

Key - Fall 2017 Honors Chemistry Final Review

Scientific method

- observation - using the 5 senses to notice something
- hypothesis - testable explanation of hypothesis
- experiment - step by step method for testing hypothesis
- data/analysis - information gathered during an experiment (data).
analysis is mathematical calculations & reasoning done on the data
- theory/scientific law - theory is an explanation of how phenomena occur while a law explains why the phenomena occurs

- (1) a) honeybee colonies are dying
b) a pathogen is believed to be killing the colonies
c) set up several (perhaps 6) separate colonies of honeybees.
each should have the same number & type of bee and be kept under similar environmental conditions (temperature, water, food, etc.)
introduce the pathogen to half of the colonies and observe.
d) the infected colonies would die while the uninfected colonies would be healthy.
e) either all the colonies would be healthy or dead.

Lab Safety

- (2) a) loose clothing/dangling jewelry can knock over glassware or become contaminated w/chemicals
b) goggles protect eyes from flying glassware & chemicals
c) closed-toe shoes protect feet from dropped glassware & chemicals
d) no food/drink in lab b/c it could get contaminated
e) no horseplay b/c you could knock over glassware or chemicals

Lab Equipment

- (3)



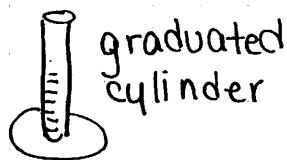
beaker



thermometer



funnel



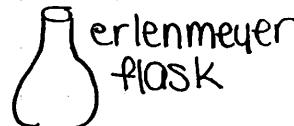
graduated cylinder



balance



Beaker -
the
muppet



Erlenmeyer
flask

Scientific Notation

- (4) a) 0.00000678 s = $6.78 \times 10^{-6} \text{ s}$
- b) 19100000 J = $1.91 \times 10^7 \text{ J}$
- c) 0.000546 g = $5.46 \times 10^{-4} \text{ g}$
- d) 12110000000 °C = $1.211 \times 10^{10} \text{ °C}$
- e) $8.76 \times 10^4 \text{ atm}$ = 87600 atm
- f. $3.42 \times 10^{-4} \text{ mol}$ = $.000342 \text{ mol}$

Nuclear Chemistry

- (5) a) fusion
b) fission
c) fusion
d) fusion

States of Matter

- (6) (1) liquid
(2) gas
(3) solid
- (4) plasma
(5) solid
(6) solid & plasma

(7) liquid

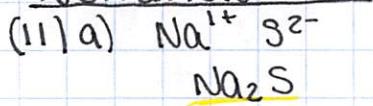
- (7) a) physical
b) chemical
c) physical
d) physical
- e) chemical
f) chemical
g) physical
h) chemical

- (8) a) element
b) homogeneous mix.
c) compound
- d) heterogeneous mix.
e) element
f) homogeneous mix.

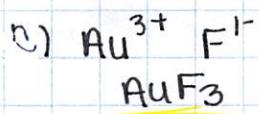
- (9) a) chemical
b) physical
c) physical
- d) chemical
e) physical
f) physical

(10) liquid

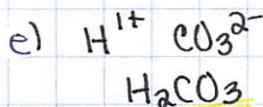
Nomenclature



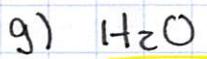
b) hydrochloric acid



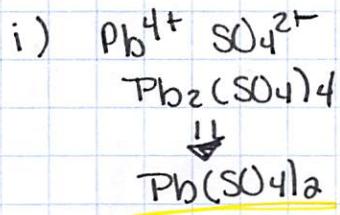
d) dinitrogen pentoxide



f) calcium nitrate

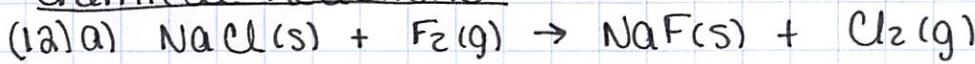


h) phosphorous acid



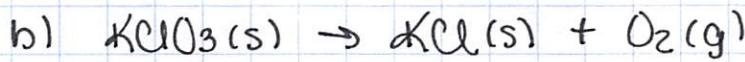
j) iron(III) oxalate

Chemical Reactions

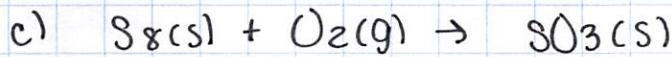


(14)

