Mastering Chemistry Chapter 8 Answer Key

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 Solutes disrupt the ordering of the solvent structure, so more kinetic energy must be withdrawn from a solution for it to solidify.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 Chapter 8 Answer Key is an essential resource for students and educators navigating the intricacies of chemical bonding, molecular geometry, and the principles underlying chemical structures. This chapter delves into the concepts of covalent bonding, Lewis structures, molecular shapes, and the various theories that explain how atoms combine to form molecules. Understanding these concepts is crucial for anyone pursuing studies in chemistry or related fields. In this article, we will explore the key topics covered in Chapter 8, provide insights into common challenges faced by students, and discuss how to effectively utilize the answer key to enhance learning.

Overview of Chapter 8: Chemical Bonding

Chapter 8 of Mastering Chemistry focuses primarily on the nature of chemical bonds, particularly covalent bonds, which occur when atoms share electrons. The chapter is structured to help students build a strong foundational understanding of:

- Covalent Bonds: The fundamental principles of how atoms bond through the sharing of electrons.
- Lewis Structures: A visual representation of molecules that illustrates how atoms are connected and the distribution of electrons.
- Molecular Geometry: The three-dimensional arrangement of atoms within a molecule, which influences its physical and chemical properties.
- VSEPR Theory: The Valence Shell Electron Pair Repulsion theory, which predicts molecular shapes based on electron pair repulsion.
- Hybridization: The concept that atomic orbitals mix to form new hybrid orbitals, essential for understanding molecular bonding.

Understanding Covalent Bonds

Covalent bonds form when two nonmetal atoms share electrons to achieve a full valence shell, often leading to more stable configurations. In this section, we will break down the types of covalent bonds and their characteristics.

Types of Covalent Bonds

1. Single Bonds: Involves one pair of shared electrons (e.g., H_2).
2. Double Bonds: Involves two pairs of shared electrons (e.g., O_2).
3. Triple Bonds: Involves three pairs of shared electrons (e.g., N_2).

These bonds vary in strength and length, with triple bonds being the strongest and shortest, while single bonds are the weakest and longest.

Electron Density and Bond Polarity

Electronegativity plays a crucial role in determining the polarity of a bond. Bonds can be classified as:

- Nonpolar Covalent: Equal sharing of electrons (e.g., Cl_2).
- Polar Covalent: Unequal sharing of electrons, resulting in partial charges (e.g., HCl).

Understanding these distinctions is vital for predicting molecular behavior during chemical reactions.

Constructing Lewis Structures

Lewis structures are a fundamental tool for visualizing molecular bonding. They help in understanding the arrangement of atoms and the distribution of electrons in a molecule.

Steps to Draw Lewis Structures

1. Count the Total Valence Electrons: Add up the valence electrons from each atom in the molecule.
2. Determine the Central Atom: Usually the least electronegative atom, except for hydrogen.
3. Arrange the Atoms: Place the central atom in the center and arrange the other atoms around it.
4. Form Bonds: Connect atoms with single bonds and subtract the used electrons from the total count.
5. Distribute Remaining Electrons: Assign remaining electrons to complete octets for surrounding atoms, then for the central atom if possible.
6. Create Multiple Bonds if Necessary: If the central atom does not have an octet, convert lone pairs on neighboring atoms into double or triple bonds.

This systematic approach enables students to visualize the structure of molecules and predict their reactivity and properties.

Molecular Geometry and VSEPR Theory

Understanding molecular geometry is crucial for predicting how molecules will behave in different chemical environments. VSEPR theory provides a framework for determining the shape of a molecule based on electron pair repulsion.

Common Molecular Shapes

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

Each shape corresponds to a specific arrangement of bonding and lone pairs of electrons, which significantly affects the molecule's properties.

Hybridization

Hybridization explains the mixing of atomic orbitals to form new hybrid orbitals. This concept is vital for understanding how atoms bond in complex molecules.

