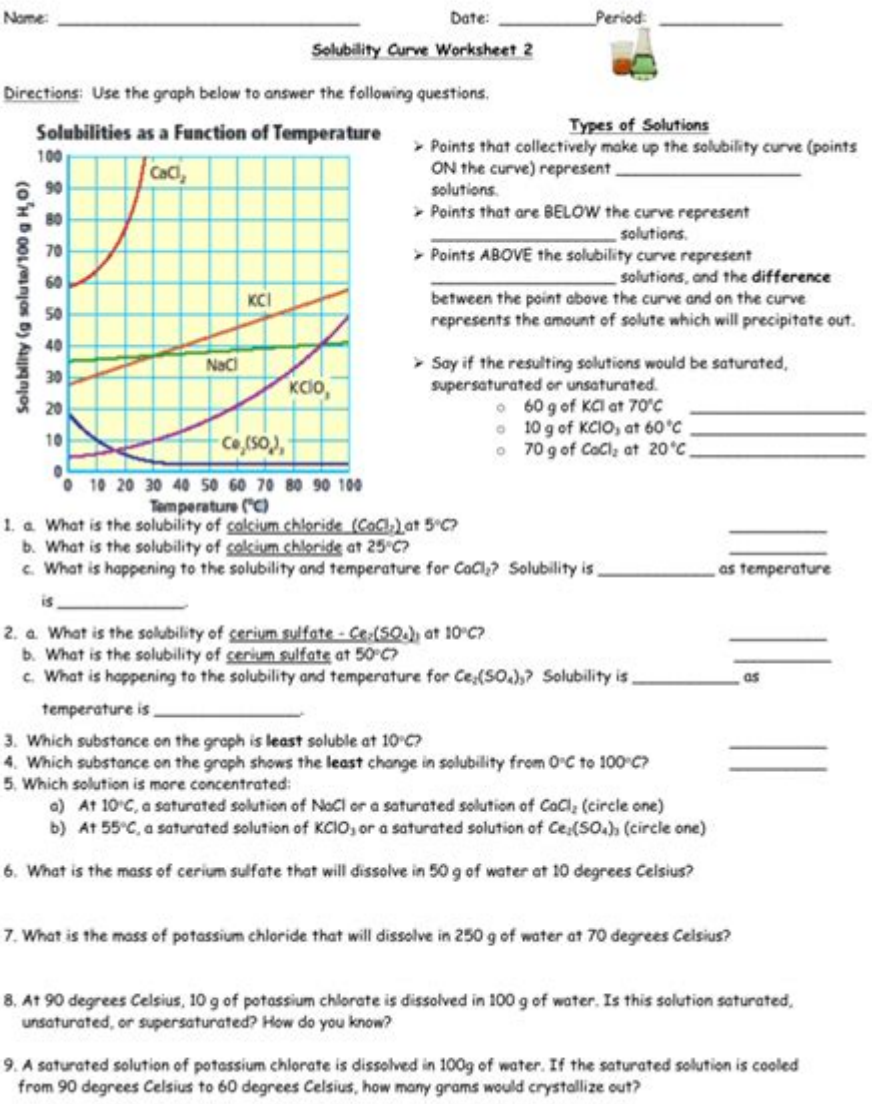
Solubility Curve Practice Problems Worksheet



Name: _____ Date: _____ Period: _____

Solubility Curve Worksheet 2

Directions: Use the graph below to answer the following questions.

