MSL Review (Break Packet)

Name: Key

Complete the following conversions:

Kh dk d c m

1) 4.13 hm = 41300. cm
2) 5,200 mL = 5.2 L
3) 504,687 g = 504.687 kg
4) 394 mm = 3.94 dm
5) 72 daL = 72,000 cL
6) 35 cg = 350 mg

Atomic Theory

7) Atomic number is the number of protons
8) Mass number is the number of protons and neutrons
9) Number the correct amount of protons, neutrons, and electrons in the chart:

	Protons	Neutrons	Electrons
$^{25}_{12}Mg^{2+}$	12	13	10
Aluminum-27	13	14	13
$^{14}_{6}C$	6	8	6
Co-59	27	32	27
$^{35}_{17}Cl^{-}$	17	18	18
A nitrogen ion with 8 neutrons	7	8	10

10) Elements are identified by the number of protons
11) Isotopes of the same element have differing numbers of neutrons
12) An ion of an element has a charge
13) The difference between carbon-12 and carbon 14 is: # of neutrons

14) A neutral atom has 16 electrons and 17 neutrons, what is it? Sulfur-23
15) What is an Ion? charged atom (+ or −)
16) What is an Isotope? same # of protons, diff # of neutrons
17) Write an electron configuration for Potassium. K = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
18) Write an electron configuration for Bromine. Br = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
19) Draw an orbital diagram for phosphorus.

1s ↑↓ 2s ↑↓ 2p ↑↓ ↑↓ ↑↓ 3s ↑↓ 3p ↑ ↑ ↑

20) What wavelength of light is released?:

a) Vis n = 3 to n = 2 color = Red
b) IR n = 6 to n = 3
c) UV n = 2 to n = 1
d) Vis n = 4 to n = 2 color = Blue
e) IR n = 5 to n = 3
f) UV n = 3 to n = 1
g) Vis n = 6 to n = 2 color = Violet

Periodic Table

21) Elements in Group 13 have 3 electrons in their outer energy level.

22) Elements that are in the same group have similar chemical & physical properties.

23) Which families do these elements belong to?

a) Bromine 17 halogens
b) Calcium 2 alkaline earth metals
c) Krypton 18 noble gases
d) Cesium 1 alkali metals

24) What is the charge of elements in Lithium's Family? +1

25) What is the charge of elements in the Halogen Family? -1

26) What is electronegativity? ability of an atom to attract electrons when the atom is in a compound

27) What element has the highest electronegativity? F

28) What is the electronegativity of noble gases? Ø

29) As you move from left to right across the periodic table, atomic radius decreases.

30) As you move down a group on the periodic table, atomic radius increases

31) What is the element with the largest atomic size?: Na, (Ba) S, or Te

32) What is ionization energy? the energy required to remove an electron from an atom

33) As you move from left to right across the periodic table, ionization energy increases.

34) As you move from top to bottom down the periodic table, ionization energy decreases

35) Which has the highest first ionization energy?: Li, Cs, B, (Cl)

36) When the following elements become ions, are the ions larger or smaller than the original atom?

a) Al smaller
b) S larger
c) Cl larger
d) Mg smaller

37) How many metals, nonmetals, and metalloids are found in group 14?

38) Identify the characteristics as either those of metals or of nonmetals: 1 nm, 2 metalloid, 2 metals

a) Ductile and Malleable metal
b) Brittle non
c) Good conductor of heat and electricity metal
d) Luster metal

Bonding

39) An ionic compound is made from a metal Cation and a nonmetal anion or a polyatomic ion.

40) A covalent compound is made from a nonmetal and a nonmetal.

41) A metallic compound is made from a metal and a metal. In a metallic compound, valence electrons are free to move around. They form a sea of electrons which explains why metallic compounds can bend (ductile + malleable)

42) [Ionic / covalent] compounds can conduct electricity when dissolved or melted.

43) Which are most likely to be solids at room temperature: ionic or covalent compounds?

44) The smallest unit of an ionic compound is the formula unit.