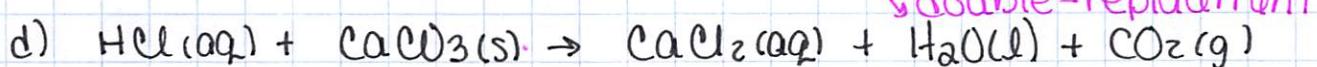
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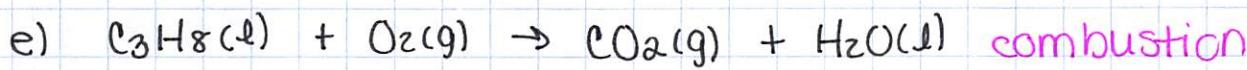
decomposition



synthesis



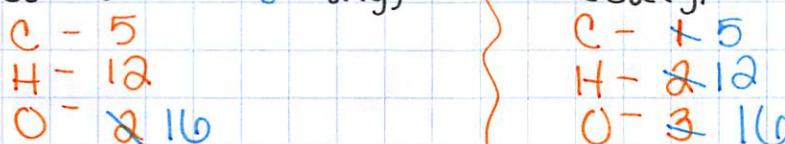
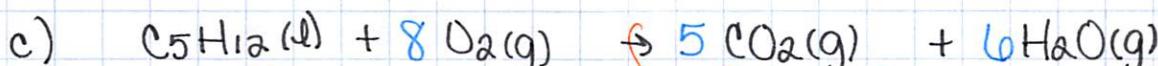
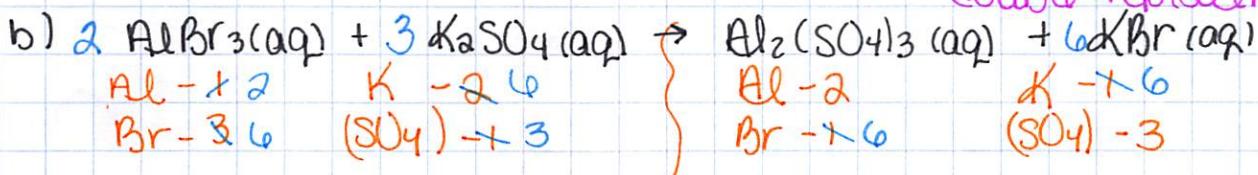
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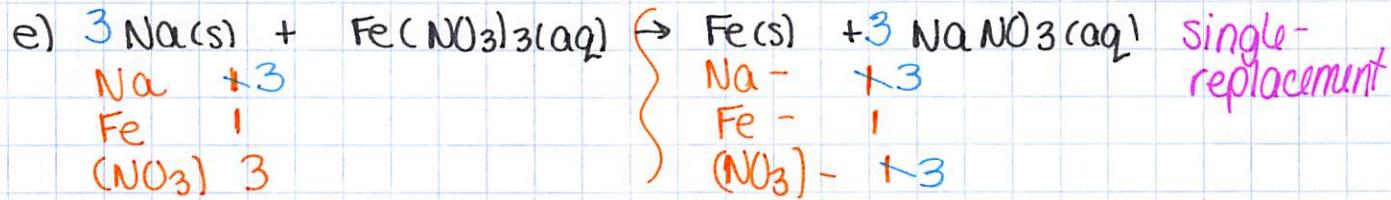
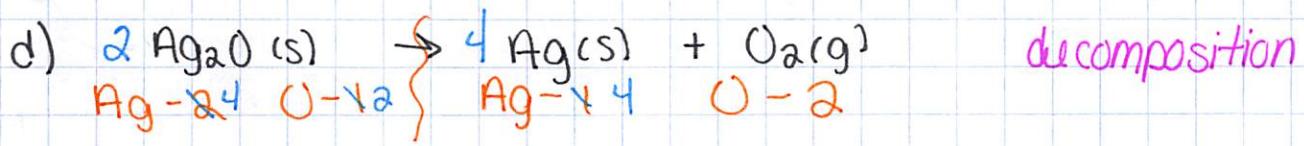
synthesis



