Review #2

CheMis+ry: http://genest.weebly.com

Stop in for help every day at lunch and Tues & Thurs after school!

After-hours question? Email me at home: segnenst@madison.k12.wi.us

Name _____

Period _____

1. Important conversion factors to know:
2. At STP 1 mole of any gas has a volume of __22.4__ liters
3. For 0.33M HCl there are __1__ liters for every __0.33__ mole of HCl
4. In the reaction $3 H_2 + N_2 \longrightarrow 2 NH_3 + 92kJ$

    There are __92__ kJ for every __1__ moles of nitrogen gas reacting. Also, for every 3 moles of hydrogen gas that react you will probably form __2__ moles of NH_3 This reaction is (absorbing? / (giving off?)) energy.

5. Memorized formulas. Fill in the formula of each::
    a. phosphoric acid ____H_3PO_4____
    b. hydrochloric acid ____HCl____
    c. sulfuric acid ____H_2SO_4____
    d. sodium hydroxide base ____$NaOH$____
    e. ammonia base ____NH_3____

6. Each drawing has one big mistake. Check the correct box and then re-do the whole drawing with the mistake fixed.
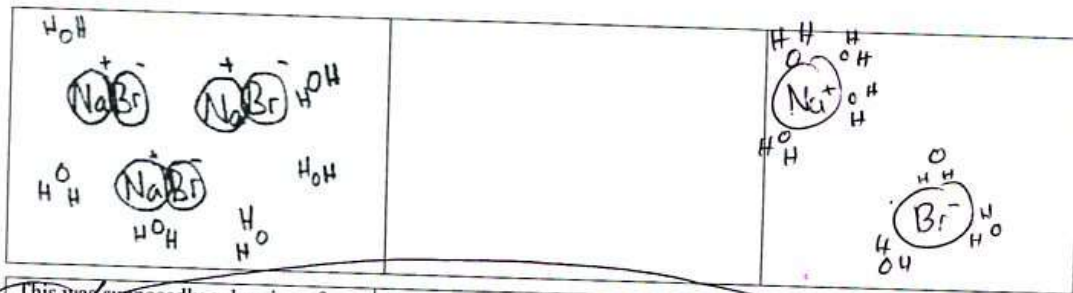
This was supposedly a drawing of $AlBr_{3(aq)}$	Which mistake? (choose one) □ no charge shown! □ drawn as a solid (not separated) ☒ wrong ratio, wrong number of each □ drew aqueous instead of liquid*	should have three times as many Br as aluminum

This goes with the asterisk above.

* LIQUID means molecules are touching closely but are disorderly, non-brick wall, no pattern. There is NO WATER present.
    AQUEOUS means water surrounds each particle.

This was supposedly a drawing of $AlBr_{3(aq)}$	Which mistake? (choose one) □ no charge shown! ☒ drawn as a solid (not separated) □ wrong ratio, wrong number of each □ drew aqueous instead of liquid*	waters

| This was supposedly a drawing of $NaBr_{(aq)}$ See top of next page	Which mistake? (choose one) □ no charge shown! ☒ drawn as a solid (not separated) □ wrong ratio, wrong number of each □ drew aqueous instead of liquid*	See next page

This was supposedly a drawing of **NaBr(L)**
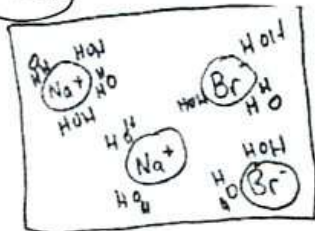
Which mistake? (choose one)
☐ no charge shown!
☒ drawn as a solid (not separated)
☐ wrong ratio, wrong number of each
☐ drew aqueous instead of liquid*

Correct way to draw a liquid is touching but disorderly
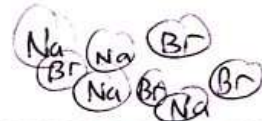
7. For each reaction below decide whether the given conversion factors are true or false.

$$2\ NH_{3(g)} \rightarrow N_{2(g)} + 3\ H_{2(g)} \qquad \Delta H = 92.2\ kJ$$

$\dfrac{92.2\ kJ}{2\ N_2}$	$\dfrac{N_2}{H_2}$	$\dfrac{3\ H_2}{92.2\ kJ}$	$\dfrac{3\ H_2}{2\ NH_3}$
☐ True	☐ True	☒ True	☒ True
☒ False	☒ False	☐ False	☐ False
$\dfrac{22.4\ L\ H_2}{1\ mol\ H_2}$	$\dfrac{28.02\ grams\ N_2}{1\ mol\ N_2}$	$\dfrac{92.2\ kJ}{3\ moles\ H_2}$	$\dfrac{6.02 \times 10^{23}\ moles\ H_2}{1\ molecule\ H_2}$
☐ True	☒ True	☒ True	☐ True
☐ False	☐ False	☐ False	☒ False

true if at S.T.P.

