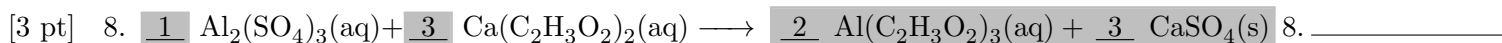
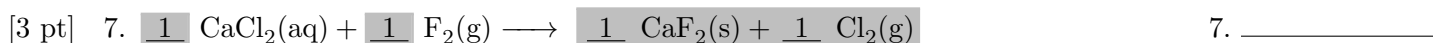
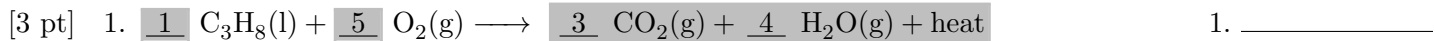


Name: _____ Class: _____ Date: _____

Instructions: Answer the following questions. Show ALL work for problems to receive full credit. Make sure to include proper units and significant figures for all answers.

Complete and balance the following reactions. Indicate the state (solid, liquid or gas) of the products when known. If heat is produced as a product include it. If no reaction occurs write NR in the answer blank.

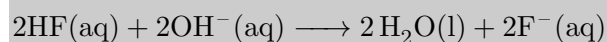
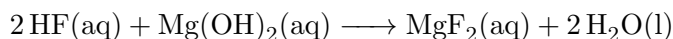


CHE 111 - Exam 4

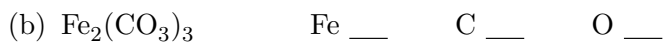
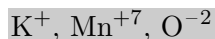
- [6 pt] 9. Define each of the following terms, list what type of molecules have these properties and give an example compound for each.

	Definition	Class of Molecules	Example
Strong Electrolyte	Dissociates 100% into ions	Strong Acids Strong Bases Ionic (aq)	H ₂ SO ₄ etc. NaOH etc. NaCl(aq) etc.
Weak Electrolyte	Dissociate < 10% into ions	Weak Acids Weak Acids	CHC ₂ H ₃ O ₂ etc NH ₄ OH etc.
Non-Electrolyte	Do not dissociate when dissolved in water	Molecular Compounds Ionic (s)	CHO etc. PbI ₂ Etc.

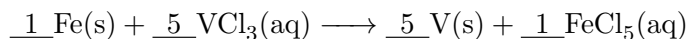
- [4 pt] 10. Write the total ionic equation and the net ionic equation for the following reaction:



- [5 pt] 11. What is the oxidation number of each of the atoms in the following compounds or ions.



- [5 pt] 12. In the following reaction write the oxidation number of each element below it. Determine which element is oxidized and which element is reduced and write it in the answer blank.



Oxidized: Fe

Reduced: V

0

+3, -1

0

+5, -1

CHE 111 - Exam 4

[0 pt] 13. Some useful and not so useful Molecular Weights to save you some time:

PbCl ₂ = 278.11 g/mol	NaCl = 58.44 g/mol	Pb(NO ₃) ₂ = 331.23 g/mol
Ca(OH) ₂ = 74.10 g/mol	Al ₂ (SO ₄) ₃ = 342.11 g/mol	C ₂ H ₆ = 30.07 g/mol
CO ₂ = 44.01g/mol	H ₂ O = 18.02 g/mol	O ₂ = 16.00 g/mol
H ₂ SO ₄ = 98.09 g/mol	H ₃ PO ₄ = 98.00 g/mol	NaOH = 40.00 g/mol
Na = 22.99 g/mol	Fe ₂ O ₃ = 159.70 g/mol	Al = 26.95 g/mol
Fe = 55.85 g/mol	Al ₂ O ₃ = 101.90 g/mol	

[4 pt] 14. What is the Molarity of a solution made from 25.0 g of Ca(OH)₂ added to 350.0 mL of 14. **0.964 M Ca(OH)₂** water?

$$\frac{25.0 \text{ g Ca(OH)}_2}{350 \text{ mL}} \times \frac{1 \text{ mol Ca(OH)}_2}{74.10 \text{ g Ca(OH)}_2} \times \frac{1 \text{ mL}}{0.001 \text{ L}} = 0.963948$$

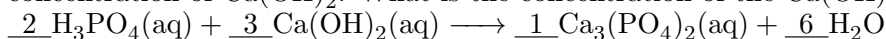
[4 pt] 15. How many O atoms are in 25.0 g of Al₂(SO₄)₃? 15. **5.28 × 10²³ atoms Al₂(SO₄)₃**

$$\frac{25.0 \text{ g Al}_2(\text{SO}_4)_3}{342.11 \text{ g Al}_2(\text{SO}_4)_3} \times \frac{1 \text{ mol Al}_2(\text{SO}_4)_3}{1 \text{ mol Al}_2(\text{SO}_4)_3} \times \frac{6.02 \times 10^{23} \text{ molec.}}{1 \text{ mol Al}_2(\text{SO}_4)_3} \times \frac{12 \text{ atoms O}}{1 \text{ molecule Al}_2(\text{SO}_4)_3} = 5.2790 \times 10^{23}$$