Solubilities as a Function of Temperature

Types of Solutions

- Points that collectively make up the solubility curve (points ON the curve) represent _____ solutions.
- Points that are BELOW the curve represent _____ solutions.
- Points ABOVE the solubility curve represent _____ solutions, and the **difference** between the point above the curve and on the curve represents the amount of solute which will precipitate out.
- Say if the resulting solutions would be saturated, supersaturated or unsaturated.
  - 60 g of KCl at 70°C _____
  - 10 g of $KClO_3$ at 60°C _____
  - 70 g of $CaCl_2$ at 20°C _____

1. a. What is the solubility of calcium chloride ($CaCl_2$) at 5°C? _____
   b. What is the solubility of calcium chloride at 25°C? _____
   c. What is happening to the solubility and temperature for $CaCl_2$? Solubility is _____ as temperature is _____.
2. a. What is the solubility of cerium sulfate - $Ce_2(SO_4)_3$ at 10°C? _____
   b. What is the solubility of cerium sulfate at 50°C? _____
   c. What is happening to the solubility and temperature for $Ce_2(SO_4)_3$? Solubility is _____ as temperature is _____.
3. Which substance on the graph is **least** soluble at 10°C? _____
4. Which substance on the graph shows the **least** change in solubility from 0°C to 100°C? _____
5. Which solution is more concentrated:
   a) At 10°C, a saturated solution of NaCl or a saturated solution of $CaCl_2$ (circle one)
   b) At 55°C, a saturated solution of $KClO_3$ or a saturated solution of $Ce_2(SO_4)_3$ (circle one)
6. What is the mass of cerium sulfate that will dissolve in 50 g of water at 10 degrees Celsius?
7. What is the mass of potassium chloride that will dissolve in 250 g of water at 70 degrees Celsius?
8. At 90 degrees Celsius, 10 g of potassium chlorate is dissolved in 100 g of water. Is this solution saturated, unsaturated, or supersaturated? How do you know?
9. A saturated solution of potassium chlorate is dissolved in 100g of water. If the saturated solution is cooled from 90 degrees Celsius to 60 degrees Celsius, how many grams would crystallize out?

Solubility curve practice problems worksheet is an essential educational tool used in chemistry to help students understand the concept of solubility. Solubility refers to the maximum amount of a solute that can dissolve in a solvent at a given temperature and pressure. Understanding solubility curves, which graphically represent this relationship, is crucial for students aspiring to excel in chemistry. In this article, we will delve into the significance of solubility curves, explore how to interpret them, and provide practice problems to enhance learning.

Understanding Solubility Curves

Solubility curves are graphical representations that illustrate how the solubility of a substance varies

with temperature. The x-axis typically represents temperature (in degrees Celsius), while the y-axis shows the amount of solute (usually in grams) that can dissolve in a fixed amount of solvent (typically 100 grams of water).

Key Components of Solubility Curves

1. Saturated Solution: This is a solution in which no more solute can dissolve at a given temperature. The solubility curve indicates the maximum amount of solute that can be dissolved in the solvent.

2. Unsaturated Solution: If a solution contains less solute than the maximum amount that can be dissolved, it is considered unsaturated.

3. Supersaturated Solution: This is a solution that contains more solute than can be dissolved at a specific temperature. It is often achieved by increasing the temperature and then slowly cooling the solution.

How to Read a Solubility Curve

To effectively utilize a solubility curve, follow these steps:

1. Identify the Solute: Determine which solute the curve represents. Different solutes have different solubility properties.

2. Locate the Temperature: Find the temperature of interest on the x-axis.

3. Determine Solubility: Move vertically from the temperature line up to the curve to find the corresponding solubility value on the y-axis.

4. Analyze the Data: Decide if the solution at that temperature is saturated, unsaturated, or supersaturated based on the given amount of solute.

Importance of Solubility Curves in Chemistry

Solubility curves serve several important purposes in the study of chemistry:

- Predicting Behavior: They allow chemists to predict how substances will behave in various conditions, which is crucial for laboratory experiments and industrial applications.

- Understanding Temperature Effects: Solubility curves illustrate how temperature influences the solubility of solids and gases, which is vital for processes such as crystallization and distillation.

- Informing Practical Applications: Knowledge of solubility is important in fields like pharmacology, where the solubility of drugs can impact their efficacy and absorption.