8. 3 H2 + N2 ---> 2 NH3 + 92kJ
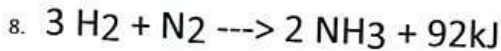
a) How many litres of hydrogen are required to produce 5.0 litres of NH3 at the same temperature and pressure? Assume STP conditions.

$$5.0\ L\ NH_3 \times \left(\frac{1\ mol\ NH_3}{22.4\ L\ NH_3}\right) \times \left(\frac{3\ mol\ H_2}{2\ mol\ NH_3}\right)\left(\frac{22.4\ L\ H_2}{1\ mol\ H_2}\right) = 7.5\ L\ H_2$$
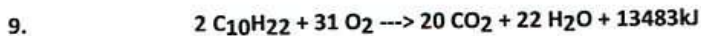
b) What amount of energy is released when 5.00 grams of NH3 are produced?

$$5.00\ grams\ NH_3 \times \left(\frac{1\ mole\ NH_3}{17.04\ gram\ NH_3}\right)\left(\frac{92\ kJ}{2\ mole\ NH_3}\right) = 13.5\ kJ$$

this number comes always from coefficients of balanced equation

c) Given the reaction above, what mass of nitrogen is needed to produce 889.0 kJ of energy?

$$889 kJ \times \left(\frac{1 \, mol \; N_2}{?? \, kJ} \right) \left(\frac{28.0 \, grams \; N_2}{1 \, mol \; N_2} \right) = 270 \, grams \; N_2$$

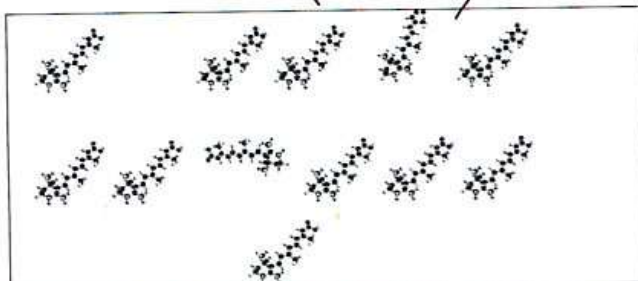9. $2 \, C_{10}H_{22} + 31 \, O_2 \longrightarrow 20 \, CO_2 + 22 \, H_2O + 13483 kJ$

a) What volume of CO_2 is produced when 17.4 litres of oxygen is used? Assume STP conditions.

$$17.4 \, L \; O_2 \times \left(\frac{1 \, mol \; O_2}{22.4 \, L \; O_2} \right) \times \left(\frac{20 \, mol \; CO_2}{31 \, mol \; O_2} \right) \times \left(\frac{22.4 \, L \; CO_2}{1 \, mol \; CO_2} \right) = 11.2 \, L \; CO_2$$

b) What amount of energy is released when 1.00 gram of $C_{10}H_{22}$ is burned?

$$1.00 \, gram \; C_{10}H_{22} \times \left(\frac{1 \, mol \; C_{10}H_{22}}{142.3 \, g \; C_{10}H_{22}} \right) \times \left(\frac{13483 \, kJ}{2 \, mol \; C_{10}H_{22}} \right) = 47.4 \, kJ$$

"RETINOL" IS A NUTRIENT NECESSARY FOR VISION. ITS MOLECULAR WEIGHT IS 286.45 GRAMS PER MOLE

10. What is the total mass of the entire box above?

$$12 \, molecules \times \left(\frac{1 \, mole \; Retinol}{6.02 \times 10^{23} \, molecules \; RETINOL} \right) \times \left(\frac{286.45 \, gram}{1 \, mole \; Retinol} \right) = 5.71 \times 10^{-21} \, grams$$

don't forget the exponent!

11. How many moles of retinol are in the box?

$$12 \, molecules \times \left(\frac{1 \, mole}{6.02 \times 10^{23} \, molecules} \right) = 1.99 \times 10^{-23} \, moles$$

12. If the molarity of the box is 0.00039M, what is the volume of the box?

★★★ AHA! THIS USES THE FORMULA $concentration = \frac{moles}{liters}$

rearranges to:

$$Volume = \frac{moles}{concentration}$$

so $$Volume = \frac{1.99 \times 10^{-23} \, moles}{0.00039 \, \frac{mol}{L}}$$

$$Volume = 5.1 \times 10^{-20} \, liters$$

13. $4 NH_3 + 5 O_2 \longrightarrow 6 H_2O + 4 NO + 905 kJ$

a) What mass of NO is produced when 2.0 moles of NH_3 react?