[4 pt] 16. How many grams of H₂O can be produced by burning 28.75 grams of C₂H₆? 16. **51.69 g H₂O**
2 C₂H₆(g) + 7 O₂(g) → 4 CO₂(g) + 6 H₂O(g)

$$\frac{28.75 \text{ g C}_2\text{H}_6}{30.07 \text{ g C}_2\text{H}_6} \times \frac{1 \text{ mol C}_2\text{H}_6}{1 \text{ mol C}_2\text{H}_6} \times \frac{6 \text{ mol H}_2\text{O}}{2 \text{ mol C}_2\text{H}_6} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 51.686897$$

[5 pt] 17. In a titration, it took 115.0 mL of 0.38 M H₃PO₄ to neutralize 45.0 mL of an unknown 17. **1.5 M Ca(OH)₂** concentration of Ca(OH)₂. What is the concentration of the Ca(OH)₂ solution?



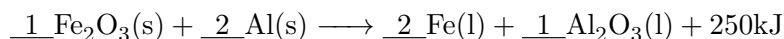
$$\frac{115.0 \text{ mL H}_3\text{PO}_4}{45.0 \text{ mL Ca(OH)}_2} \times \frac{0.001 \text{ L}}{1 \text{ mL}} \times \frac{0.38 \text{ mol H}_3\text{PO}_4}{1 \text{ L H}_3\text{PO}_4} \times \frac{3 \text{ mol Ca(OH)}_2}{2 \text{ mol H}_3\text{PO}_4} \times \frac{1 \text{ mL}}{0.001 \text{ L}} = 1.456666$$

[5 pt] 18. Relax, take a break. Imagine yourself on you dream vacation doing something amazing. Tell me where you are and what you are doing? (Then get back to work you slackers!)

CHE 111 - Exam 4

- [5 pt] 19. Your 3.00 g "sample" of cocaine is cut with NaCl. To determine the percentage impurity you react your "sample" with $\text{Pb}(\text{NO}_3)_2$ to produce 5.30 g of PbCl_2 precipitate. What is the percentage of NaCl in your cocaine? 74.3 %
- [8 pt] 20. An unknown hydrocarbon (C_xH_y) was combusted to produce 22.72 g CO_2 and 11.62 g of H_2O . The molecular weight of the original compound is 58.119 g/mol.
- (a) What is the percentage of Carbon? 20(a) 82.67%
- (b) What is the percentage of Hydrogen? 20(b) 17.33%
- (c) What is the Empirical Formula of the compound? 20(c) C_2H_5
- (d) What is the Molecular Formula of the compound? 20(d) C_4H_{10}

[21 pt] 21. You perform a reaction in lab starting with 50.0 g of Fe_2O_3 and 75.0 g Al. Show all calculations in the space provided.



(a) What is the limiting reactant? 21(a) **Fe₂O₃**

$$\frac{50.0 \text{ g Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{55.845 \text{ g Fe}}{1 \text{ mol Fe}} = 34.9686$$

$$\frac{75.0 \text{ g Al}}{26.982 \text{ g Al}} \times \frac{1 \text{ mol Al}}{2 \text{ mol Al}} \times \frac{1 \text{ mol Fe}}{1 \text{ mol Fe}} \times \frac{55.845 \text{ g Fe}}{1 \text{ mol Fe}} = 77.7006$$

(b) How many grams of the excess reagent will be left over? 21(b) **58.1 g Al**

$$\frac{50.0 \text{ g Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{2 \text{ mol Al}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{26.982 \text{ g Al}}{1 \text{ mol Al}} = 16.895$$

Start - End = Left Over
75.0 - 16.9 = 58.1

(c) What is the theoretical yield in grams of Fe in grams? 21(c) **35.0 g Fe₂O₃**

See part (a)

(d) What is the theoretical yield in grams of Al_2O_3 in grams? 21(d) **31.9 g Al₂O₃**

See part (a)

(e) What is the percent yield if you performed the reaction and produced 23.0 grams of Fe? 21(e) **65.7 %**

$$\text{Percent Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

$$\frac{23.0}{35.0} \times 100 = 65.71$$

(f) How many Joules of heat will be released? 21(f) **78,300 J**

$$\frac{50.0 \text{ g Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{250 \text{ kJ}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{1000 \text{ J}}{1 \text{ kJ}} = 78,271.76$$

(g) Does the reaction obey Lavoisier Law? Explain. 21(g) **78,300 J**