Reversible Reactions Mastery Booklet

Reversible reactions are ones where the products can turn back into reactants. Use your notes to help you answer the questions below.

Part 1: Fundamentals

1. Ammonium chloride (NH_4Cl) breaks down into ammonia (NH_3) and hydrogen chloride (HCl). This is a reversible reaction.
    a) Write a word equation for this reaction
    b) Write a symbol equation for this reaction using the formulae provided in the question.
    c) Balance your symbol equation
2. How have you shown that this is a reversible reaction?
3. A reaction between A and B makes C and D. The reaction is reversible.
    a) Write an equation for this reaction. A and C are liquids, B and D are gases.
    b) Explain what it means that this is a reversible reaction
    c) When A and B react together they release 71kJ of energy to the surroundings. What does this say about the reaction?
4. How does the energy change for a reversible reaction in one direction compare with the energy change in the other direction?
5. Page 140: what can anhydrous copper (II) sulphate be used to test for?
6. The word equation shows the reaction between anhydrous cobalt chloride and water.

    Anhydrous cobalt chloride (blue) + water ⇌ hydrated cobalt chloride (pink)

    a) Name the type of reaction shown by the sign ⇌
    b) When the student added water to anhydrous cobalt chloride what happened?
    c) A student measured the temperature rise when anhydrous cobalt chloride was added to water. The student's results are shown in the table below.

	Trial 1	**Trial 2**	**Trial 3**
Temperature at start (°C)	22	21	22.5
Temperature at end (°C)	44	43	47

    d) Calculate a temperature change for each trial
    e) Calculate the mean temperature change
    f) Is this reaction endothermic or exothermic? Explain your answer.
    g) Name the type of reaction when hydrated cobalt chloride reacts to form anhydrous cobalt chloride and water.
    h) What temperature change would you expect for this?
    i) Explain your answer to (g)

Challenge: questions 2 and 3 on page 139

Part 2: Dynamic Equilibrium

Dynamic equilibrium is the point at which reactants are products are turning into each other at the same rate. At the start of a reaction, lots of product is being made. As time goes on, less product is being made because we run out of reactant. But also product starts turning back into reactant. When this is happening at the same **rate**, the reaction has reached dynamic equilibrium.

7. A reversible reaction is occurring between X and Y to make XY.
    a) Write an equation for this reaction.
    b) Identify the reactants and the product.
    c) At the beginning of the reaction, there is no XY. What needs to happen before X and Y can turn into XY?
    d) As the reaction goes on, XY turns back into X and Y. Explain why this occurs.
    e) The rate of the forward reaction (X + Y) at dynamic equilibrium is 42g/s. What is the rate of the reverse reaction?
    f) A students heats up the reaction mixture. What does this do to the rate of the reaction? Explain your answer.
    g) In what other ways could the student increase the rate of reaction?