Mastering Chemistry Answer Key Chapter 5

16 SOLUTIONS

Reviewing Content

42. The solvent is the substance in which the solute is dissolved.

43. Random collisions of the solvent molecules with the solute particles provide enough force to overcome gravity.

44. **solubility:** the amount of a substance that dissolves in a given quantity of solvent at specified conditions of temperature and pressure to produce a saturated solution.
saturated solution: a solution containing the maximum amount of solute for a given amount of solvent at a constant temperature and pressure. **unsaturated solution:** a solution that contains less solute than a saturated solution at a given temperature and pressure. **miscible:** describes liquids that dissolve in each other. **immiscible:** describes liquids that are insoluble in each other.

45. Particles of solute crystallize.

46. No; if there were undissolved solute, the excess solute would come out of a supersaturated solution.

47. 5.55×10^2 g $AgNO_3$

48. Solubility increases with pressure.

49. a. 1.6×10^{-2} g/L
b. 4.7×10^{-2} g/L

50. *Dilute* and *concentrated* are relative terms and are not quantitative. Molarity provides the exact number of moles of solute per liter of solution.

51. Molarity is the number of moles of solute dissolved in one liter of solution.
a. 1.3M KCl
b. 3.3×10^{-1}M $MgCl_2$

52. 2.00×10^1 mL

53. a. 5.0×10^{-1} mol NaCl, 29 g NaCl
b. 1.0 mol KNO_3, 1.0×10^{-2} g KNO_3
c. 2.5×10^2 mol $CaCl_2$, 2.8 g $CaCl_2$

54. a. 2.3×10^1 g NaCl
b. 2.0 g $MgCl_2$

55. a. 16% (v/v) ethanol
b. 63.6% (v/v) isopropyl alcohol

56. Colligative properties are properties of a solution that depend only on the number of solute particles; boiling-point elevation, freezing-point depression, and vapor-pressure lowering. Boiling points are elevated because shells of solvent form around solute particles, reducing the amount of solvent molecules that have sufficient energy to escape the solution; relative to the pure solvent, the amount of energy required to cause vaporization or boiling increases. Solutes disrupt the ordering of the solvent structure, so more kinetic energy must be withdrawn from a solution for it to solidify. This lowers the freezing point of the solution.

57. a. sea water
b. 1.5*M* KNO_3
c. 0.100*M* $MgCl_2$

58. The effective molality of the $Ca(NO_3)_2$ solution is 3m. The effective molality of the $NaNO_3$ solution is 2m.

59. When vapor pressure is lowered relative to pure solvent, more energy must be supplied to reach the boiling point; thus the boiling point is increased relative to pure solvent.

60. The salt lowers the freezing point of the ice-water cooling mixture.

61. 1*M* solution: 1 mol of solute in 1 L of solution; 1*m* solution: 1 mol of solute in 1000 g of solvent

62. Add 27.0 g H_2O to 32.0 g CH_3OH.

63. a. 100.26°C
b. 101.54°C

64. a. −4.46°C
b. −2.2°C

65. a. −1.1°C
b. −0.74°C
c. −1.5°C

Understanding Concepts

66. a. The freezing-point depression is twice as great for solute B; solute B must provide twice as many particles in solution.

Mastering Chemistry Answer Key Chapter 5 is an essential resource for students and educators aiming to understand the intricate concepts of chemical bonding and molecular structure. Chapter 5 often focuses on the principles of covalent bonding, molecular geometry, and polarity, which are crucial for grasping advanced chemistry topics. This article will delve into the key concepts covered in this chapter, provide insight into common problems and solutions, and demonstrate how to effectively utilize the answer key for mastering chemistry.

Understanding the Basics of Covalent Bonding

Covalent bonding is the process through which two atoms share electrons, allowing them to achieve

a more stable electron configuration. This section will cover the following key aspects:

1. Electron Sharing

- Single Bonds: Formed when two atoms share one pair of electrons (e.g., H_2).
- Double Bonds: Occur when two pairs of electrons are shared (e.g., O_2).
- Triple Bonds: Formed when three pairs of electrons are shared (e.g., N_2).

2. Bond Length and Strength

Covalent bonds vary in strength and length depending on the number of shared electron pairs. Generally, the more pairs of electrons shared between atoms, the shorter and stronger the bond.

- Single bonds are the longest and weakest.
- Double bonds are shorter and stronger.
- Triple bonds are the shortest and strongest.

3. Electronegativity and Polar Covalent Bonds

Electronegativity is the tendency of an atom to attract electrons in a bond. When two atoms with different electronegativities bond, the electrons are not shared equally, leading to a polar covalent bond.