$$2.0 \, \underset{NH_3}{mol} \times \left(\frac{4 \; mol \; NO}{4 \; mol \; NH_3} \right) \times \left(\frac{30.0 \; grams \; NO}{1 \; mol \; NO} \right) = 60. \; grams \; NO$$

b) What volume of NH_3 is required to react with 3.00 litres of oxygen at STP?

$$3.00 \, \underset{O_2}{L} \times \left(\frac{moles \; O_2}{22.4 \; L \; O_2} \right) \left(\frac{4 \; moles \; NH_3}{5 \; moles \; O_2} \right) \left(\frac{22.4 \; L \; NH_3}{1 \; moles \; NH_3} \right) = 2.4 \; L \; NH_3$$

c) What volume of gaseous water, at STP, is produced along with 2.83 litres of NO gas at STP?

$$2.83 \, \underset{H_2O}{L} \times \left(\frac{1 \; mol \; H_2O}{22.4 \; L \; H_2O} \right) \times \left(\frac{4 \; mol \; NO}{6 \; mol \; H_2O} \right) \left(\frac{22.4 \; L \; NO}{1 \; mol \; NO} \right) = 1.89 \; L \; NO$$

d) How much energy is produced when 2.70 grams of NH_3 are burned?

$$2.70 \, \underset{NH_3}{grams} \times \left(\frac{1 \; mol \; NH_3}{17.0 \; grams \; NH_3} \right) \times \left(\frac{905 \; kJ}{4 \; mol \; NH_3} \right) = 35.8 \; kJ$$

Name _____
Period _____

1. If you are working with a solution of 0.7M $NaCl_{(aq)}$ which of these ratios are 'ONE'? In the box below each if the factor is true write True! if the factor is incorrect rewrite it so it isn't.

| $\dfrac{1\ year}{365.25\ days}$	$\dfrac{22.4\ moles\ STP\ gas}{1\ mole\ STP\ gas}$	$\dfrac{0.7\ L}{1\ mol\ Na +}$	$\dfrac{1\ inch}{12\ feet}$	$\dfrac{1\ mol\ Cl}{6.02 \times 10^{23}\ atoms\ of\ chlorine\ ions}$
true	backwds! $\dfrac{22.4\ L}{1\ mole}$	backwds $\dfrac{0.7\ moles}{1\ liter}$	backwords $\dfrac{1\ foot}{12\ inches}$	TRUE

2. This is a solid chunk of sodium carbonate.
   - In the box draw an aqueous chunk of the same substance.
   - Include eight water molecules.
   - Make sure the waters are pointing in the right direction!
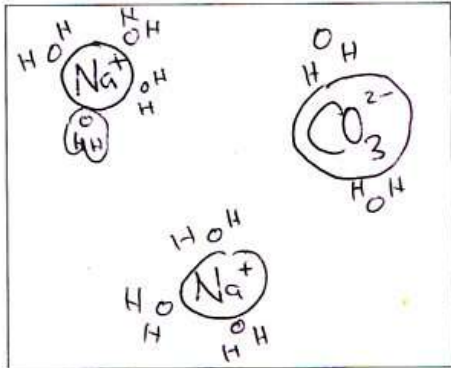
3.

4. Which end of H₂O has which electrical charge? Circle a correct choice in each parenthetical pair.	
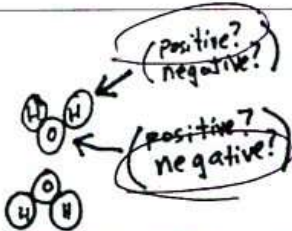
solution	solute	solvent
tears	NaCl	water
soda	CO_2	water
air	oxygen	nitrogen
tooth fillings!	silver, copper	mercury
moisturizer	glycerine	water
18 karat gold jewelry	copper	GOLD

5. Fill in the missing squares in the above table of solutes and solvents

6. Things are facing in the wrong directions here. Think about 'opposites attract' and draw things facing correctly in the box.
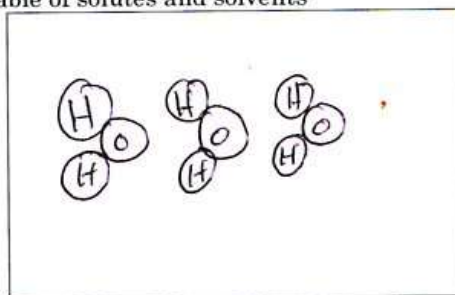
7. From memory, what is the formula of each
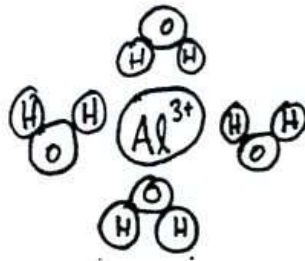
carbonic acid ___H_2CO_3___

phosphoric acid ___H_3PO_4___

8. Natural gas contains 97% methane (CH_4), 1.5% ethane (C_2H_6), 1% CO_2, and 0.5% nitrogen gases.

solvent ___methane___

solute(s): everything else

9. Things are facing in the wrong directions here. Think about 'opposites attract' and draw things facing correctly in the box.

