Free Response Question (I)

1. For each of the following three reactions, in part (i) write a balanced equation for the reaction and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction. You may use the empty space at the bottom of the next page for scratch work, but only equations that are written in the answer boxes provided will be graded.

(a) Solid copper(II) sulfate pentahydrate is gently heated.

(i) Balanced equation:

(ii) How many grams of water are present in 1.00 mol of copper(II) sulfate pentahydrate?

(b) Excess concentrated aqueous ammonia is added to a solution of nickel(II) nitrate, leading to the formation of a complex ion.(Not on the test)

(i) Balanced equation:

(ii) Which of the reactants acts as a Lewis acid?

(c) Methylamine (CH_3NH_2) is added to a solution of hydrochloric acid.

(i) Balanced equation:

(ii) Methylamine dissolves in water to form a solution. Indicate whether this solution is acidic, basic, or neutral.

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(a) A sample of solid iron(III) oxide is reduced completely with solid carbon.

(i) Balanced equation:

(ii) What is the oxidation number of carbon before the reaction, and what is the oxidation number of carbon after the reaction is complete

(b) Equal volumes of equimolar solutions of ammonia and hydrochloric acid are combined.

(i) Balanced equation:

(ii) Indicate whether the resulting solution is acidic, basic, or neutral. Explain.

(c) Solid mercury(II) oxide decomposes as it is heated in an open test tube in a fume hood.

(i) Balanced equation:

(ii) After the reaction is complete, is the mass of the material in the test tube greater than, less than, or equal to the mass of the original sample? Explain.