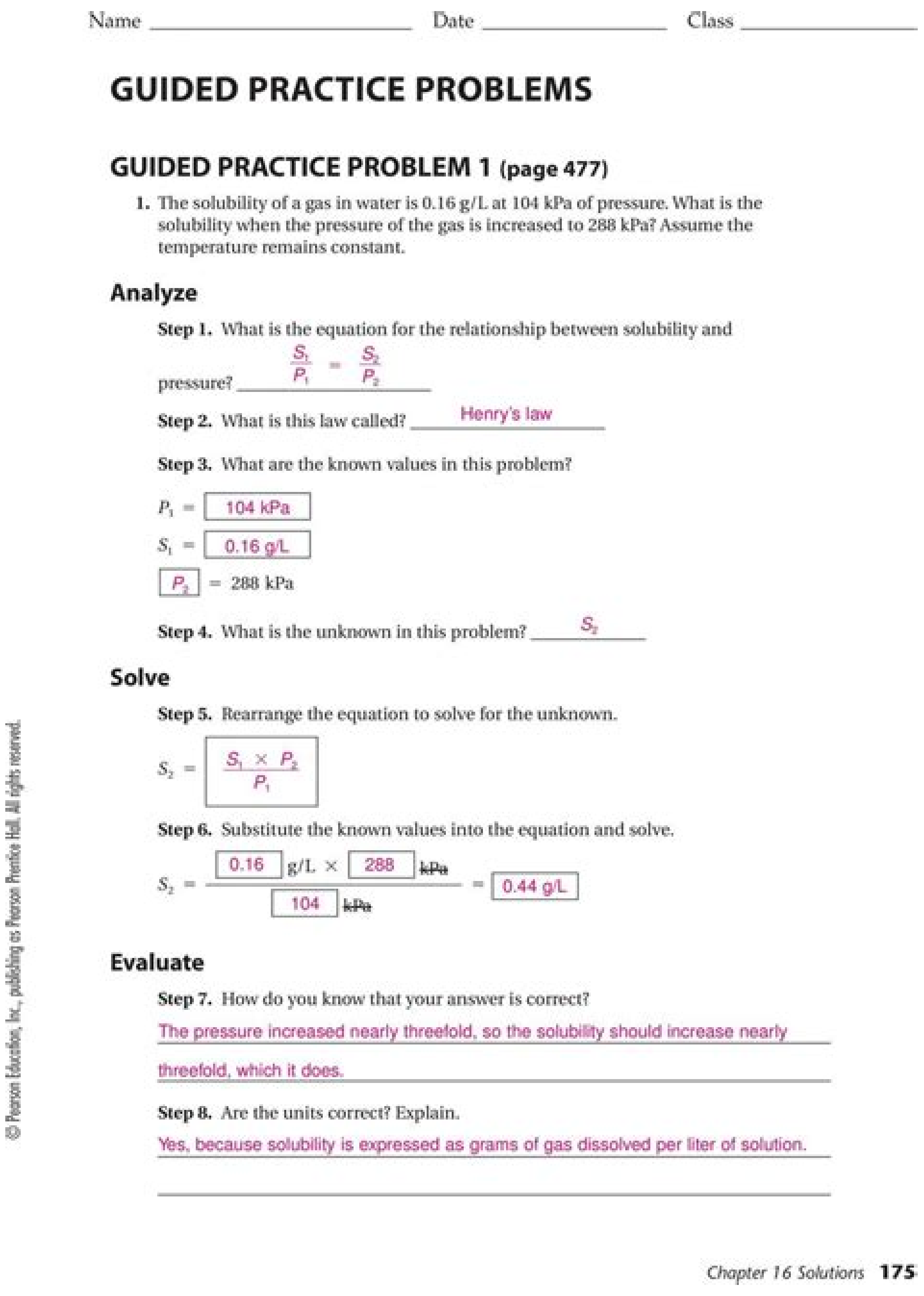
161 Properties Of Solutions Section Review Worksheet Answers



Name ______________ Date ______________ Class ______________

GUIDED PRACTICE PROBLEMS

GUIDED PRACTICE PROBLEM 1 (page 477)

1. The solubility of a gas in water is 0.16 g/L at 104 kPa of pressure. What is the solubility when the pressure of the gas is increased to 288 kPa? Assume the temperature remains constant.

