Final Exam Study Guide (CP and Honors) Name: KEY

Measurements in Science:

1. Determine the correct number of significant digits:
   a. 356.56 = 5
   b. 0.00201 = 3
   c. 23000 = 2
   d. 34.000 = 5
2. Record your answer in the correct number of significant digits:
   a. 3.5 + 2.003 = 5.5
   b. 2.35 x 1200 = 2800
   c. 100.50 – 22.445 = 78.06
   d. 80.626 / 21 = 3.8

Atomic Structure:

3. List the three subatomic particles, their location, their charge, and their relative size compared to each other:

Particle	Location	Charge	Relative Size (amu)
Proton	Nucleus	+	1
Neutron	Nucleus	0	1
Electron	Electron Cloud	–	0

4. Name the group each element is a part of, write the number of valence electrons and determine the oxidation number.

A) Nitrogen — Nitrogen Family — 5 ve⁻ / -3 ox #
B) Calcium — Alkaline Earth Metals — 2 ve⁻ / +2 ox #
C) Chlorine — Halogens — 7 ve / -1 ox #
D) Neon — Noble Gases — 8 ve⁻ / 0 ox #
E) Iron — Transition Metal — # of valence e and ox # vary

Fill in the blanks with the correct terms:

5. atomic # is equal the number of protons in an atom.
6. average atomic mass is the average mass of all the isotopes for a particular element.
7. mass # is the sum of the protons and neutrons of an atom.
8. isotopes are forms of the same element, but different numbers of neutrons.
9. ions are atoms that have gained or lost electrons.
10. families Vertical columns on the periodic table. All elements in these columns have similar properties.
11. periods Horizontal rows on the periodic table. All elements in these rows have same # of energy levels.
12. ox # Term for the number of electrons gained lost or shared in order to get an octet.
13. valence are the outermost electrons for an atom.
14. ionic type of bonding where electrons are transferred. Formed between a metal and nonmetal
15. covalent type of bonding where electrons are shared. Formed between two nonmetals.
16. % yield The equation for this is (Experimental / Actual) x 100
17. metals are to the left of the staircase and have + oxidation numbers. These atoms lose e⁻.
18. nonmetals are to the right of the staircase and have – oxidation numbers. These atoms gain e⁻.
19. metalloids are the elements that touch the staircase. They have properties of both metals and nonmetals.
20. zero the sum of the oxidation numbers in an ionic bond.

49. Determine which molecule of the pair has the greater **bond** polarity, explain why.

A) Carbon Disulfide or (Sulfur Difluoride) Sulfur and fluorine have a greater difference in electronegativity, giving it a greater bond polarity.

B) Boron Trihydride or (Ammonia (NH_3))

Chemical Reactions:

For the following, balance and classify the reactions:

50. $2\ C_3H_8 + 1\ O_2 \rightarrow 6\ CO_2 + 8\ H_2O$ Rxn type: combustion

51. $2\ HBr + \_\_\ Ca(OH)_2 \rightarrow \_\_\ H_2O + \_\_\ CaBr_2$ Rxn type: acid base

52. $3\ Pb + 2\ H_3PO_4 \rightarrow 3\ H_2 + \_\_\ Pb_3(PO_4)_2$ Rxn type: single replacement

53. $2\ AlBr_3 + 3\ K_2SO_4 \rightarrow 6\ KBr + \_\_\ Al_2(SO_4)_3$ Rxn type: double replacement

54. $2\ Hg_2I_2 + \_\_\ O_2 \rightarrow 2\ Hg_2O + 2\ I_2$ Rxn type: single replacement

55. $2\ N_2O_5 \rightarrow \_\_\ O_2 + 4\ NO_2$ Rxn type: decomposition

Translate, predict the products, and then balance the equation. Include states of matter!

56. Potassium reacts with Aluminum Sulfate →

$6\ K_{(s)} + Al_2(SO_4)_{3(aq)} \rightarrow 3\ K_2SO_{4(aq)} + 2\ Al_{(s)}$

57. Silver Nitride combines with Magnesium Sulfite →

$2\ Ag_3N_{(aq)} + 3\ MgSO_{3(aq)} \rightarrow 3\ Ag_2SO_{3(s)} + Mg_3N_{2(aq)}$

58. Phosphoric Acid reacts with Barium Hydroxide →

$2\ H_3PO_{4(aq)} + 3\ Ba(OH)_2 \rightarrow 6\ HOH_{(l)} + Ba_3(PO_4)_{2(aq)}$

For the reactions below, identify the oxidizing agent, the reducing agent, what has been reduced, and what has been oxidized.

