

Calculations:

1. In this chemical reaction one product is pure copper, the other is a combination of iron and sulphate. Write the chemical formula and the I.U.P.A.C. names for two possible iron sulphate compounds based on the more common oxidation states of iron (Fe^{2+} & Fe^{3+}). If you have done this correctly you should have TWO formula and TWO names!
2. Based on your answer to #1, write TWO different balanced chemical equations that could represent this single replacement reaction. Use the formula CuSO_4 for the copper(II) sulphate pentahydrate (ignore the five attached water molecules). Also note that water is simply the medium for the reaction and does not enter into the chemical equations.
3. Based on your answer to #2, do TWO separate stoichiometric calculations that predict the expected mass of copper product based on the mass of iron you used in your experiment. Both of these calculations will require three conversion factors. These answers are called theoretical values since they are based on "stoichiometric theory".
4. Find your experimental mass of copper product. This will require a standard three line calculation. Compare your two possible theoretical masses of copper metal with your experimentally observed mass of copper. Identify the balanced chemical equation from #2 that best matches your experimental results.
5. Based on your answer to #4 perform a %error calculation using your experimental and theoretical mass of copper metal.

$$\% \text{ error} = \frac{|\text{experimental mass} - \text{theoretical mass}|}{\text{theoretical mass}} \times 100 \%$$

Concluding Questions:

1. Find and write definitions for oxidation and for reduction.
2. Synthesis, Decomposition and Single Replacement reactions are also Redox Reactions. This means that one element has undergone a reduction and a second element has undergone an oxidation (Redox is short for REDuction-OXidation). Write the chemical reaction (the one you have determined to be the best from above) and write the oxidation states of all elements above each elements symbol. Next, using these oxidation states, determine which element was oxidized and which element was reduced. Make sure that this is clearly stated. You may wish to answer your question using the arrow method shown in class!
3. Is the reaction between Fe and CuSO_4 reaction endothermic or exothermic? Back up your answer with one clear visual observation.
4. How can you test that the copper product was in fact dry?
5. Identify three good sources of error inherent in this experimental procedure.