Analyze

Step 1. What is the equation for the relationship between solubility and pressure? $\frac{S_1}{P_1} = \frac{S_2}{P_2}$

Step 2. What is this law called? Henry's law

Step 3. What are the known values in this problem?

$P_1 = \boxed{104\text{ kPa}}$

$S_1 = \boxed{0.16\text{ g/L}}$

$\boxed{P_2} = 288\text{ kPa}$

Step 4. What is the unknown in this problem? S_2

Solve

Step 5. Rearrange the equation to solve for the unknown.

$$S_2 = \boxed{\frac{S_1 \times P_2}{P_1}}$$

Step 6. Substitute the known values into the equation and solve.

$$S_2 = \frac{\boxed{0.16}\text{ g/L} \times \boxed{288}\ \cancel{\text{kPa}}}{\boxed{104}\ \cancel{\text{kPa}}} = \boxed{0.44\text{ g/L}}$$

Evaluate

Step 7. How do you know that your answer is correct?

The pressure increased nearly threefold, so the solubility should increase nearly threefold, which it does.

Step 8. Are the units correct? Explain.

Yes, because solubility is expressed as grams of gas dissolved per liter of solution.

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161 properties of solutions section review worksheet answers represent a crucial component in understanding the behavior, characteristics, and applications of solutions in chemistry. Solutions are homogeneous mixtures formed when one substance (the solute) dissolves in another (the solvent). This article aims to provide a comprehensive overview of the properties of solutions, focusing on the key concepts often covered in educational worksheets, including the physical and chemical properties, types of solutions, and their applications.

Understanding Solutions

A solution is a mixture where one substance is dissolved in another, resulting in a uniform composition. Solutions can exist in various states of matter, including gases (like air), liquids (like saltwater), and solids (like alloys). The key components of a solution include:

- Solute: The substance that is dissolved.
- Solvent: The substance that dissolves the solute.

Physical Properties of Solutions

The physical properties of solutions can be distinguished from those of pure substances. Here are some key properties:

1. Concentration

Concentration is a measure of how much solute is present in a given quantity of solvent or solution. Common ways to express concentration include:

- Molarity (M): Moles of solute per liter of solution.
- Molality (m): Moles of solute per kilogram of solvent.
- Percent by mass: (mass of solute / mass of solution) x 100.
- Percent by volume: (volume of solute / volume of solution) x 100.

2. Boiling Point Elevation and Freezing Point Depression

Solutions exhibit different boiling and freezing points compared to pure solvents. This phenomenon occurs due to the presence of solute particles, which disrupt the formation of the solvent's structure:

- Boiling Point Elevation: Adding a solute increases the boiling point of the solvent.
- Freezing Point Depression: Adding a solute decreases the freezing point of the solvent.

The relationships can be quantified using the formulas:
- $\Delta T_b = i \cdot K_b \cdot m$ (for boiling point elevation)
- $\Delta T_f = i \cdot K_f \cdot m$ (for freezing point depression)

Where i is the van 't Hoff factor, K_b and K_f are the ebullioscopic and cryoscopic constants, respectively, and m is the molality.

3. Vapor Pressure Lowering

The presence of a non-volatile solute in a solvent lowers the vapor pressure of the solution compared to the pure solvent. This is described by Raoult's Law, which states that the vapor pressure of a solvent in a solution is equal to the vapor pressure of the pure solvent multiplied by the mole fraction of the solvent.

4. Osmotic Pressure

Osmotic pressure is the pressure required to prevent the flow of solvent into a solution through a semipermeable membrane. It is dependent on the concentration of solute particles in the solution. The formula for osmotic pressure (Π) is given by:

$$
\Pi = i \cdot C \cdot R \cdot T
$$

Where C is the concentration in moles per liter, R is the ideal gas constant, and T is the temperature in Kelvin.