59. $\overset{0}{4Na} + \overset{0}{O_2} \rightarrow \overset{+1\ -2}{2Na_2O}$

Na = oxidized because it loses electrons (reducing agent)

O = reduced because it gains electrons (ox. agent)

60. $\overset{+2}{Mg}(NO_3)_2 + \overset{0}{2Li} \rightarrow \overset{+1}{2LiNO_3} + \overset{0}{Mg}$

Li = oxidized / reducing agent

Mg = reduced / oxidizing agent

HONORS: For the following two reactions, determine the Net Ionic Reactions:

61. $Mg(ClO_3)_2 + 2NH_4OH \rightarrow Mg(OH)_2 + 2NH_4ClO_3$

$Mg^{+2}_{(aq)} + 2OH^{-1}_{(aq)} \rightarrow Mg(OH)_{2(s)}$

62. $2LiF + BeSO4 \rightarrow Li_2SO_4 + BeF_2$

NO Reaction

21. Fill in the following table:

NAME	SYMBOL	ATOMIC #	MASS #	PROTONS	ELECTRONS	NEUTRONS	CHARGE
Nickel - 59	$^{59}_{28}Ni$	28	59	28	28	31	0
Strontium - 88	$^{88}_{38}Sr^{+2}$	38	88	38	36	50	+2
Phosphorous - 33	$^{33}_{15}P^{-3}$	15	33	15	18	18	-3

Periodic Trends and Light:

22. Explain the difference between electronegativity and electron affinity. In what directions on the periodic table do they both increase? Electronegativity is the tendency for an atom's nucleus to attract electrons from ANOTHER atom into a chemical bond, whereas electron affinity is the amount of energy needed to gain an electron. They both increase from left to right and bottom to top.

23. Define ionization energy. In what directions on the periodic table does it increase?
Ionization energy is the amount of energy required to remove an electron. 1st ionization energy increases from left to right and from bottom to top.

24. Identify the element that has the highest: A) electronegativity, B) atomic radius, and C) ionization energy.
A) Fluorine B) Francium C) Helium

25. When an atom becomes a cation, what happens to its # of electrons and its overall radius? When at atom becomes an anion, what happens to its # of electrons and its overall radius? Cations lose electrons and so their atomic radius decreases because they have less energy levels. Anions gain electrons and their atomic radius increases because electrons are repelling in the same energy level.

26. Describe the complete process in which an atom of sodium would give off light, as they do in many streetlights.
① An electron must absorb energy to jump from the ground state to excited state.
② When an electron falls from the excited state to a lower energy level, it releases energy.
③ Energy is released in the form of a photon (VISIBLE LIGHT)

27. **HONORS:** Using the equations $c = \lambda\nu$ and $E = h\nu$ if a ray of light has a wavelength of 7.00×10^{-7} m, what is the frequency of this wave? What is the energy of this wave, where h is planck's constant and = 6.626×10^{-34}?

$c = \lambda\nu$

$3.00 \times 10^{8} \frac{m}{s} = (7.00 \times 10^{-7} m)\nu$

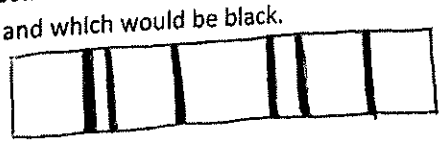
$\nu = 4.29 \times 10^{14} s^{-1}$

$E = h\nu$

$E = (6.626 \times 10^{-34} J \cdot s)(4.29 \times 10^{14} s^{-1})$

$E = 2.84 \times 10^{-19} J$

28. Each element gives off a unique set of spectral lines which show the individual colors of light given off by the atom. Sketch what a set of spectral lines would look like from an absorption spectrum and an emission spectrum. Label which parts would be colored and which would be black.