double-replacement

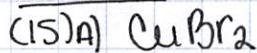


combustion



(14) See # 12 & 13

moles

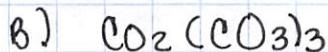


MM

$$\frac{1 \text{ Cu} \times 63.55 \text{ g}}{2 \text{ Br} \times 79.90 \text{ g}} = \frac{63.55 \text{ g}}{223.35 \text{ g}}$$

$$\% \text{ Cu} = \frac{63.55 \text{ g}}{223.35 \text{ g}} \times 100 = 28.45\%$$

$$\% \text{ Br} = \frac{159.80 \text{ g}}{223.35 \text{ g}} \times 100 = 71.55\%$$



MM

$$\begin{aligned} 2 \text{ CO} \times 58.93 \text{ g} &= 117.86 \text{ g} \\ 3 \text{ C} \times 12.01 \text{ g} &= 36.03 \text{ g} \\ 9 \text{ O} \times 16.00 \text{ g} &= \underline{\underline{144.00 \text{ g}}} \\ &297.89 \text{ g} \end{aligned}$$

$$\% \text{ CO} = \frac{117.86 \text{ g}}{297.89 \text{ g}} \times 100 = 39.56\%$$

$$\% \text{ C} = \frac{36.03 \text{ g}}{297.89 \text{ g}} \times 100 = 12.10\%$$

$$\% \text{ O} = \frac{144.00 \text{ g}}{297.89 \text{ g}} \times 100 = 48.34\%$$

(16) $\frac{34.5 \text{ g H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} \left| \begin{array}{c} 1 \text{ mol H}_2\text{O} \\ 18.02 \text{ g H}_2\text{O} \end{array} \right. = 1.91 \text{ mol}$

(17) $\frac{.456 \text{ L H}_2\text{O}}{22.4 \text{ L}} \left| \begin{array}{c} 1 \text{ mol} \\ 22.4 \text{ L} \end{array} \right| \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 1.23 \times 10^{22} \text{ molecules}$

(18) $\frac{21.1 \text{ g CaCl}_2}{110.98 \text{ g}} \left| \begin{array}{c} 1 \text{ mol} \\ 110.98 \text{ g} \end{array} \right. = .190 \text{ mol}$

(19) $\frac{6.789 \times 10^{22} \text{ f.u. CaCl}_2}{6.02 \times 10^{23} \text{ f.u.}} \left| \begin{array}{c} 1 \text{ mol} \\ 6.02 \times 10^{23} \text{ f.u.} \end{array} \right. = .1128 \text{ mol}$

(20) $\frac{99.99 \text{ g HNO}_3}{63.02 \text{ g}} \left| \begin{array}{c} 1 \text{ mol} \\ 63.02 \text{ g} \end{array} \right| \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = 9.552 \times 10^{23} \text{ molecules}$

$$(21) \frac{7.87 \times 10^{25} \text{ molecules } \text{SO}_3}{6.02 \times 10^{23} \text{ molecules}} \frac{1 \text{ mol}}{1 \text{ mol}} = 22.4 \text{ L} = 2930 \text{ L}$$

$$(22) \text{ a) } \text{C}_3\text{H}_7 \\ \text{ c) } \text{CH}_2\text{O}$$

$$\text{ b) } \text{C}_3\text{H}_8 \\ \text{ d) } \text{CO}_2(\text{CO}_3)_3$$

$$(23) \frac{66.611 \text{ g C}}{12.01 \text{ g}} \frac{1 \text{ mol}}{1 \text{ mol}} = 5.54629 \text{ mol C} / 1.38656 \text{ mol} = 4 \text{ C}$$

$$\frac{11.204 \text{ g H}}{1.01 \text{ g}} \frac{1 \text{ mol}}{1 \text{ mol}} = 11.09307 \text{ mol H} / 1.38656 \text{ mol} = 8 \text{ H}$$

$$\frac{22.185 \text{ g O}}{16.00 \text{ g}} \frac{1 \text{ mol}}{1 \text{ mol}} = 1.38656 \text{ mol O} / 1.38656 \text{ mol} = 1 \text{ O}$$

