

MULTIPLE CHOICE (3pts each): Write the ONE letter corresponding to the correct answer on the line next to each question. The LETTER ASSOCIATED WITH THE CORRECT ANSWER MUST BE WRITTEN ON THE LINE NEXT TO THE QUESTION in order to receive full credit.

- Which of the following compounds would be the most soluble in water? 1.) A
 a.) ☒ CH₃OH b.) PbCl₂ c.) C₂H₄ d.) FeCO₃
- The largest component of a solution is referred to as the 2.) D
 a.) solute b.) precipitate c.) spectator ion d.) ☒ solvent
- Which of the following solutions would have the largest number of dissolved ions? 3.) B
 a.) 2.0M NaCl
4M b.) ☒ 2.0M Na₂SO₄
6M c.) 3.0M Ag₂CO₃
insol d.) 3.0M PbS
insol
- What is the oxidation number on chromium in V₂O₆²⁻? 4.) A
 a.) ☒ +5 b.) +6 c.) +10 d.) +12
- What is the correct formula for the precipitate formed from the following reactants? NaOH (aq) + CaBr₂ 5.) C
 a.) NaBr₂ b.) NaBr c.) ☒ Ca(OH)₂ d.) CaOH
- What is the oxidizing agent in the reaction: $\overset{0}{\text{Fe}} + \overset{+2}{\text{SnCl}_2} \rightarrow \overset{0}{\text{Sn}} + \overset{+2}{\text{FeCl}_2}$ 6.) D
 a.) Fe b.) Sn c.) Fe²⁺ d.) ☒ Sn²⁺
- What are the products of the reaction between H₂SO₄ and KOH? 7.) C
 a.) H₂SO₄ and KOH b.) H₂S & K₂O c.) ☒ H₂O & K₂SO₄ d.) H₂, O₂, & K₂S
- If you start with 6.0 moles of H₂ and 6.0 moles of N₂, how many moles of NH₃ can be produced in the reaction 3H₂ + N₂ → 2NH₃? 8.) B
 a.) 2.0mol b.) ☒ 4.0mol c.) 6.0mol d.) 12.0mol
 $4(\frac{2}{3}) = 4$ $6(\frac{2}{3}) = 12$
- What is the concentration of a 500.0mL solution containing 5.00g MgF₂? 9.) A
 a.) ☒ 0.161M b.) 10.0M c.) 1.61x10⁻⁴M d.) 0.0100M
 $24.305 \text{ g/mol} + 2(18.9984 \text{ g/mol}) = 62.3018 \text{ g/mol}$ $5.00 \text{ g} (\frac{1 \text{ mol}}{62.3018 \text{ g}}) = 0.0803 \text{ mol} / 0.5 \text{ L}$
- What volume of a 0.136M stock solution would be needed to make 250mL of a 0.0500M solution? 10.) C
 a.) 680.mL b.) 1.70mL c.) ☒ 91.9mL d.) 27.2mL

$$(0.136 \text{ M})(x) = (0.0500 \text{ M})(250 \text{ mL})$$

2023F_C

$$x = 91.9 \text{ mL}$$

SHORT ANSWER (10 pts each): Completely answer all of the following questions. Read all questions carefully!!! ALL WORK MUST BE SHOWN TO RECEIVE FULL CREDIT. If your work is in a different location, you must make a note of this in the given work area for the problem in order for the work to be considered for partial credit. Make sure to include units and report all mathematical answers to the correct number of significant figures. Write final answers in designated locations when indicated.

1.) Given the reaction $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$,

a.) if 15.2g of iron (III) oxide (159.6882g/mol) is combined with 25.5g carbon monoxide (28.0104g/mol), what is the limiting reagent?

Answer: Fe_2O_3

$$15.2\text{g} \left(\frac{1\text{mol}}{159.6882\text{g}} \right) = 0.0951855\text{mol Fe}_2\text{O}_3 \left(\frac{2\text{mol Fe}}{1\text{mol Fe}_2\text{O}_3} \right) = 0.19037\text{mol Fe}$$

$$25.5\text{g} \left(\frac{1\text{mol}}{28.0104\text{g}} \right) = 0.910376\text{mol CO} \left(\frac{2\text{mol Fe}}{3\text{mol CO}} \right) = 0.60692\text{mol Fe}$$

← Less so Fe_2O_3 is LR

b.) What mass of iron would be produced?

Answer: 10.6g

$$0.19037\text{mol Fe} \left(\frac{55.845\text{g}}{\text{mol}} \right) = 10.6312\text{g}$$

2.) A 0.599g sample of an unknown compound containing carbon, hydrogen, and oxygen was burned to produce 1.20g CO_2 (44.0098g/mol) and 0.490g H_2O (18.01528g/mol). What was the empirical formula of the unknown compound?