Absorption 

Emission 

↑ each colored line is the wavelength of visible light we see when an electron FALLS from excited state to ground state (high → low energy level)

Electron Configuration and Orbital Diagrams:

29. Write the full electron configuration for the following elements: Mg, Fe, and Br

Mg: $1s^2\ 2s^2\ 2p^6\ 3s^2$

Fe: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$

Br: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

30. Write the noble gas electron configuration (using the noble gas as a shortcut) for the elements In, Ta, and Ti

In [Kr] $5s^2\ 4d^{10}\ 5p^1$

Ta [Xe] $6s^2\ 4f^{14}\ 5d^3$

Ti [Ar] $4s^2\ 3d^2$

31. Draw the noble gas orbital diagrams (boxes and arrows using the noble gas as a shortcut) for: S, As, and Zr

S [Ne] 3s 3p

As [Ar] 4s 3d 4p

Zr [Kr] 5s 4d

32. Describe Hund's rule, Pauli's Exclusion Principle, and the Aufbau Principle for orbital diagrams, and show an example for each where it is not being correctly followed.

Hund's Rule: every orbital gets 1 e^- before it pairs

Violation: 1s 2s 2p

Pauli Exclusion Principle: when electrons are paired, they must have opposite spins.

Violation: 1s 2s 2p

Aufbau Principle: electrons must fill in the lowest energy level first.

Violation: 1s 2s 2p

33. Using the example of Arsenic (As) above, how many valence electrons does it have? Which orbitals are included in this number? Arsenic has 5 valence electrons located in the 4s and 4p sublevels.

As [Ar] 4s 3d 4p

34. An *orbital* is one region where a pair of electrons are most likely to be found. These orbitals are grouped into *sublevels* based on their shape and the order they are filled. How many orbitals are in each of the 4 different sublevels (s,p,d,f)?

S sublevel contains 1 orbital

P sublevel contains 3 orbitals

d sublevel contains 5 orbitals

f sublevel contains 7 orbitals

Nuclear Chemistry

35. What does it mean for an atom to be radioactive? What is it going to do eventually as a result of this?

A radioactive isotope has an extremely unstable nucleus. Eventually, it will fission in order to become stable, either undergoing alpha, beta, or gamma decay.

36. Give the nuclear symbol with the numbers of an alpha particle, a beta particle, and a gamma ray. Describe how powerful each one is based on how deep it can penetrate.

^4_2He = alpha — least penetrating, can be blocked by paper.

$^0_{-1}e$ = Beta — moderately penetrating, can be blocked by Al foil.

$^0_0\gamma$ = gamma — most penetrating, can be blocked by lead shields or concrete.

37. Describe the difference between nuclear fusion and nuclear fission, including the starting substances, products, and temperatures at which they occur. Give 2 examples where process occurs.

~~38.~~ Nuclear fission is when a radioactive isotope splits to become stable. This happens at relatively low temperatures resulting in 2 stable atoms.
Nuclear fusion is when 2 small nuclei combine at VERY high temperatures.

39. An example of a half-life chart is shown. Mathematically, what is happening to the mass as you move down the column? What is happening to the time column?

Mass	Time	# of Half-lives
100 g	0 s	0
50 g	75 s	1
25 g	150 s	2
12.5 g	225 s	3
6.25 g	300 s	4

÷ by 2 in ½

Adds 75s every time

Every half life that passes, the mass decreases by half and the time increases by the length of 75 seconds.

40. How much of an 800 kg sample of carbon-14 is leftover after 28650 years, if C-14 has a half-life of 5730 years?

$\frac{28650\ years}{5730\ years} = 5$ half lives

① 800 kg ÷ 2 = 400 kg
② 400 kg ÷ 2 = 200 kg
③ 200 kg ÷ 2 = 100 kg
④ 100 kg ÷ 2 = 50 kg
⑤ 50 kg ÷ 2 = **25 kg**

Naming and Bonding:

41. Name the following compounds: Determine if they are Ionic and if a Trans. Metal is present, Covalent or an Acid.

A) $CaBr_2$ = Calcium bromide B) NiP = Nickel (III) phosphide C) N_3O_7= trinitrogen heptaoxide

D) AlF_3 = Aluminum fluoride E) H_2S = hydrosulfuric acid F) $CuBr_2$ = copper (II) bromide

G) KNO_3= potassium nitrate H) CCl_4 = carbon tetrachloride I) S_2F_3= disulfur trifluoride

J) H_2SO_4= sulfuric acid K) ZnI_3 = zinc (III) iodide L) H_2PO_3= phosphorous acid

M) B_2Br_5 = diboron pentabromide N) $Mn(ClO_4)_2$ = manganese (II) perchlorate O) HCl = hydrochloric acid