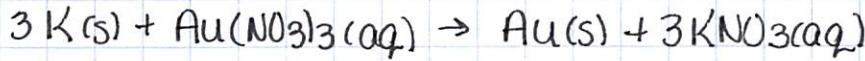
EF
 $\frac{\text{EF}}{\text{C}_4\text{H}_8\text{O}}$

$$\begin{array}{rcl} \text{MM of EF} \\ \hline 4\text{C} \times 12.01 \text{ g} & = & 48.04 \text{ g} \\ 8\text{H} \times 1.01 \text{ g} & = & 8.08 \text{ g} \\ 1\text{O} \times 16.00 \text{ g} & = & 16.00 \text{ g} \\ \hline & & 72.22 \text{ g} \end{array}$$

$$\frac{144.24 \text{ g}}{72.22 \text{ g}} \approx 2$$

MF
 $2(\text{C}_4\text{H}_8\text{O}) = \text{C}_8\text{H}_{16}\text{O}$

Stoichiometry



(23)

$$\text{(A) given} = 21.0 \text{ mol K} \\ \text{unknown} = \text{mol KNO}_3$$

$$\frac{21.0 \text{ mol K}}{3 \text{ mol Au}} = \frac{3 \text{ mol KNO}_3}{3 \text{ mol K}} = 21.0 \text{ mol KNO}_3$$

$$\text{(B) given} = 1.50 \text{ mol K} \\ \text{unknown} = \text{g Au}$$

$$\frac{1.50 \text{ mol K}}{3 \text{ mol K}} = \frac{1 \text{ mol Au}}{1 \text{ mol Au}} = 98.5 \text{ g Au}$$

$$\text{(C) given} = 50.00 \text{ g Au}(\text{NO}_3)_3 \\ \text{unknown} = \text{g KNO}_3$$

$$\frac{50.00 \text{ g Au}(\text{NO}_3)_3}{383.00 \text{ g Au}(\text{NO}_3)_3} = \frac{1 \text{ mol Au}(\text{NO}_3)_3}{1 \text{ mol Au}(\text{NO}_3)_3} = \frac{3 \text{ mol KNO}_3}{1 \text{ mol KNO}_3} = \frac{101.11 \text{ g KNO}_3}{101.11 \text{ g KNO}_3} = 39.60 \text{ g KNO}_3$$

$$\text{(D) given: } 30.00 \text{ mol K} \\ \therefore 9.00 \text{ mol Au}(\text{NO}_3)_3$$

unknown: LR

\uparrow
 $\text{Au}(\text{NO}_3)_3$

$$\frac{30.00 \text{ mol K}}{3 \text{ mol K}} = \frac{1 \text{ mol Au}}{1 \text{ mol Au}} = 19.70 \text{ g Au}$$

$$\frac{9.00 \text{ mol Au}(\text{NO}_3)_3}{1 \text{ mol Au}(\text{NO}_3)_3} = \frac{1 \text{ mol Au}}{1 \text{ mol Au}} = \frac{177.3 \text{ g Au}}{177.3 \text{ g Au}} = \text{lowest amount}$$

(E) given: 1173g K $\frac{1173\text{g K}}{3447\text{g Au}(\text{NO}_3)_3}$ $\frac{1\text{mol K}}{39.10\text{g K}}$ $\frac{1\text{mol Au}}{1\text{mol Au}(\text{NO}_3)_3}$ $\frac{196.97\text{g}}{1\text{mol Au}}$ = 1970g Au

unknown: LR

$\frac{3447\text{g Au}(\text{NO}_3)_3}{1\text{mol Au}(\text{NO}_3)_3}$	$\frac{1\text{mol Au}(\text{NO}_3)_3}{38.00\text{g Au}(\text{NO}_3)_3}$	$\frac{1\text{mol Au}}{1\text{mol Au}(\text{NO}_3)_3}$	$\frac{196.97\text{g Au}}{1\text{mol Au}}$
--	---	--	--