45) The smallest unit of a covalent compound is the molecule.

46) In order to be a nonpolar molecule, the molecule must:

a) have no unshared pair of electrons

b) be surrounded by same element.

47) Name the shape of these molecular (covalent) compounds. Are they polar molecules?:

1) NH_3 trigonal pyramidal ; yes
2) HBr linear , yes
3) O_2 linear , no
4) CCl_4 tetrahedron , no
5) H_2O bent ; yes
6) BF_3 trigonal planar, no

Nomenclature 48)

Name these compounds		Write the formula for these compounds	
$Na_3(PO_4)$	sodium phosphate	Hydrofluoric acid	HF
PbO_2	lead IV oxide	Dinitrogen monoxide	N_2O
$CuSO_4$	copper II sulfate	Silver sulfide	Ag_2S
N_2O_3	dinitrogen trioxide	Iron (III) oxide	Fe_2O_3
CCl_4	carbon tetra chloride	Copper (II) nitrate	$Cu(NO_3)_2$
H_2CO_3	hydrogen carbonate	Carbon tetrachloride	CCl_4
HF	hydrofluoric acid	Nitric acid	HNO_3
HNO_2	nitrous acid	Aluminum chloride	$AlCl_3$
$AgNO_3$	silver nitrate	Potassium carbonate	K_2CO_3
CO	carbon monoxide	Sodium phosphate	Na_3PO_4
K_3P	potassium phosphide	Lead (IV) oxide	PbO_2
$CrCl_3$	chromium III chloride	Oxygen gas	O_2
PCl_5	phosphorus pentachloride	Sulfurous acid	H_2SO_3
C_4O_8	tetracarbon octoxide	Magnesium permanganate	$Mg(MnO_4)_2$

Reactions

Name the type of reaction and then balance the following reactions.

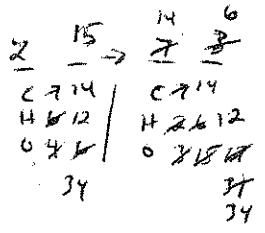
49) 2 N_2 + 1 O_2 → 2 N_2O — synthesis

50) 2 HgO → 2 Hg + 1 O_2 — decomposition

51) 2 $Al(OH)_3$ + 3 H_2SO_4 → 1 $Al_2(SO_4)_3$ + 6 H_2O — double replacement

52) 2 $C_7H_6O_2$ + 15 O_2 → 14 CO_2 + 6 H_2O — combustion

53) 2 Al + 3 FeO → 1 Al_2O_3 + 3 Fe — single replacement



Predict the products of the following reactions or write "Does not occur".

54) 2 Li + 1 CaO → 1 Li_2O + 1 Ca

55) ____H_2 + ____NaCl → DNR

56) ____$AgNO_3$ + ____HCl → 1 HNO_3 (aq) + 1 $AgCl$ (s)

57) ____$BaCl_2$ + ____NaOH → 2 NaCl (aq) + 1 $Ba(OH)_2$ (aq) DNR

58) Label which products are soluble (aq) or insoluble (s) (use ref chart)

s Ag_2SO_4	s CaF_2	aq K_2SO_4
aq $Sr(OH)_2$	aq $(NH_4)_3PO_4$	aq H_2SO_4
s $MgCO_3$	aq Li_2O	s $PbBr_2$

59) Write the net ionic equation for:

$2AgNO_3 + K_2SO_4 \rightarrow Ag_2SO_4 + 2KNO_3$ (s, aq)

$2Ag^{+1} + 2NO_3^{-1} + 2K^{+1} + SO_4^{2-} \rightarrow Ag_2SO_4 + 2K^{+} + 2NO_3^{-1}$

$2Ag^{+} + SO_4^{2-} \rightarrow Ag_2SO_4$ (s)

Stoichiometry

60) 1 mole = 6.02×10^{23} particles, 1 mole = 22.4 L at STP, 1 mole CH_4 = 16 grams