42. Write the correct formulas for the following compounds:

A) Lithium Sulfite = Li_2SO_3 B) Iron (II) Phosphide= Fe_3P_2 C) Tetrasulfur Pentafluoride = S_4F_5

D) Phosphoric Acid = H_3PO_4 E) Barium Nitride= Ba_3N_2 F) Hydronitric Acid = H_3N

G) Copper (III) Iodide = CuI_3 H) Aluminum Phosphate= $AlPO_4$ I) Calcium Oxide= CaO

J) Barium Oxide = BaO K) Gallium Hydroxide = $Ga(OH)_3$ L) Silicon Heptabromide = $SiBr_7$

M) Ammonium Phosphate = $(NH_4)_3PO_4$ N) Sulfurous Acid = H_2SO_3

Molecular Geometry and Intermolecular Forces

43. An attraction between two molecules due to a small difference in electronegativity is dipole-dipole

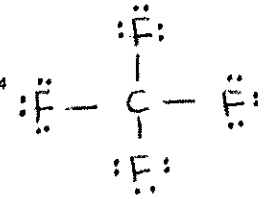
44. When there is an unequal sharing of electrons within a molecule, it is said to be polar

45. When a molecule has perfect symmetry and all bonding regions are the same, it is considered nonpolar

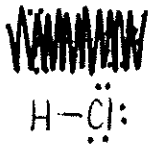
46. **HONORS:** A special type of dipole-dipole interaction that involves OH, FH and NH bonds Hydrogen Bonding

47. **HONORS**: An intermolecular force achieved when electrons temporary shift is called London Dispersion

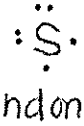
48. Draw the Lewis Dot for each molecule. Determine if the Bonds are polar or nonpolar, and if the Molecule is polar or nonpolar. **HONORS:** Write what type of intermolecular bonding each of these examples will have and why?

A) CF_4 

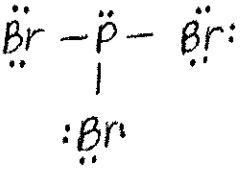
London Dispersion

B) HCl 

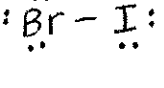
Dipole-Dipole

C) S 

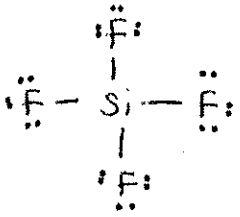
London Dispersion

D) PBr_3 

Dipole-Dipole

E) BrI 

Dipole-Dipole

F) SiF_4 

London Dispersion

Molar Conversions

63. For the following, determine the molar mass of each compound:

A) $MgCl_2$ 95.21 g/mol

B) $Mg(OH)_2$ 58.33 g/mol

C) $Ca(NO_3)_2$ 164.06 g/mol

64. Determine the percent composition by mass of sodium for the following two compounds.

NaBr: $\%Na = \frac{22.99\ g/mol}{102.89\ g/mol} \times 100$

$\%Na = 22.34\%$

Na_2S: $\%Na = \frac{45.98\ g/mol}{78.05\ g/mol} \times 100$

$\%Na = 58.91\%$

65. Determine the number of moles in 2.5 grams of O_2

$2.5\ g\ O_2 \times \frac{1\ mol\ O_2}{32.00\ g\ O_2} = 0.078\ mol\ O_2$

66. Determine the number of grams in 2.5 moles of O_2

$2.5\ mol\ O_2 \times \frac{32.00\ g\ O_2}{1\ mol\ O_2} = 80.\ g\ O_2$

67. Determine the number of particles in 2.5 moles of O_2

$2.5\ mol\ O_2 \times \frac{6.02 \times 10^{23}\ mc\ O_2}{1\ mol\ O_2} = 1.5 \times 10^{24}\ mc\ O_2$

68. Determine the number of grams in 2.5×10^{23} formula units of NaCl

$2.5 \times 10^{23}\ F.u\#O_2 \times \frac{1\ mol\ O_2}{6.02 \times 10^{23}\ mcO_2} \times \frac{32.00\ g\ O_2}{1\ mol\ O_2} = 13\ g\ O_2$

69. Determine the moles of 200 grams of CaO

$200\ g\ CaO \times \frac{1\ mol\ CaO}{56.08\ g\ CaO} = 4\ mol\ CaO$

70. Determine the number of atoms in 36 grams of Carbon.

$36\ g\ C \times \frac{1\ mol\ C}{12.01\ g\ C} \times \frac{6.02 \times 10^{23}\ atoms\ C}{1\ mol\ C} = 1.8 \times 10^{24}\ atoms\ C$

71. A compound, Ammonium Bromate has the following percent composition by mass. Determine the empirical formula for the compound.

