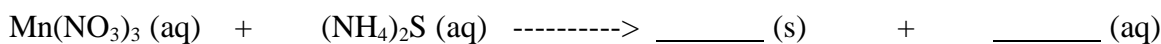


For full credit, please show all work clearly; please answer questions 2(a), 3, and 4 on the test sheets, and 1 and 2 (b-i) on the paper provided. Please write your real name on all answer sheets:

(1.) A molecular compound X comprises 69.60% S and 30.40% N. The molar mass is found from experiment to be 187 g.

- (a) Please determine the empirical and molecular formulae of X. (10 points)
- (b) Combustion of X generates the dioxides of sulfur and nitrogen; please write the balanced equation for this combustion. (5 points)
- (c) How many grams of each dioxide are produced from the complete combustion of 1.000 g of X? (Assume O₂ in excess) (10 points)

(2.) Suppose 122.2 mL of 0.170 M Mn(NO₃)₃ (aq) solution is mixed with 107.0 mL of 0.240 M (NH₄)₂S (aq) solution.



- (a) Please complete and balance the equation shown above: (5 points)
 - (b) Is this a metathesis reaction? (2 pts)
 - (c) What are the names of the products? (4 pts)
 - (d) Please write the net ionic reaction (2 pts). Please name the spectator ions (2 pts)
 - (e) By one calculation of your choice, please show which reactant is the limiting reactant (10 pts).
 - (f) What is the theoretical yield (in g) of the precipitate? (5 points)
 - (g) The precipitate was collected and dried, and the percentage yield determined to be 77.7%. What was the mass of this product? (5 points)
 - (h) Before mixing the solutions, what is the concentration of the nitrate ion? (2 points)
 - (i) After mixing the solutions, what is the concentration of the nitrate ion? (3 points)
- (3.) Please complete and balance the following, using parentheses to assign aqueous solution and precipitate, where appropriate. In addition, please write the net ionic reaction for each, please name the spectator ions, and please name all the precipitates: (5 x 5 points)



(4.) Please "match the pairs" by writing the best matching letter in the space given, using each letter once only: (10 x 1 points)

- | | |
|----------------------------|---------------------------------------|
| _____ concentration | (A) replacement |
| _____ u | (B) surrounded by six water molecules |
| _____ theoretical yield | (C) way to report mass of constituent |
| _____ metathesis | (D) obeyed in chemical equations |
| _____ molecular formula | (E) a mass derived from stoichiometry |
| _____ Cl ⁻ (aq) | (F) a relative property of solutes |
| _____ solute | (G) moles/1000 mL of solution |
| _____ percentage | (H) represents molar mass |
| _____ solubility | (I) it dissolves |
| _____ mass balance | (J) standard units of atomic mass |