61) 4.50 moles of oxygen gas are collected at STP, what volume does this occupy? $\frac{4.50 \text{ mol } O_2}{1} \left| \frac{22.4 \text{ L } O_2}{1 \text{ mol } O_2} \right. = 100.8 \text{ L } O_2$

62) 3.1×10^{24} atoms Al = 5.15 moles $\frac{3.1 \times 10^{24} \text{ atoms Al}}{1} \left| \frac{1 \text{ mol Al}}{6.02 \times 10^{23} \text{ atoms}} \right. =$

63) 1.5 moles H_2O = 9.03×10^{23} molecules $\frac{1.5 \text{ moles } H_2O}{1} \left| \frac{6.02 \times 10^{23} \text{ molecule}}{1 \text{ mol } H_2O} \right. =$

64) 10 moles CO2 = 440 grams $\frac{10 \text{ mol } CO_2}{1} \left| \frac{44 \text{ g } CO_2}{1 \text{ mol } CO_2} \right. =$

65) Determine the mass of lithium hydroxide produced when 0.38g of lithium nitride reacts with water according to the following equation. $Li_3N + 3H_2O \rightarrow NH_3 + 3LiOH$

$\frac{0.38 \text{ g } Li_3N}{1} \left| \frac{1 \text{ mol } Li_3N}{35 \text{ g } Li_3N} \right| \frac{3 \text{ mol LiOH}}{1 \text{ mol } Li_3N} \left| \frac{24 \text{ g LiOH}}{1 \text{ mol LiOH}} \right. = 0.78 \text{ g LiOH}$

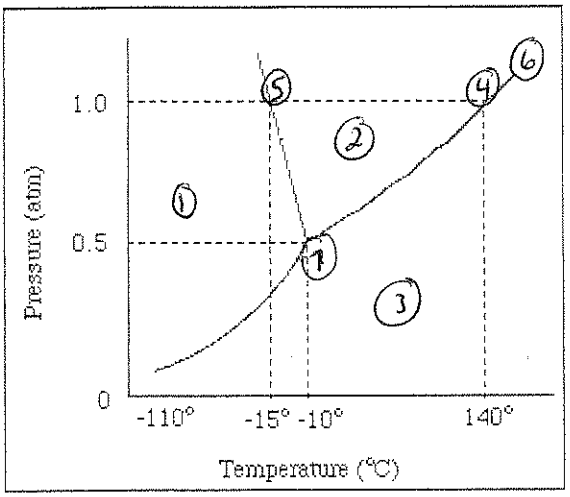
66) Propane (C_3H_8) burns in oxygen to produce carbon dioxide and water vapor. The balanced equation for this reaction is: $C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$. What volume of carbon dioxide is produced when 2.8 L of oxygen are consumed?

$\frac{2.8 \text{ L } O_2}{22.4 \text{ L } O_2} \left| \frac{1 \text{ mol } O_2}{5 \text{ mol } O_2} \right| \frac{3 \text{ mol } CO_2}{1 \text{ mol } CO_2} \left| \frac{22.4 \text{ L } CO_2}{1 \text{ mol } CO_2} \right. = 1.68 \text{ L } CO_2$

67) Find the mass of sodium required to produce 5.68L of hydrogen gas at STP from the reaction described by the following equation: $2Na + 2H_2O \rightarrow 2NaOH + H_2$.

$\frac{5.68 \text{ L } H_2}{22.4 \text{ L } H_2} \left| \frac{1 \text{ mol } H_2}{1 \text{ mol } H_2} \right| \frac{2 \text{ mol Na}}{1 \text{ mol Na}} \left| \frac{23 \text{ g Na}}{1 \text{ mol Na}} \right. = 11.66 \text{ g Na}$