NH_4BrO_3

9.59 % Nitrogen 2.76 % Hydrogen 54.74 % Bromine 32.89 % Oxygen

$9.59\ g\ N \times \frac{1\ mol\ N}{14.01\ g\ N} = \frac{0.685\ mol\ N}{0.685\ mol} = 1$

$2.76\ g\ H \times \frac{1\ mol\ H}{1.01\ g\ H} = \frac{2.73\ mol\ H}{0.685\ mol} = 4$

$54.74\ g\ Br \times \frac{1\ mol\ Br}{79.9\ g\ Br} = \frac{0.685\ mol\ Br}{0.685\ mol} = 1$

$32.89\ g\ O \times \frac{1\ mol\ O}{16.00\ g\ O} = \frac{2.05\ mol\ O}{0.685\ mol} = 3$

72. You have determined that an empirical formula of a compound is CH_2O. What would be the molecular formula for glucose if its molecular mass is 180 grams/mol?

	Empirical	Molecular
Formula	CH_2O	$C_6H_{12}O_6$
Mass	30 g/mol	180 g/mol

Empirical and molecular formulas are related by MASS.

$\frac{180\ g/mol}{30\ g/mol} = 6$

73. An empirical formula for an Alkane would be C_2H_6. What would be the molecular formula for Decane, with a molecular mass of 150.4 g/mol?

	Empirical	Molecular
Formula	C_2H_6	$C_{10}H_{30}$
Mass	30.08 g/mol	150.4 g/mol

Solutions and Dilutions

74. What is the percent by mass of a NaCl if 5.68 grams of the salt is dissolved in 150 mL of water?

$\%\,NaCl = \frac{NaCl}{NaCl + H_2O} \times 100$ $\%\,NaCl = \frac{5.68\,g}{155.68\,g} \times 100 = \boxed{3.65\%}$

75. How many grams of $KClO_4$ is dissolved into a 175 grams of solution that is 3.5 % by mass?

$\%\,KClO_4 = \frac{KClO_4}{KClO_4 + H_2O} \times 100$ $3.5\% = \frac{KClO_4}{175\,g} \times 100$ $\boxed{KClO_4 = 6.1\,g}$

76. How many grams of $AlCl_3$ are required to make a 2.25M solution in 30.0 mL of water?

$30.0\,mL \times \frac{1\,L}{1000\,mL} \times \frac{2.25\,mol\,AlCl_3}{1\,L} \times \frac{133.33\,g\,AlCl_3}{1\,mol\,AlCl_3} = 9.00\,g\,AlCl_3$

77. What volume of 12*M* HCl is needed to prepare 250 mL of 0.20*M* HCl?

$M_1V_1 = M_2V_2$ $(12M)(V_1) = (0.20M)(250\,mL)$ $V_1 = 4.2\,mL$

78. A solution contains 8.3 moles of NaCl in 1250 mL of water. What is its molarity?

$M = \frac{mol}{L}$ $M = \frac{8.3\,mol}{1.250\,L}$ $M = 6.6\,\frac{mol}{L}$

79. If 150 mL of water is added to 250 mL of a 3.1 M solution, what is the molarity of the new solution?

$M_1V_1 = M_2V_2$ $(M_1)(400\,mL) = (250mL)(3.1M)$ $M_1 = 1.9\,\frac{mol}{L}$

80. How much water is added to 500. mL of 6.8 M solution to dilute it to a molarity of 3.2 M? $1062.5 - 500mL$

$M_1V_1 = M_2V_2$ $(6.8M)(500\,mL) = (3.2M)(V_2)$ $V_{added} = \boxed{560\,mL}$

Use the solubility graph to the right to answer the following questions:

81. What is the **least** soluble compound at 20 °C?

$KClO_3$

82. According the slop of the line for NH_3, we can assume that it is a gas.

83. 60 grams of KNO_3 are dissolved at 50° C. How many grams of KNO_3 would need the be added to saturate the solution at this temperature?