Creating a Solubility Curve Practice Problems Worksheet

To reinforce the understanding of solubility curves, a practice problems worksheet can be highly beneficial. Here’s how to create one:

Step-by-Step Approach

1. Select Solutes: Choose a few common solutes, such as sodium chloride (NaCl), potassium nitrate (KNO_3), or sugar (sucrose).

2. Gather Data: Collect solubility data for these solutes at various temperatures. This data can often be found in chemistry textbooks or reputable online resources.

3. Plot the Curves: Using graph paper or graphing software, plot the solubility of each solute against temperature to create individual solubility curves.

4. Formulate Questions: Create questions based on the curves. Ensure they cover various aspects such as identifying saturated and unsaturated solutions, calculating the amount of solute that can dissolve at specific temperatures, and interpreting shifts in solubility.

Example Problems

Below are some example practice problems that can be included in a solubility curve worksheet:

1. Problem 1: Basic Interpretation
- Given a solubility curve for KNO_3, what is the solubility at 60°C? If you have 75 grams of KNO_3, will it dissolve in 100 grams of water at this temperature?

2. Problem 2: Determining Solution Type
- At 25°C, the solubility of NaCl is 36 grams per 100 grams of water. If 50 grams of NaCl is added to 100 grams of water, what type of solution is formed?

3. Problem 3: Supersaturation
- Describe how you could create a supersaturated solution of sugar in water and explain the process that occurs when the solution cools.

4. Problem 4: Comparative Analysis
- Compare the solubility of KNO_3 and NaCl at 40°C. Which solute has a higher solubility, and by how much?

Answer Key for Practice Problems

1. Answer 1: (Consult the KNO_3 solubility curve for the exact value; the solution will likely be

unsaturated since 75 grams exceeds the solubility limit.)
2. Answer 2: The solution is supersaturated since 50 grams exceeds the solubility limit for 100 grams of water.
3. Answer 3: To create a supersaturated solution, heat the water and dissolve more sugar than can remain dissolved at room temperature. Upon cooling, some sugar may crystallize out.
4. Answer 4: (Refer to the respective solubility values from the curves for the exact details.)

Conclusion

A well-structured **solubility curve practice problems worksheet** is an invaluable resource for students studying chemistry. By understanding and practicing with solubility curves, students can gain a deeper insight into the behavior of substances in various conditions, enhancing their comprehension of essential chemical principles. With the provided problems and methods for creating a worksheet, educators can effectively engage students and facilitate a better understanding of solubility.

Frequently Asked Questions

What is a solubility curve?

A solubility curve is a graphical representation that shows the relationship between the solubility of a substance in a solvent at various temperatures.

How can a solubility curve be used in practice problems?

A solubility curve can be used to determine the amount of solute that can dissolve in a solvent at a specific temperature, which can help solve various chemistry problems involving saturation and concentration.

What does it mean if a point lies above the solubility curve?

If a point lies above the solubility curve, it indicates that the solution is supersaturated, meaning it contains more solute than can be dissolved at that temperature.

What information is typically included in a solubility curve practice problems worksheet?

A solubility curve practice problems worksheet typically includes graphs, questions about interpreting the graph, calculations for solubility at given temperatures, and scenarios involving supersaturation or dilution.

How do you determine the solubility of a substance from a curve?

To determine the solubility of a substance from a curve, locate the temperature on the x-axis and find the corresponding value on the y-axis, which indicates the maximum amount of solute that can

dissolve in the solvent at that temperature.

What types of substances are commonly represented in solubility curves?

Common substances represented in solubility curves include salts like sodium chloride, potassium nitrate, and various sugars, as their solubility varies significantly with temperature.

Can solubility curves be applied to real-world scenarios?

Yes, solubility curves can be applied to real-world scenarios such as determining the optimal conditions for chemical reactions, managing environmental concerns like saltwater intrusion, and in industries like pharmaceuticals.

What is the significance of the temperature axis on a solubility curve?

The temperature axis on a solubility curve is significant because it shows how solubility changes with temperature, indicating that most solids become more soluble as temperature increases, while gases typically become less soluble.

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