KMT and Gas Laws

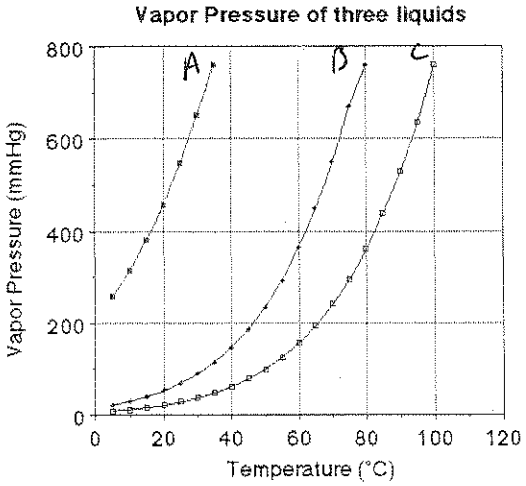


68) Label each of the following on the diagram (left):

1 2 3 4 5

Solid, liquid, gas, normal boiling point, normal melting point, critical point, triple point

6 7



69) Which substance has the lowest normal boiling point?

A

70) Which substance(s) would be a liquid at 60°C and 600mmHg?

B & C

71) Convert 620 torr to atm.

$$620 \text{ torr} \left| \frac{1 \text{ atm}}{760 \text{ torr}} \right. = 0.816 \text{ atm}$$

72) The pressure of a 50.0 L sample of gas is 600mmHg at 25.0°C. If the temperature drops to 15°C and the volume expands to 60.0L, what will the pressure of the gas be?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(600\text{mmHg})(50\text{L})}{298\text{K}} = \frac{P_2(60\text{L})} {288\text{K}} \qquad P_2 = \frac{(600\text{mmHg})(50\text{L})(288\text{K})}{(298\text{K})(60\text{L})} = 483.2 \text{ mmHg}$$

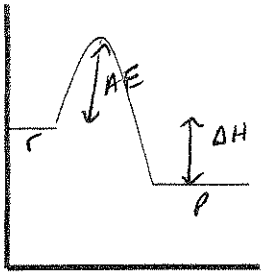
73) What is the pressure (in atm) of 1.7 moles of nitrogen gas if the temperature is 45°C and the volume is 68L?

$$PV = nRT \qquad P = \frac{nRT}{V} \qquad P = \frac{(1.7\text{mol})\left(0.0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}\right)(318\text{K})}{68\text{L}} = 0.65 \text{ atm}$$

74) If five gases in a cylinder each exert a partial pressure of 1.50 atm, what is the total pressure exerted by the gases?

$$1.50 \text{ atm} \times 5 = 7.5 \text{ atm}$$

Thermochemistry



75) Label the following parts of the graph: reactants, products, activation energy, enthalpy

76) What type of reaction is the chart showing and how do you know?

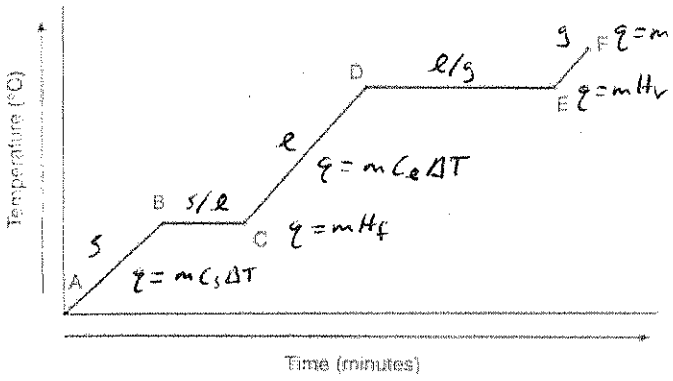
Exothermic reactants higher PE than products

77) What is happening during an endothermic reaction? What is happening to the energy (where is it going)?

energy is absorbed from surroundings to reaction

78) To calculate the amount of heat absorbed when a substance is melting, what formula do you use? What does each piece of the formula represent? $q = m H_f$ → heat of fusion; m → mass

79)



Label the graph with the appropriate equations for finding Heat (q):
$q = mH_f$ $q = mH_v$ $q = mC_\ell\Delta T$ $q = mC_\ell\Delta T$ $q = mC_g\Delta T$

Label the graph indicating the state(s) that water would be observed:
solid, liquid, gas, solid/liquid mix, liquid/gas mix

80) What is happening from D to E? What formula do we use to calculate the heat during this period?

vaporization $\ell \leftrightarrow g$ $q = m H_v$

81) What phase is the substance in from A to B?

solid

82) How much heat is needed to change 56 grams of liquid water to vapor at 100°C?