20 grams

84. What two salts have the same degree of solubility at 19° C?

NaCl / NH_4Cl

85. A saturated solution of potassium nitrate is prepared at 60° C using 100. mL of water. How many grams of solute will precipitate out of the solution if the temperature is suddenly cooled to 30° C?

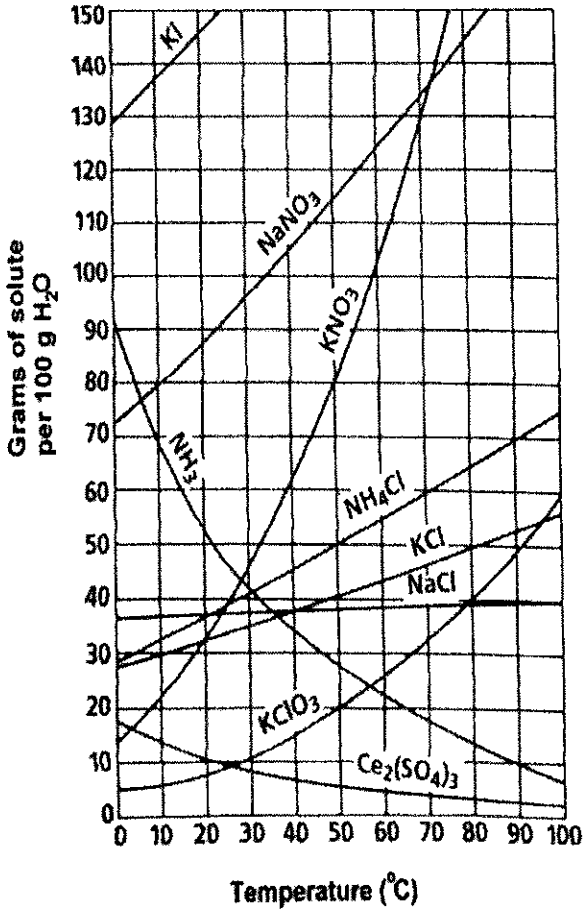
55 grams

86. If 50. mL of water that is saturated with $KClO_3$ at 25° C is solely evaporated to dryness, how many grams of the dry salt would be recovered?

5 grams

87. Which of the salts has the greatest solubility at 10° C?

KI



Stoichiometry

88. If you have 12 grams of Nitrogen, how many moles of Ammonia (NH_3) will you have?

$\_\_N_2 + \underline{3}\ H_2 \rightarrow \underline{2}\ NH_3$

$12\,g\ N_2 \times \frac{1\,mol\ N_2}{28.02\,g\ N_2} \times \frac{2\,mol\ NH_3}{1\,mol\ N_2} = 0.856\,mol\ NH_3$

89. If you have 3.5 moles of Hydrogen, how many grams of Ammonia(NH_3) will you produce?

$3.5\,mol\ H_2 \times \frac{2\,mol\ NH_3}{3\,mol\ H_2} \times \frac{17.04\,g\ NH_3}{1\,mol\ NH_3} = 40.\,g\ NH_3$

90. 4.5 moles of Calcium are used, how many moles of Lithium will be produced?

$\_\_Ca + \underline{2}\ LiF \rightarrow \_\_CaF_2 + \underline{2}\ Li$

$4.5\,mol\ Ca \times \frac{2\,mol\ Li}{1\,mol\ Ca} = 9.0\,mol\ Li$

91. 45.8 grams of Lithium Fluoride will produce how many grams of Calcium Fluoride?

$45.8\,g\ LiF \times \frac{1\,mol\ LiF}{25.94\,g\ LiF} \times \frac{1\,mol\ CaF_2}{2\,mol\ LiF} \times \frac{78.08\,g\ CaF_2}{1\,mol\ CaF_2} = 68.9\,g\ CaF_2$

92. If an experiment yields 3.56 grams of product, and the mass expected from calculations is 4.2 grams, what is your percent yield?

$\frac{3.56\,g}{4.2\,g} \times 100 = 84.7\ \%\ yield$

93. What is a limiting reactant?

The reactant that produces the lowest amount of product.