= 1773g Au
lowest amount

Atomic Structure

(24) Element	Atomic #	Mass #	# of protons	# of electrons	# of neutrons
sulfur	16	32	16	16	16
cadmium	48	112	48	48	64
tantalum	73	181	73	73	108
einsteinium	99	252	99	99	153

- (25) (A) Ti - $22e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
 (B) Ni - $28e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
 (C) Br - $35e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
 (D) Sr - $38e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$

(26) $\lambda = 4.00 \times 10^{-7}\text{m}$ (400nm, $1\text{m} = 1 \times 10^9\text{nm}$)

$$c = \lambda \nu$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$\lambda = 4.00 \times 10^{-7}\text{m}$$

$$\nu = ?$$

$$E = h\nu$$

$$E = ?$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$\nu = 7.50 \times 10^{14} \text{ 1/s}$$

$$\nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m/s}}{4.00 \times 10^{-7}\text{m}} = 7.50 \times 10^{14} \text{ 1/s}$$

$$E = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(7.50 \times 10^{14} \text{ 1/s})$$

$$E = 4.97 \times 10^{-19} \text{ J}$$

(27) $\nu = \frac{c}{\lambda}$

$$\nu = \frac{3.00 \times 10^8 \text{ m/s}}{1.00 \times 10^1\text{m}}$$

$$\nu = 3.00 \times 10^7 \text{ 1/s}$$

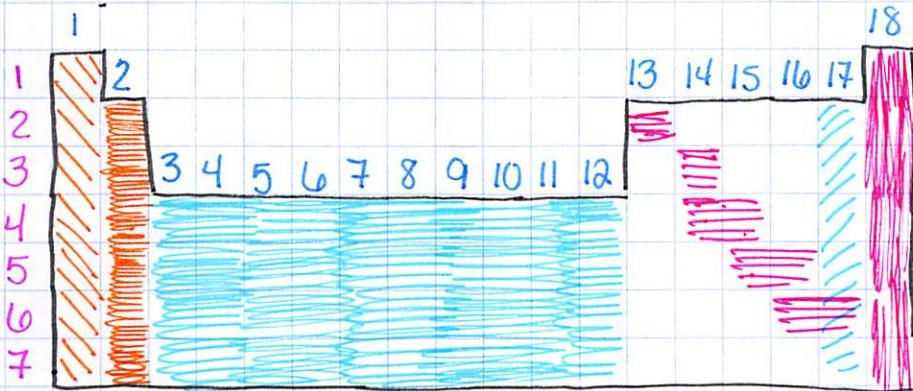
$$E = (6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^7 \text{ 1/s})$$

$$E = 1.99 \times 10^{-26} \text{ J}$$

Chemical Bonds

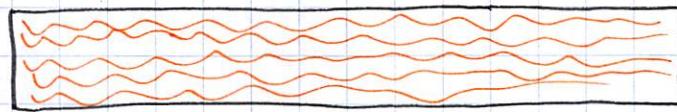
- (28) a) CO_2 - 2 nonmetals \Rightarrow covalent bonds
 b) FeF_3 - 1 metal & 1 nonmetal \Rightarrow ionic bonds
 c) NH_3 - 2 nonmetals \Rightarrow covalent bonds
 d) CaBr_2 - 1 metal & 1 nonmetal \Rightarrow ionic bonds
 e) MgSO_4 - 1 metal & 1 polyatomic ion made of 2 nonmetals
 \Rightarrow both ionic & covalent bonds
 f) KClO_3 - 1 metal & 1 polyatomic ion made of 3 nonmetals
 \Rightarrow both ionic & covalent bonds

(29)



(30)