oops ... this is on top of next page

10. Suppose an excess of aluminum was allowed to react with 45 mL of aqueous 0.39M hydrochloric acid to produce aluminum chloride and hydrogen gas. Assume the acid is the limiting reactant.

$$2Al + 6HCl \rightarrow 3H_2 + 2AlCl_3$$

   a. Write a balanced equation.
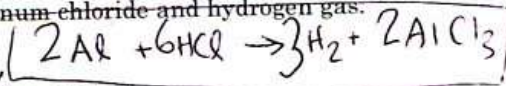
ANSWER ↑

   b. If all of the acid reacts, how many moles of aluminum should react?

$$45mL \times \left(\frac{1\ L}{1000\ mL}\right)\left(\frac{.39\ mol\ HCl}{1\ L\ HCl}\right)\times\left(\frac{2\ mol\ Al}{6\ mol\ HCl}\right) = 5.85\times10^{-3}\frac{mol}{Al}$$

   c. If all of the acid reacts, how many grams of aluminum chloride will form?

$$45mL\ HCl \times \left(\frac{1\ L}{1000\ mL}\right)\left(\frac{.39\ mol\ HCl}{1\ L\ HCl}\right)\times\left(\frac{2\ mol\ AlCl_3}{6\ mol\ HCl}\right)\left(\frac{133.33\ gram\ AlCl_3}{1\ mol\ AlCl_3}\right) = 0.78\ grams\ AlCl_3$$

   d. If all of the acid reacts, how many liters, at STP, of hydrogen should form?

$$45\ mL\ HCl \times\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{.39\ mol\ HCl}{1\ L}\right)\left(\frac{3\ mol\ H_2}{6\ mol\ HCl}\right)\left(\frac{22.4\ L\ H_2}{1\ mol\ H_2}\right) = 0.20\ L\ H_2$$

SKIP! →

Determine the volume in liters of carbon dioxide that should be produced in the reaction between 98.0. g of carbon and 500. liters of O_2. (Similar to the scissors sheet) LIMITING REACTANT; SKIP; THIS WON'T BE ON TEST. Too LON

11. What is the formula for finding volume if you're given moles and concentration?
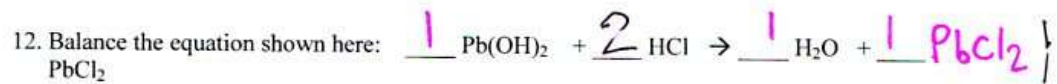
the original formula is

$$conc = \frac{moles}{volume}$$

rearranges to

$$volume = \frac{moles}{conc}$$

12. Balance the equation shown here: $\underline{1}$ Pb(OH)$_2$ + $\underline{2}$ HCl → $\underline{1}$ H$_2$O + $\underline{1}$ PbCl$_2$
PbCl$_2$

13. Based on the equation in the previous problema, if 45 mL of a 0.100M solution of Pb(OH)2 reacts, what volume of 0.740M HCl will react?

$$45\text{mL}_{Pb(OH)2} \times \left(\frac{1 \ L \ Pb(OH)_2}{1000 \ mL \ Pb(OH)_2}\right)\left(\frac{0.100 \ \frac{mol}{L} Pb(OH)_2}{1 \ L \ Pb(OH)_2}\right)\left(\frac{2 \ \frac{mol}{HCl}}{1 \ \frac{mol}{Pb(OH)_2}}\right)\left(\frac{1 \ L \ HCl}{.740 \ \frac{mol}{HCl}}\right) =$$

14. Based on the equation in the previous problema, if 0.975L of a 0.050M solution of Pb(OH)2 reacts, what volume of 1.3M HCl will react?

$$.975 L \ Pb(OH)_2 \times \left(\frac{.050 \ \frac{mol}{Pb(OH)_2}}{1 \ L \ Pb(OH)_2}\right)\left(\frac{2 \ \frac{mol}{HCl}}{1 \ \frac{mol}{Pb(OH)_2}}\right) \times \left(\frac{1 \ L \ HCl}{1.3 \ \frac{mol}{HCl}}\right) =$$

15. Balance the equation shown here: $\underline{3}$ KOH(aq) + $\underline{1}$ H$_3$PO$_4$(aq) →
$\underline{1}$ K$_3$PO$_4$(aq) + $\underline{3}$ H$_2$O(l)