94. **HONORS:** If 5.6 grams of hydrochloric acid is reacted with 10.4 grams of calcium hydroxide, how many grams of water will be produced? What is the limiting reactant? $2HCl + Ca(OH)_2 \rightarrow 2H_2O + CaCl_2$

$5.6\,g\ HCl \times \frac{1\,mol\ HCl}{36.46\,g\ HCl} \times \frac{2\,mol\ H_2O}{2\,mol\ HCl} \times \frac{18.02\,g\ H_2O}{1\,mol\ H_2O} = \boxed{2.8\,g\ H_2O}$ LR IS HCl

$10.4\,g\ Ca(OH)_2 \times \frac{1\,mol\ Ca(OH)_2}{74.1\,g\ Ca(OH)_2} \times \frac{2\,mol\ H_2O}{1\,mol\ Ca(OH)_2} \times \frac{18.02\,g\ H_2O}{1\,mol\ H_2O} = 5.1\,g\ H_2O$

Acids & Bases

State whether the following are acids or bases, or both.

95. Have a sour taste. Acids

96. Has a pOH of 8.5 ~~Bases~~ Acids

97. Feel slippery Base

98. Has a pH of 8.5. Base

99. Damaging to skin if concentrated Both

100. Turns blue litmus paper red Acid

101. Produces hydronium ions according to Arrhenius Acid

102. Produces hydroxide ions according to Arrhenius Base

103. Donates protons according to Bronsted-Lowry Acid

104. Accepts protons according to Bronsted-Lowry Base

105. Can produce hydrogen gas if reacting with metals Acid

106. Found in Milk of Magnesia Base

107. **HONORS:** A solution has an H+ concentration of 1.27×10^{-12} M. What is the pOH of the solution? Is it an acid or base?

$pH = -\log(1.27 \times 10^{-12}\,M)$

$pH = 11.9$

$pH + pOH = 14$

$14 - 11.9 = pOH$

$pOH = 2.1$

108. **HONORS:** A solution has a pOH of 3.46. What is the pH of the solution?

$pH + pOH = 14$ $\quad pH = 14 - 3.46$ $\quad pH = 10.54$

Gas Laws

109. What are the five principles of kinetic molecular theory?

① gases are tiny particles
② Temperature is proportional to average KE.
③ collisions produce pressure

110. Some students believe that teachers are full of hot air. If Ms. K inhales 2.2 liters of gas at a temperature of 18° C and it heats to a temperature of 38° C in her lungs, what is the new volume of the gas?

$\frac{V_1}{V_2} = \frac{T_1}{T_2}$ $\quad \frac{2.2\,L}{V_2} = \frac{291\,K}{311\,K}$ $\quad V_2 = 2.4\,L$

111. What is the Ideal Gas Law? What units do you have to use when using the Ideal Gas Law?

$PV = nRT$ $\quad P = atm$ $\quad n = mol$ $\quad V = L$ $\quad T = K$

112. A gas has a volume of 400.0 mL at 3.00 °C and 120.0 torr. What would the volume of the gas be at 117.0 °C and 3350.0 torr of pressure?

$\frac{P_1V_1}{P_2V_2} = \frac{n_1R_1T_1}{n_2R_2T_2}$ $\quad \frac{(120\,torr \times \frac{1\,atm}{760\,torr})(.400L)(390K)}{(3350\,torr \times \frac{1\,atm}{760\,torr})(276K)} = V_2 = 0.0202L$

113. If there is a gas at 440.0 mmHg with a volume of 350.0 mL, what volume does this change to when the pressure is changed to 1.5 atm?

$P_1V_1 = P_2V_2$ $\quad \frac{(440.0mmHg \times \frac{1atm}{760\,mmHg})(0.3500L)}{1.5\,atm} = V_2 = 0.135L$

114. If a gas is closed in a container at 23.0 °C then pressurized from 855 torr to 1422 torr, what will the new temperature of the gas be?

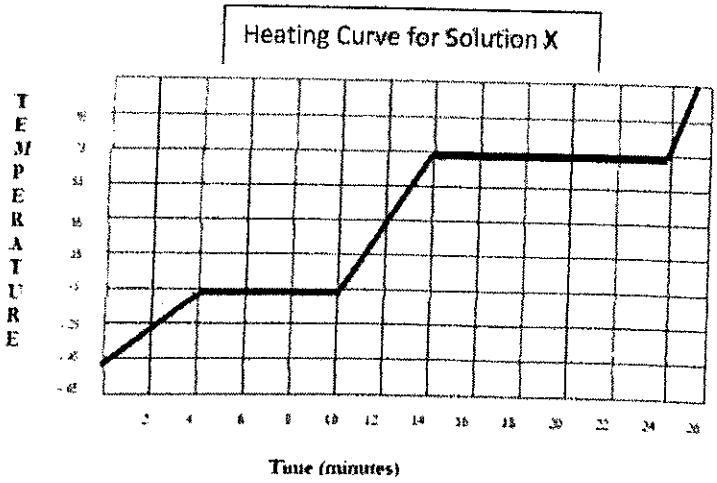
$\frac{P_1}{P_2} = \frac{T_1}{T_2}$ $\quad \frac{(855\,torr \times \frac{1atm}{760\,torr})}{(1422\,torr \times \frac{1atm}{760\,torr})} = \frac{(296K)}{T_2}$ $\quad T_2 = 492\,K$