- sp Hybridization: Linear geometry (e.g., $BeCl_2$).
- sp^2 Hybridization: Trigonal planar geometry (e.g., BF_3).
- sp^3 Hybridization: Tetrahedral geometry (e.g., CH_4).

Recognizing the hybridization state of an atom helps predict its bonding behavior and molecular shape.

Utilizing the Answer Key Effectively

The answer key for Chapter 8 serves as a valuable resource for students. Here’s how to make the most of it:

Study Strategies Using the Answer Key

1. Self-Assessment: Use the answer key to check your understanding after completing practice problems or exercises. This helps identify areas where you need further review.
2. Understand Mistakes: Analyze incorrect answers to learn from mistakes. Understanding why an answer is wrong is often more beneficial than simply knowing the right answer.
3. Reinforce Learning: After reviewing the answer key, revisit challenging concepts and practice additional problems to reinforce your understanding.
4. Collaborate with Peers: Discussing answers and problem-solving strategies with classmates can enhance comprehension and retention.

Common Challenges and Solutions

Students often face specific challenges when studying Chapter 8. Here are some common issues and strategies to overcome them:

- Difficulty in Drawing Lewis Structures: Practice is key. Start with simpler molecules before tackling more complex ones. Utilize online resources and molecular modeling kits for visualization.
- Understanding Molecular Geometry: Use molecular models to visualize shapes. Drawing 3D representations can aid in grasping the spatial arrangement of atoms.
- Confusion with Hybridization: Relate hybridization to molecular geometry. Practice identifying hybridization in various compounds to build intuition.

Conclusion

Mastering Chemistry Chapter 8 is a pivotal step in developing a comprehensive understanding of chemical bonding and molecular structures. The chapter's focus on covalent bonds, Lewis structures, molecular geometry, and hybridization provides students with the tools needed to analyze and predict chemical behavior effectively. Utilizing the answer key strategically allows students to enhance their learning experience, build confidence, and achieve academic success in chemistry. By embracing these concepts and employing effective study strategies, students can truly master the art of chemical bonding and pave the way for future scientific endeavors.

Frequently Asked Questions

What is the main focus of Chapter 8 in Mastering Chemistry?

Chapter 8 typically focuses on chemical bonding, including topics such as ionic and covalent bonds, bond polarity, and molecular geometry.

How can I access the answer key for Chapter 8 in Mastering Chemistry?

The answer key can usually be found in the resources section of the Mastering Chemistry platform, or it may be provided by your instructor.

Are the answer keys in Mastering Chemistry reliable for exam preparation?

Yes, the answer keys are generally reliable as they are created by educational professionals and are aligned with the course content.

What type of questions can I expect in Chapter 8 of Mastering Chemistry?

You can expect a variety of questions including multiple-choice, short answer, and problem-solving questions related to chemical bonding.

Can I find practice problems related to Chapter 8 in Mastering Chemistry?

Yes, Mastering Chemistry offers a range of practice problems and exercises that correspond to the concepts covered in Chapter 8.

How does understanding Chapter 8 concepts help in mastering chemistry?

Understanding the concepts of chemical bonding is crucial as it forms the foundation for predicting molecular properties and reactivities in advanced chemistry topics.

What are some common mistakes students make in Chapter 8?

Common mistakes include confusing ionic and covalent bonds, miscalculating bond angles, and misunderstanding electronegativity differences.

Is there a specific study strategy for mastering Chapter 8?

A good strategy includes reviewing lecture notes, practicing problems, using visual aids like molecular models, and forming study groups.

Are there any online resources to supplement learning from Chapter 8?

Yes, online resources such as Khan Academy, YouTube tutorials, and educational websites like ChemCollective can provide additional explanations and practice.

What should I do if I find the Chapter 8 material challenging?

If you find the material challenging, consider seeking help from your instructor, utilizing tutoring services, or participating in study groups to enhance your understanding.

Mastering Chemistry Chapter 8 Answer Key

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