Answer: $\text{C}_2\text{H}_4\text{O}$

$$1.20\text{g CO}_2 \left(\frac{1\text{mol}}{44.0098\text{g}} \right) = 0.027267\text{mol CO}_2 \left(\frac{1\text{mol C}}{1\text{mol CO}_2} \right)$$

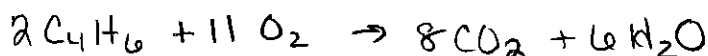
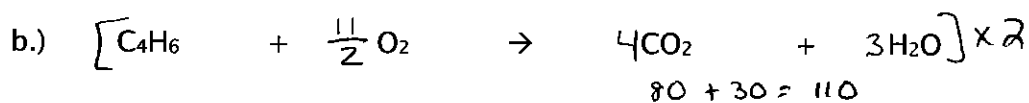
$$= \frac{0.027267\text{mol C} \left(\frac{12.011\text{g}}{\text{mol}} \right)}{0.01354} \rightarrow 2\text{C} = 0.3275\text{g C}$$

$$0.490\text{g H}_2\text{O} \left(\frac{1\text{mol}}{18.01528\text{g}} \right) = 0.027199\text{mol H}_2\text{O} \left(\frac{2\text{mol H}}{1\text{mol H}_2\text{O}} \right)$$

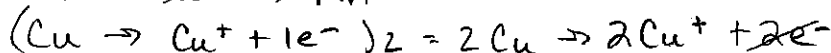
$$= \frac{0.054398\text{mol H} \left(\frac{1.00794\text{g}}{\text{mol}} \right)}{0.01354} \rightarrow 4\text{H} = 0.05483\text{g H}$$

$$0.599\text{g} - 0.3275\text{g} - 0.05483\text{g} = 0.21667\text{g O} \left(\frac{1\text{mol}}{15.9994\text{g}} \right) = 0.01354\text{mol O}$$

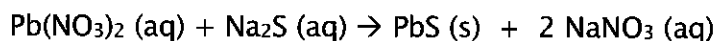
3.) Balance the following equations:



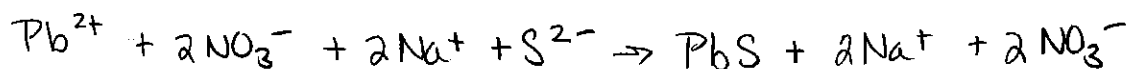
Use the charges to balance the following equation:



Write the total ionic and net ionic equations for the following reaction:



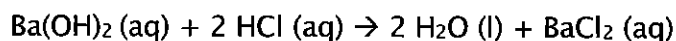
d.) Total ionic equation (you do not need to include phases):



e.) Net ionic equation (you do need to include phases):



4.) If 38.76mL of 0.250M barium hydroxide is needed to fully titrate 35.00mL of hydrochloric acid, what is the concentration of the hydrochloric acid solution?



Answer: 0.537 M

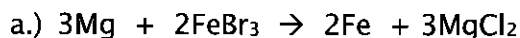
$0.03876\text{L} \left(\frac{0.250\text{mol}}{\text{L}} \right)$

$= 0.0094\text{ mol Ba}(\text{OH})_2 \left(\frac{2\text{ mol HCl}}{1\text{ mol Ba}(\text{OH})_2} \right)$

$= \frac{0.0188\text{ mol HCl}}{0.03500\text{L}}$

$= 0.53714\text{ M}$

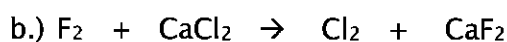
5.) For each of the following reactions, write the oxidation and reduction half reaction, then indicate the oxidizing agent for each. Write the symbol for the oxidizing agent, not the name.



Oxidation $\frac{1}{2}$ reaction: $\text{Mg} \rightarrow \text{Mg}^{2+} + 2e^-$

Reduction $\frac{1}{2}$ reaction: $\text{Fe}^{3+} + 3e^- \rightarrow \text{Fe}$

Oxidizing Agent: Fe^{3+}

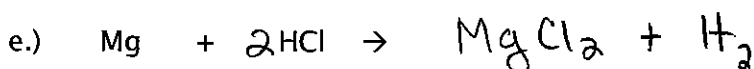
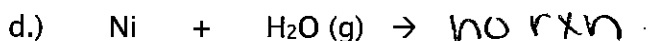
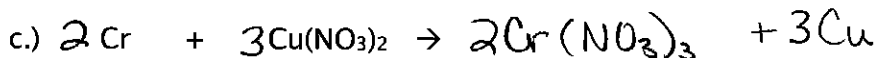
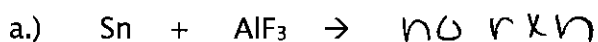


Oxidation $\frac{1}{2}$ reaction: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-$

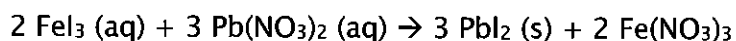
Reduction $\frac{1}{2}$ reaction: $\text{F}_2 + 2e^- \rightarrow 2\text{F}^-$

Oxidizing Agent: F_2

6.) Complete and balance the following equations. If no reaction will occur, write no rxn.



7.) Lead (II) nitrate was reacted with 25.00mL of iron (III) iodide to form 0.258g of solid lead (II) iodide (461.008g/mol). What was the concentration of the iron (III) iodide solution?



Answer: 0.0149 M

$$0.258 \text{ g} \left(\frac{1 \text{ mol}}{461.008 \text{ g}} \right)$$

$$= 0.000559643 \text{ mol PbI}_2 \left(\frac{2 \text{ FeI}_3}{3 \text{ PbI}_2} \right)$$

$$= \frac{0.000373095 \text{ mol FeI}_3}{0.02500 \text{ L}}$$

$$= 0.014924 \frac{\text{mol}}{\text{L}}$$