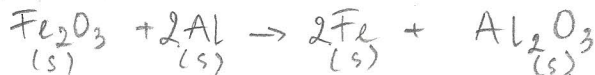


Please read all the questions VERY carefully before answering. Ask your instructor if you do not understand. No outside paper is allowed. The last page is a periodic table with constants. Total points =  $53 + (25 * 3) = 75 = 128$

SHORT ANSWER. Please write the set-up equation first, then put the raw data with units before calculating. Write the word or phrase that best completes each statement or answers the question.

- 1) In the reaction between  $\text{Fe}_2\text{O}_3$  (s) and Al (s) to produce Fe (s) and  $\text{Al}_2\text{O}_3$  (s), 23.5 g of  $\text{Fe}_2\text{O}_3$  was reacted with 13.2 g of Al. (a) Show all your calculations to find out the limiting reagent (8 pts.)

1)  $\text{Fe}_2\text{O}_3$



$$\text{Fe produced by Al} = 13.2 \text{ g Al} \times \frac{1 \text{ mol Al}}{27 \text{ g Al}} \times \frac{2 \text{ mol Fe}}{2 \text{ mol Al}} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = 27.4 \text{ g Fe}$$

$$\text{Fe produced by Fe}_2\text{O}_3 = 23.5 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{(56 \times 2 + 16 \times 3) \text{ g Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = 16.45 \text{ g Fe}$$

→  $\text{Fe}_2\text{O}_3$  is the limiting reagent because it produces the smaller amount of Fe. ✓

(b) [EXTRA POINT QUESTION]

Calculate the amount (in grams) of the reagent that remained unreacted (6 pts.)

$$\text{mol Al} = 13.2 \text{ g Al} \times \frac{1 \text{ mol Al}}{27 \text{ g Al}} = 0.489 \text{ mol}$$

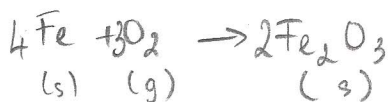
$$\text{mol Al react} = 23.5 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{(56 \times 2 + 16 \times 3) \text{ g Fe}_2\text{O}_3} \times \frac{2 \text{ mol Al}}{1 \text{ mol Fe}} = 0.294 \text{ mol Al}$$

$$\rightarrow \text{mol Al remained} = 0.489 - 0.294 = 0.195 \text{ mol Al}$$

$$\rightarrow \text{Al remained} = 0.195 \text{ mol Al} \times \frac{27 \text{ g Al}}{1 \text{ mol Al}} = \boxed{5.265 \text{ g Al}}$$

2) Iron, Fe(s) reacts with oxygen gas, O<sub>2</sub>(g) to produce Fe<sub>2</sub>O<sub>3</sub> (s). Calculate how many grams of (a) Fe and (b) O are necessary to make 23.7 g of Fe<sub>2</sub>O<sub>3</sub> (4 pts. each, total 8 pts)

2)  $\frac{16.6 \text{ g Fe}}{7.11 \text{ g O}_2}$



$$\text{Fe (g)} = 23.7 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{(56 \times 2 + 16 \times 3) \text{ g Fe}_2\text{O}_3} \times \frac{4 \text{ mol Fe}}{2 \text{ mol Fe}_2\text{O}_3} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = 16.59 \text{ g Fe} \checkmark$$

$$\text{O}_2 \text{ (g)} = 23.7 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{(56 \times 2 + 16 \times 3) \text{ g Fe}_2\text{O}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol Fe}_2\text{O}_3} \times \frac{(16 \times 2) \text{ g O}_2}{1 \text{ mol O}_2} = 7.11 \text{ g O}_2 \checkmark$$

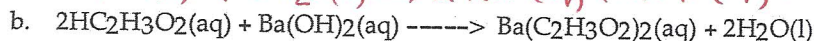
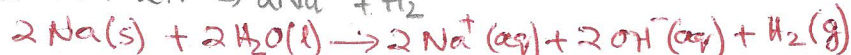
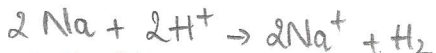
3) Write the net-ionic equation for the following reactions: Include phase labels for both reactants and products. Also classify each reaction, giving its type. (4 pts/each; 8 pts. tot)

3) \_\_\_\_\_



Net Ionic Equation:

Reaction Type: acid-base neutralization



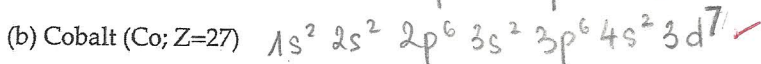
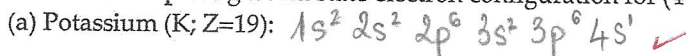
Net Ionic Equation:

Reaction Type: acid-base neutralization



4) Draw the complete ground state electron configuration for (4 pts./each; Total = 8pts.)

4) \_\_\_\_\_



5) Using only periodic table,

5) \_\_\_\_\_

(a) List atomic numbers 15, 16, 33 in order of increasing atomic size (6 pts.)



(b) List elements Be, N, F in order of increasing first ionic ionization energy (6 pts.)