Chemical Properties of Solutions

Chemical properties of solutions relate to how solutes interact with solvents and the resulting chemical behavior. Here are some important aspects:

1. Acidity and Basicity

Solutions can exhibit acidic or basic properties, which are determined by the presence of hydrogen ions (H^+) or hydroxide ions (OH^-). The pH scale measures these properties, with values below 7 indicating acidity, 7 being neutral, and above 7 indicating basicity.

2. Conductivity

Conductivity in solutions is a measure of a solution's ability to conduct electricity, which is primarily influenced by the presence of ions. Electrolytes, substances that dissociate into ions in solution, enhance conductivity. Solutions can be classified as:

- Strong electrolytes: Completely dissociate into ions (e.g., NaCl).
- Weak electrolytes: Partially dissociate into ions (e.g., acetic acid).
- Nonelectrolytes: Do not dissociate into ions (e.g., sugar).

3. Reaction Rates

The concentration of reactants in a solution can affect the rate of chemical reactions. Generally, an increase in concentration leads to an increase in the reaction rate, as there are more reactant particles available to collide and react.

Types of Solutions

Solutions can be classified based on the physical state of the solute and solvent, as well as their concentration. Here are the main types:

1. Homogeneous Solutions

These solutions have a uniform composition throughout. Examples include:

- Saltwater (solid solute in liquid solvent).
- Air (gas solute in gas solvent).

2. Heterogeneous Solutions

These solutions do not have a uniform composition and may separate into distinct layers. Examples include:

- Oil and water (liquid-liquid).
- Sand in water (solid-liquid).

3. Saturated, Unsaturated, and Supersaturated Solutions

- Saturated Solutions: Contain the maximum amount of solute that can dissolve at a specific temperature.
- Unsaturated Solutions: Contain less solute than can be dissolved.
- Supersaturated Solutions: Contain more solute than is typically soluble at a given temperature, often achieved through heating and then cooling the solution.

Applications of Solutions

Solutions play an essential role in various fields, including chemistry, biology, medicine, and industry. Some applications include:

- Biological Systems: Many biochemical processes occur in aqueous solutions, such as enzymatic reactions and cellular respiration.

- Pharmaceuticals: Many medications are administered in solution form for better absorption and distribution in the body.
- Industrial Processes: Solutions are used in manufacturing, such as in the production of fertilizers, dyes, and food products.

Conclusion

In summary, the 161 properties of solutions section review worksheet answers encapsulate a wealth of knowledge critical for understanding the behavior and properties of solutions in various contexts. From their physical properties like boiling point elevation and vapor pressure lowering to their chemical properties such as acidity and conductivity, solutions are foundational to many scientific and practical applications. Understanding these properties enhances our ability to manipulate and utilize solutions effectively in both laboratory and real-world situations. This comprehensive overview serves as a valuable resource for students and professionals alike in their study of chemistry and its applications.

Frequently Asked Questions

What are the key properties of solutions highlighted in the '161 properties of solutions section review worksheet'?

The key properties of solutions include concentration, solubility, boiling point elevation, freezing point depression, and osmotic pressure.

How does the '161 properties of solutions section review worksheet' help in understanding solution behavior?

The worksheet provides structured questions and answers that reinforce concepts of solution chemistry, allowing students to apply theoretical knowledge to practical scenarios.

What type of problems can be found in the '161 properties of solutions section review worksheet'?

Problems typically include calculations related to molarity, dilutions, colligative properties, and comparisons of different types of solutions.

Are the answers provided in the '161 properties of solutions section review worksheet' comprehensive for exam preparation?

Yes, the answers are designed to be comprehensive, providing explanations and step-by-step solutions that are essential for effective exam preparation.

How can students effectively use the '161 properties of solutions section review worksheet' for study?

Students can use the worksheet to practice problem-solving skills, reinforce their understanding of key concepts, and prepare for quizzes and exams by reviewing both questions and detailed answers.

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