(31)



periods - horizontal rows
 groups - vertical columns

(32) Sc, Br, Ni

- a) $\text{Br} < \text{Ni} < \text{Sc}$
 b) $\text{Sc} > \text{Ni} > \text{Br}$

- c) $\text{Sc} < \text{Ni} < \text{Br}$
 d) $\text{Br} > \text{Ni} > \text{Sc}$

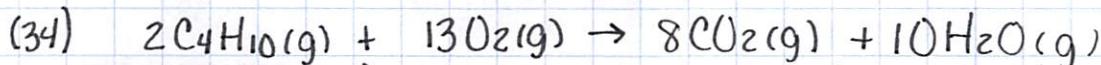
(33) Se, Pb, F

- a) $\text{F} < \text{Se} < \text{Pb}$
 b) $\text{Pb} > \text{Se} > \text{F}$

- c) $\text{Pb} < \text{Se} < \text{F}$
 d) $\text{F} > \text{Se} > \text{Pb}$

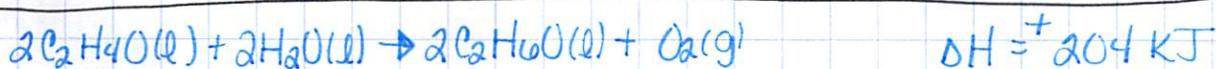
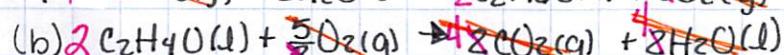
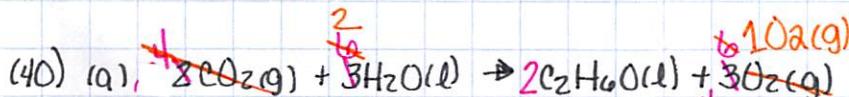
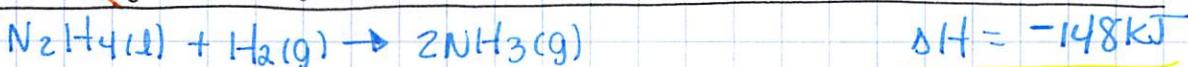
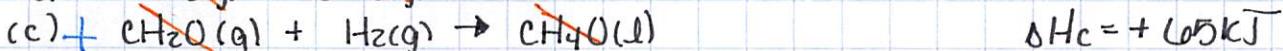
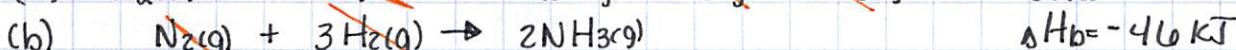
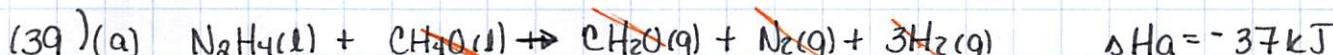
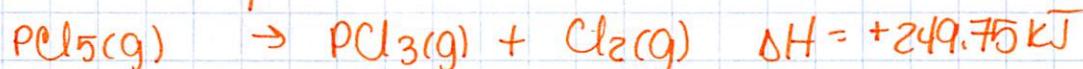
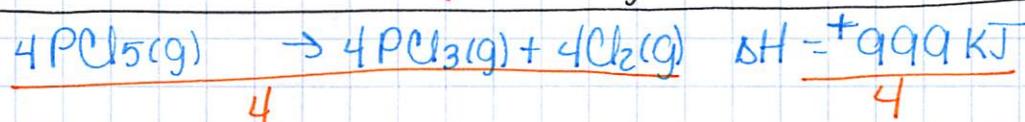
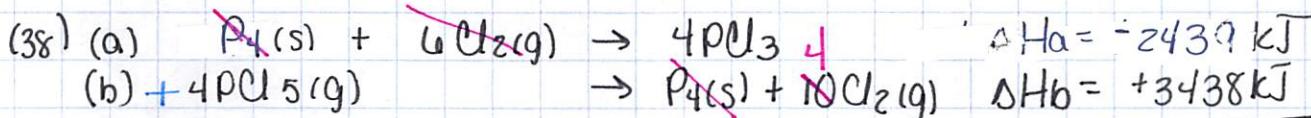
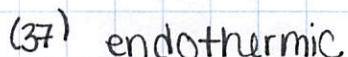
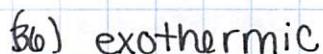
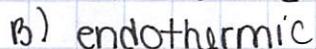
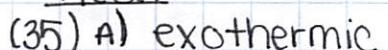
alkali metals
 alkaline earth metals
 transition metals
 metalloids
 halogens
 noble gases
 inner transition metals

