g 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?
   $\frac{47.232\ g}{73.8\ g/mol} = 0.640\ mol\ Li_2CO_3$ $\quad \frac{0.640\ mol}{2.50\ M} = 0.256\ L\ Li_2CO_3$

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

$M_iV_i = M_fV_f$ $[HNO_3]_f = \frac{(0.45M)(0.4000L)}{0.5500\ L} = 0.33\ M\ HNO_3$

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?

$M_iV_i = M_fV_f$ $V_f = \frac{(4.00M)(0.1500L)}{2.50\ M} = 0.240\ L$ 0.240 L – 0.1500 L = 0.090 L

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.

(5.00L)(0.020M) = 0.10 mol $Ca(ClO)_2$ 0.10 mol $Ca(ClO)_2$ x 143.1g/mol = 14 g $Ca(ClO)_2$
Weigh out 14g of $Ca(ClO)_2$ and put into a 5.00L volumetric flask. Fill water halfway, swirl to dissolve the salt, then fill to the line.

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

(0.20M)(0.2L) = 0.04 mol NaOH 0.04 mol NaOH x 40.0g/mol = 1.6g = 2 g NaOH

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

$M_iV_i = M_fV_f$ $M_f = \frac{(3.00M)(0.25L)}{0.35L} = 2.1\ M\ HCl$

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?

$M_iV_i = M_fV_f$ $V_i = \frac{(0.050M)(0.5L)}{3.00M} = 8\ mL$

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.

$M_iV_i = M_fV_f$ $[MgCl_2]_f = \frac{(0.40M)(0.0250L)}{0.0705L} = 0.\underline{14}2\ M = 0.14\ M\ MgCl_2$

$M_iV_i = M_fV_f$ $[K_2S]_f = \frac{(0.80M)(0.0455L)}{0.0705L} = 0.\underline{51}6\ M = 0.52\ M\ K_2S$

$MgCl_{2(aq)} \rightarrow Mg^{2+}_{(aq)} + 2Cl^-_{(aq)}$
0.$\underline{14}$2 M 0.$\underline{14}$2 M 0.$\underline{28}$4 M

$K_2S_{(aq)} \rightarrow 2K^+_{(aq)} + S^{2-}_{(aq)}$
0.$\underline{51}$6 M $\underline{1.03}$ M 0.$\underline{51}$6M

Final Answer: $[Mg^{2+}] = 0.14\ M$, $[K^+] = 1.03\ M$, $[Cl^-] = 0.28\ M$, $[S^{2-}] = 0.52\ M$

85. What is a saturated solution?

A solution that has the maximum amount of solute. The rate of dissolving equals the rate of recrystallization.

86. Write the formula, complete ionic, and net ionic equation for the following:

a. $CaCl_{2(aq)} + K_2SO_{4(aq)}$

b. $Sr(OH)_{2(aq)} + MgSO_{4(aq)}$

a) F: $CaCl_{2(aq)} + K_2SO_{4(aq)} \rightarrow CaSO_{4(s)} + 2KCl_{(aq)}$

C: $Ca^{2+}_{(aq)} + 2Cl^{-}_{(aq)} + 2K^{+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow CaSO_{4(s)} + 2K^{+}_{(aq)} + 2Cl^{-}_{(aq)}$

N: $Ca^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow CaSO_{4(s)}$

b) F: $Sr(OH)_{2(aq)} + MgSO_{4(aq)} \rightarrow SrSO_{4(s)} + Mg(OH)_{2(s)}$

C: $Sr^{2+}_{(aq)} + 2OH^{-}_{(aq)} + Mg^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow SrSO_{4(s)} + Mg(OH)_{2(s)}$

N: $Sr^{2+}_{(aq)} + 2OH^{-}_{(aq)} + Mg^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow SrSO_{4(s)} + Mg(OH)_{2(s)}$

#87 is on the next page…

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