- Nonpolar Covalent Bond: Electrons are shared equally (e.g., Cl_2).
- Polar Covalent Bond: Electrons are attracted more towards one atom (e.g., H_2O).

Molecular Geometry and VSEPR Theory

Understanding molecular geometry is essential for predicting the behavior of molecules. The Valence Shell Electron Pair Repulsion (VSEPR) theory provides a model for determining the shapes of molecules based on electron pair repulsion.

1. Shapes of Molecules

Here are the most common molecular shapes predicted by VSEPR theory:

- Linear: 180° bond angle (e.g., CO_2).
- Trigonal Planar: 120° bond angle (e.g., BF_3).
- Tetrahedral: 109.5° bond angle (e.g., CH_4).
- Trigonal Bipyramidal: 90° and 120° bond angles (e.g., PCl_5).
- Octahedral: 90° bond angle (e.g., SF_6).

2. Determining Molecular Geometry

To determine the shape of a molecule, follow these steps:

1. Count the Valence Electrons: Determine the total number of valence electrons in the molecule.
2. Draw the Lewis Structure: Create a Lewis structure to visualize electron pairs.
3. Identify Electron Pair Geometry: Use the VSEPR model to predict the arrangement of electron pairs.
4. Determine Molecular Shape: Consider the positions of atoms while ignoring lone pairs for the final shape.

Polarity of Molecules

Understanding molecular polarity is vital for predicting the physical properties of substances, such as solubility and boiling points.

1. Factors Affecting Polarity

- Electronegativity Differences: A higher difference leads to a more polar bond.
- Molecular Shape: Symmetrical molecules tend to be nonpolar, while asymmetrical ones are usually polar.

2. Identifying Polar and Nonpolar Molecules

To identify whether a molecule is polar or nonpolar, consider the following:

- Check Bond Polarities: Determine if the bonds within the molecule are polar.
- Evaluate Symmetry: Analyze the molecular shape; if it is symmetrical, the molecule is likely nonpolar.

Using the Mastering Chemistry Answer Key

The Mastering Chemistry answer key is a powerful tool for students seeking to reinforce their understanding of chapter concepts. Here’s how to effectively leverage this resource:

1. Self-Assessment

- Practice Problems: Attempt the practice problems provided in the chapter. After completing them, refer to the answer key to check your work.
- Identify Weak Areas: Use the answer key to highlight topics where you struggled, allowing you to

focus your study efforts.

2. Understanding Mistakes

- Review Incorrect Answers: For every problem you get wrong, review the corresponding section in the textbook to understand the underlying concept.
- Seek Clarification: If certain concepts remain unclear, consider discussing them with your teacher or peers.

3. Reinforcement Through Repetition

- Revisit Difficult Problems: Go back to challenging problems and attempt them again after studying the relevant material.
- Create Flashcards: Develop flashcards based on the problems and solutions in the answer key to enhance retention.

Conclusion

Mastering Chemistry Answer Key Chapter 5 serves as a valuable resource for students eager to master the principles of chemical bonding, molecular structure, and polarity. By understanding the fundamentals of covalent bonding, applying VSEPR theory, and utilizing the answer key for self-assessment and reinforcement, students can significantly enhance their chemistry skills. As you work through the material, remember that consistent practice and seeking clarification when needed are key strategies for success in mastering chemistry concepts. Whether you are preparing for exams or simply aiming to deepen your understanding, this approach will serve you well on your academic journey in chemistry.

Frequently Asked Questions

What topics are covered in Chapter 5 of the Mastering Chemistry answer key?

Chapter 5 typically covers topics related to the periodic table, atomic structure, and electron configurations, including the principles of quantum mechanics as they apply to chemistry.

How can I access the Mastering Chemistry answer key for Chapter 5?

The answer key for Chapter 5 can be accessed through the Mastering Chemistry platform, usually requiring a student login or access code associated with your course materials.

What are some common challenges students face in Chapter 5 of Mastering Chemistry?

Common challenges include understanding the concepts of electron configuration, the significance of quantum numbers, and how to apply the periodic law to predict chemical properties.

Are there any recommended study strategies for mastering the content in Chapter 5?

Recommended study strategies include reviewing lecture notes, completing practice problems, utilizing flashcards for key terms, and participating in study groups to enhance understanding.

What is the importance of the periodic table in Chapter 5 of Mastering Chemistry?

The periodic table is crucial as it organizes the elements based on their atomic structure and properties, helping students understand trends such as electronegativity, ionization energy, and atomic radius.

Can I find video tutorials related to Chapter 5 on Mastering Chemistry?

Yes, Mastering Chemistry often provides video tutorials and interactive resources that can help explain complex concepts from Chapter 5, enhancing visual and practical learning.

Mastering Chemistry Answer Key Chapter 5

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