Reaction Rates



- a) The rate of the reaction would increase b/c the reactant particles would collide more often in the smaller volume.
- b) The rate would increase b/c higher temperature mean the reactant particles have more energy & move faster, so they collide more often.
- c) The rate would decrease b/c there are less collisions & less particles to collide.
- d) The rate would increase b/c the catalyst lowers the amount of activation energy the reactant particles need to collide.

Heat



$$(41) q = mc\Delta T$$



$$q = +1086.75 \text{ J}$$

$$m = 15.75 \text{ g}$$

$$c = ?$$

$$\Delta T = 175^\circ\text{C}$$

$$- 25^\circ\text{C}$$

$$\underline{150^\circ\text{C}}$$

$$c = \frac{q}{(m \cdot \Delta T)} = \frac{+1086.75 \text{ J}}{(15.75 \text{ g} \cdot 150^\circ\text{C})}$$

$$= 460 \text{ J/g}^\circ\text{C}$$

$$(42) q = ?$$

$$m = 2300.9 \text{ g}$$

$$c = .90 \text{ J/g}^\circ\text{C}$$

$$\Delta T = -16^\circ\text{C}$$

$$- 20^\circ\text{C}$$

$$\underline{-14^\circ\text{C}}$$

$$q = mc\Delta T = (2300.9)(.90 \frac{\text{J}}{\text{g}^\circ\text{C}})(14^\circ\text{C})$$

$$q = +2935.8 \text{ J}$$

$$q = +2900 \text{ J}$$

$$(43) q = ?$$

$$m = 454 \text{ g}$$

$$c = .386 \text{ J/g}^\circ\text{C}$$

$$\Delta T = -28.0^\circ\text{C}$$

$$- 96.0^\circ\text{C}$$

$$\underline{-68.0^\circ\text{C}}$$

$$q = mc\Delta T = (454 \text{ g})(.386 \frac{\text{J}}{\text{g}^\circ\text{C}})(-68.0^\circ\text{C})$$

$$q = -11916.592 \text{ J}$$

$$q = -11900 \text{ J}$$

Solutions

o Factors that affect the rate a solute can dissolve.

1. surface area - increasing the surface area of a solute increases the amount of solute that interacts w/ the solvent
2. agitation - stirring increases the number of collisions between solute & solvent particles
3. temperature - liquids & solids dissolve faster when the temperature increases b/c the particles move faster & collide more often. In gases, they dissolve faster in lower temperatures b/c they have lower energy & tend to stay in solution rather than escape.

$$(44) M = \frac{n}{V}$$



$$M = ?$$

$$n = 15.0 \text{ g Mg(OH)}_2 \quad \left| \frac{1 \text{ mol}}{58.33 \text{ g}} \right. =$$

$$V = 400 \text{ mL} = .4 \text{ L}$$

$$M = \frac{.257157552 \text{ mol}}{.4 \text{ L}}$$

$$M = .6 \text{ mol/L}$$

$$.257157552 \text{ mol}$$

$$\underline{\text{MM-Mg(OH)}_2}$$

$$1 \text{ Mg} \times 24.31 \text{ g} = 24.31 \text{ g}$$

$$2 \text{ O} \times 16.00 \text{ g} = 32.00 \text{ g}$$

$$2 \text{ H} \times 1.01 \text{ g} = 2.02 \text{ g}$$

$$+ \\ 58.33 \text{ g}$$

$$(45) V = \frac{n}{M}$$

$$M = .76 \text{ mol/L}$$

$$n = \frac{5.00 \text{ g HCl}}{36.46 \text{ g}} | \frac{1 \text{ mol}}{1 \text{ mol}}$$