$q = m H_v = (56g)(2260\ J/g) = 126{,}560\ J$

83) How much heat is released if 75 grams of water at 45°C freezes to ice at -15°C?

$q = m C_\ell \Delta T = (75g)(4.18\ J/g°C)(0-45) = -14107.5$
$q = m H_f = (75g)(334\ J/g) = -25050$
$q = m C_s \Delta T = (75g)(2.05\ J/g°C)(-15-0) = -2306.25$

$-41{,}463.75\ J$

84) What is the correct K_{eq} expression for this reaction: 4A(aq) + 3B(aq) ↔ 5C(aq) + 4D(s)

(remember to only use ~~solids~~ gas ad aqueous portions of your equation)

$$K_{eq} = \frac{[C]^5}{[A]^4[B]^3}$$

85) In the equation NaCl (l) → NaCl (s), entropy is (increasing / decreasing). decreasing

$3H_2(g) + N_2(g) \leftrightarrow 2NH_3(g) + 24.7\ kJ$

86) If more H_2 is added to this reaction, where does the equilibrium shift? right

87) If temperature of this reaction is increased (add heat), where does the equilibrium shift? left

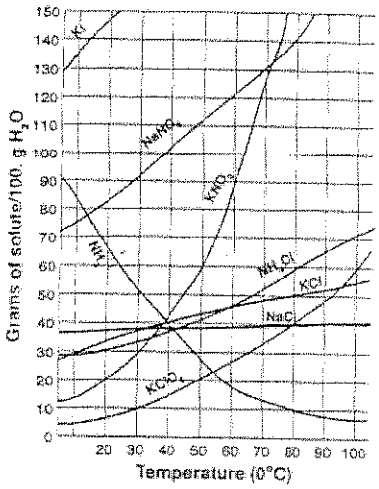
Solutions, Acids, and Bases

88) Which substances will dissolve in H_2O? (HCl, I_2, BF_3, CH_4, MgF_2, NaOH)

Ionic or polar

89) Which of the following are electrolytes? (LiBr, $C_6H_{12}O_6$, $Mg(OH)_2$, $HC_2H_3O_2$, alcohol)

Ionic, acids, & bases



90) Which substance is most soluble at 40°C?

$NaNO_3$

91) At 80°C, 70 grams of NH_4Cl is dissolved in 100 grams of H_2O. This solution is :

unsaturated, saturated, supersaturated.

92) Which solute may be a gas? NH_3

93) Which substance is least soluble at 30°C?

$KClO_3$

94) Calculate the molarity of a 2.5L solution that was made with 20 g KOH? ($M=\frac{mol}{L}$)

$\frac{20\ g\ KOH}{}\left|\frac{1\ mol\ KOH}{56\ g\ KOH}\right. = 0.357\ mol$ $\quad M = \frac{0.36\ mol}{2.5\ L} = 0.14\ M$

95) A student needed to create 200 mL of a 2M HCl solution. If the teacher provided the student with 5 M HCl, what volume would the student need to dilute it with?

$(200\ mL)(2M) = (5M)(V_2)$ $\quad V_2 = \frac{(200\ mL)(2M)}{5M} =$

96) Label the conjugate base, the conjugate acid, the acid, and the base: $H_2CO_3 + H_2O \rightarrow HCO_3^- + H_3O^+$

A B cB cA

97) What is the $[H^+]$ of a substance with a pH of 4? 1×10^{-4}

98) The pOH of 1×10^{-3}M $HC_2H_3O_2$ solution is 11

99) Calculate the pH of 5.23×10^{-5}M NaOH

$pOH = -\log[5.23 \times 10^{-5}] = 4.28$

$pH = 14 - 4.28 = 9.72$