115. How much pressure would 0.389 moles of Neon gas exert on a 275 mL container at 32°C?

$P = \frac{nRT}{V}$ $\quad P = \frac{0.389\,mol\,(0.08206\,\frac{L \cdot atm}{mol \cdot K})(305K)}{0.275L} = 35.4\,atm$

Thermochemistry

Use the heating curve to the right to answer the following questions:



116. During what times would solid be found in the beaker?

0 - 10 min

117. During what times would liquid be found in the beaker?

4 - 24 min

118. During what times would gas be found in the beaker?

14 - 20 min

Indicate whether a heating curve would be *flat* or *rising*.

119. liquid is boiling Flat

120. solid is warming Rising

121. solid is melting Flat

122. kinetic energy (temp) is increasing Rising

123. Only gas exists Rising

Describe the following processes as endothermic or exothermic, and describe if heat is absorbed or released:

124. Freezing exo, release

125. Condensing exo, release

126. Melting endo, absorb

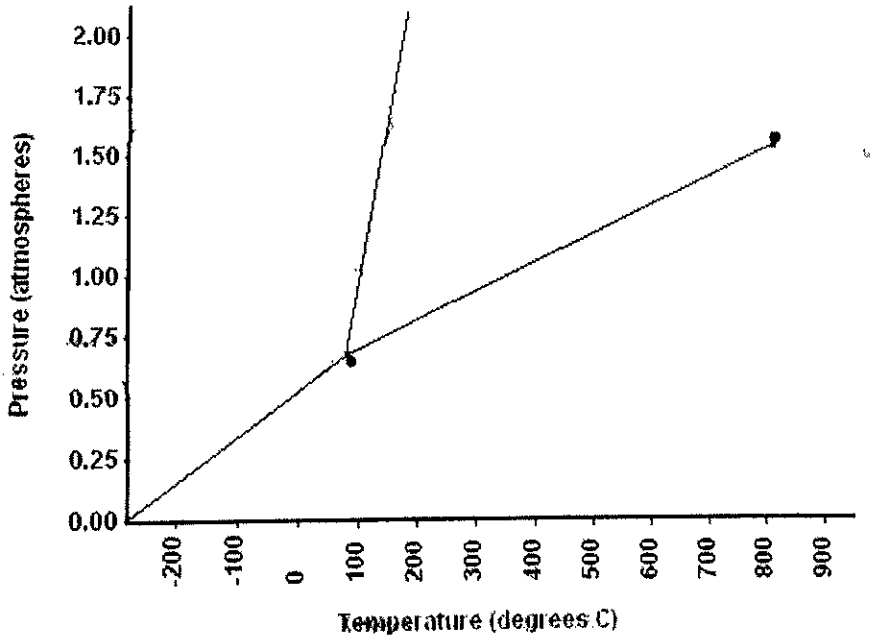
127. Vaporizing endo, absorb

128. Depositing exo, release

129. Subliming endo, absorb

HONORS: Refer to the phase diagram below when answering the questions

NOTE: "*Normal*" refers to STP – Standard Temperature and Pressure.



130. What are the values for temperature and pressure at STP? T= 273, P= 1 atm

131. What is the ***normal*** freezing point of this substance? 100 °C

132. What is the ***normal*** boiling point of this substance? 350 °C

133. What is the phase (s, l, g) of a substance at 0.5 atm and 100 °C? S

134. What is the phase (s, l, g) of a substance at 1.5 atm and 200 °C? L

135. If this substance was at a pressure of 2.0 atm, at what temperature would it melt? 150°

136. If this substance was at a pressure of 2.0 atm, at what temperature would it boil? Never!