$$V = ?$$

$$= \frac{.137136588 \text{ mol}}{.76 \text{ mol/L}}$$

$$= .18 \text{ L}$$

$$V = .137136588 \text{ mol}$$

$$.76 \text{ mol/L}$$

$$V = .18 \text{ L}$$

MH-HCl

$$1 \text{ H} \times 1.01 = 1.01 \text{ g}$$

$$1 \text{ Cl} \times 35.45 = 35.45 \text{ g}$$

$$\underline{36.46 \text{ g}}$$

$$(46) n = M \cdot V$$

$$n = (1.23 \frac{\text{mol}}{\text{L}})(1.00 \text{ L}) = 1.23 \text{ mol}$$

$$M = 1.23 \text{ mol/L}$$

$$n = ?$$

$$V = 1.00 \text{ L}$$

$$1.23 \text{ mol NH}_3 | 17.04 \text{ g}$$

$$1 \text{ mol}$$

$$= 21.04 \text{ g}$$

MH-NH₃

$$1 \text{ N} \times 14.01 \text{ g} = 14.01 \text{ g}$$

$$3 \text{ H} \times 1.01 \text{ g} = 3.03 \text{ g}$$

$$\underline{17.04 \text{ g}}$$

- Boiling Point Elevation - ... because the solute particles physically block the solvent particles from escaping the liquid & becoming a gas. ∴ Higher temps. are needed to give solvent particles enough energy to push past the solute particles & escape.
- Freezing Point Depression - ... because solute particles interfere w/ the solvent forming a solid crystal. ∴ Lower temps. are needed to slow the solvent particles & force it to solidify.

- (47) A) It will increase.
B) It will decrease.

Acids and Bases

(48) acid - substance that releases H⁺ ions in solution

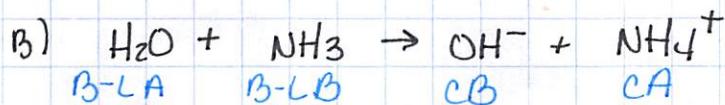
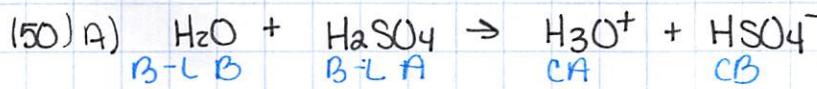
base - substance that releases OH⁻ ions in solution

(49) acid - substance that donates H⁺ ions

base - substance that accepts H⁺ ions

conjugate acid - what the base becomes after accepting an H⁺ ion

conjugate base - what the acid becomes after losing an H⁺ ion.



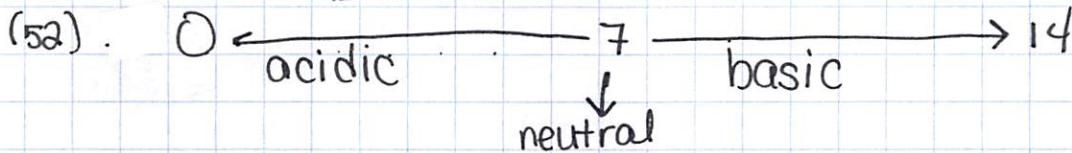
(51) strong acid - ionizes (breaks apart) 100%

weak acid - ionizes 10% or less

7 strong acids - HCl, HBr, HI, HNO₃, HClO₃, HClO₄, H₂SO₄

8 strong bases - LiOH, NaOH, KOH, RbOH, CsOH, Ca(OH)₂, Sr(OH)₂, Ba(OH)₂

pH



- A) basic
- B) acidic
- C) acidic
- D) basic

(53) A) $M_A = .85M$ $V_A = .0250L$
 $M_B = .75M$ $V_B = ?$

$$(.85M)(.0250L) = (.75M)V_B$$
$$\frac{.02125M \cdot L}{.75M} = \frac{(.75M)V_B}{.75M}$$

$.028L = V_B$

B) $M_A = 1.23M$ $V_A = ?$
 $M_B = .990M$ $V_B = 45.0mL = .0450L$

$$(1.23M)V_A = (.990M)(.0450L)$$
$$\frac{(1.23M)V_A}{1.23M} = \frac{(.990M)(.0450L)}{1.23M}$$

$V_A = .0362L$