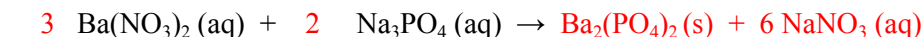


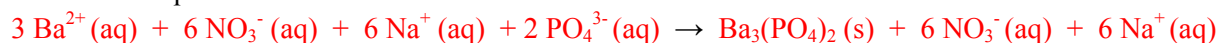
Exam III – Chapters 10, 3, & 4

Please show ALL work for full credit.

- (4 pts) Please circle all of the following that are soluble in water.
 - dry ice, CO_2 (s)
 - Al_2S_3 (s)
 - zinc, Zn
 - $\text{Ca}(\text{OH})_2$ (s)
 - I_2 (s)
 - sugar, $\text{C}_6\text{H}_{12}\text{O}_6$ (s)
- (10 pts) Predict the products of the following reaction. Be sure to include physical states and balance the equation. Then write the complete (and balanced) ionic and net ionic equations.

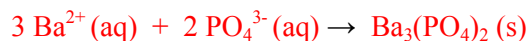


Total Ionic Equation:

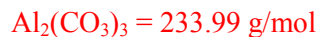


Spectator Ions: $6 \text{NO}_3^- (\text{aq}) + 6 \text{Na}^+ (\text{aq})$

Net Ionic Equation:



- (5 pts) Calculate the molar mass for aluminum carbonate.



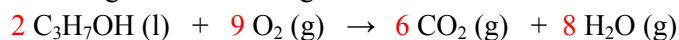
- (8 pts) Calculate the number of oxygen atoms in 2.50 g of aluminum carbonate.



- (12 pts) Comparing hexanes, C_6H_{14} (l), to n-propanol, $\text{C}_3\text{H}_7\text{OH}$ (l), please determine if the following are true or false.

- | | | |
|--|-------------|--------------|
| a. Propanol's intermolecular forces are stronger than hexanes. | True | False |
| b. Hexane's boiling point is higher than propanol's. | True | False |
| c. Hexane's viscosity is lower than propanol's. | True | False |
| d. Propanol's vapor pressure is higher than propanol's. | Ignore | True |
| e. Hexane experiences hydrogen bonding forces. | True | False |
| f. Propanol experiences dispersion forces. | True | False |

6. (10 pts) The density of *n*-propanol is 0.8034 g/cm³. How many mL of *n*-propanol are needed to produce 15.0 g of CO₂ according to the following combustion reaction:



$$15.0 \text{ g CO}_2 (1 \text{ mol CO}_2/44.01 \text{ g})(2 \text{ mol C}_3\text{H}_7\text{OH}/ 6 \text{ mol CO}_2)(1 \text{ ml}/0.803 \text{ g}) = 8.50 \text{ ml C}_3\text{H}_7\text{OH}$$

7. (12 pts) For each set of reactants below,

(1) identify the **type of reaction** by assigning one of the following letter codes:

Combination (C)

Double Replacement (DR)

Decomposition (D)

Acid-Base Neutralization (N)

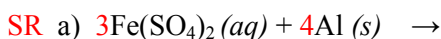
Single-replacement (SR)

(2) **predict the products** of that reaction, and **balance the equation** (don't forget physical states!)

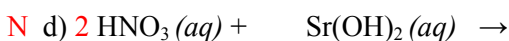
Write **NR** on the Reaction Type and Product(s) lines if no reaction occurs.

Reaction Type

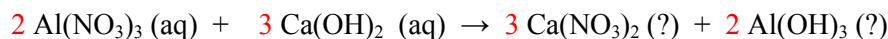
Product(s)



No Reaction



8. (17 pts total) When 125 mL of 0.500 M Al(NO₃)₃ is added to 155 mL of 0.300 M Ca(OH)₂, how many grams of precipitate are formed?



$$125 \text{ mL Al}(\text{NO}_3)_3 (0.500 \text{ mol Al}(\text{NO}_3)_3/\text{L})(1 \text{ L}/1000\text{mL})(2 \text{ mol Al}(\text{OH})_3/2 \text{ mol Al}(\text{NO}_3)_3)(78.01 \text{ g Al}(\text{OH})_3/\text{mol}) = 4.88 \text{ g Al}(\text{OH})_3$$

$$155 \text{ mL Ca}(\text{OH})_2 (0.300 \text{ mol Ca}(\text{OH})_2 /\text{L})(1 \text{ L}/1000\text{mL})(2 \text{ mol Al}(\text{OH})_3/3 \text{ mol Ca}(\text{OH})_2)(78.01 \text{ g Al}(\text{OH})_3/\text{mol}) = 2.42 \text{ g Al}(\text{OH})_3$$

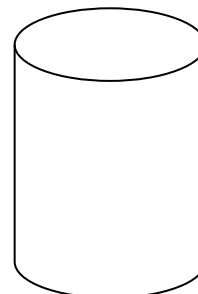
Mass of precipitate formed: 2.42 g Al(OH)₃

(2 pts) Indicate all the species present in the beaker after the reaction occurs:

Ca²⁺ and NO₃⁻ are spectators

Al³⁺ is in excess

Al(OH)₃ is the solid



(3 pts) What is the percent yield if the reaction produced only 1.25 grams of precipitate?

$$1.25 \text{ g} / 2.42 \text{ g} \times 100\% = 51.7 \%$$

9. (8 pts) What is the empirical formula for a compound containing 59.94% C, 13.44% H, and 26.62% O by mass?

$$59.94 \text{ g C (1 mol / 12.01 g)} = 4.99 \text{ mol C}$$

$$\text{C/O} = 3 \quad \text{C}_3\text{H}_8\text{O}$$

$$13.44 \text{ g H (1 mol / 1.10 g)} = 13.31 \text{ mol H}$$

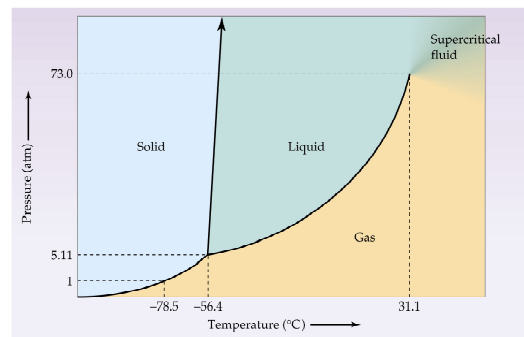
$$\text{H/O} = 8$$

$$26.62 \text{ g O (1 mol/16.00 g)} = 1.664 \text{ mol O}$$

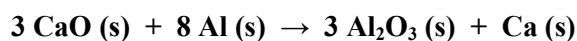
10. (4 pts) Please answer the following questions regarding the phase diagram provided:

a. The temperature for the **normal** boiling point is _____

b. The triple point occurs at what pressure? _____



11. (10 pts) In the following equation, assign oxidation numbers to **each element** in the reaction below, and identify what is: reduced, oxidized, the reducing agent, the oxidizing agent.



Oxidation Numbers: Reactants

Ca: +2

O: -2

Al: 0

Products

Ca: 0

O: -2

Al: +3

Oxidized: Al

Reduced: Ca²⁺

Oxidizing agent: CaO

Reducing agent: Al