SQA National 5 Chemistry Practice Exam Sample Study Guide

EVERYTHING you need from our exam experts!

Featuring practice questions, answers, and explanations for each question.

Questions

1. **What is the strongest attractive force in a metallic lattice?**
   - **A. Covalent bonds**
   - **B. Van der Waals forces**
   - **C. Electrostatic attraction between delocalized electrons and metal ions**
   - **D. Hydrogen bonds**

2. **What characteristic distinguishes alkenes from alkanes?**
   - **A. Alkenes contain only single bonds**
   - **B. Alkenes contain double bonds**
   - **C. Alkenes are more stable**
   - **D. Alkenes are less reactive**

3. **How is solubility defined in chemistry?**
   - **A. The volume of solvent needed for a reaction**
   - **B. The ability of a substance to dissolve in a solvent**
   - **C. The concentration of an acid in a solution**
   - **D. The amount of energy required to dissolve a substance**

4. **Which of the following is a common laboratory alkali?**
   - **A. Sulfuric acid**
   - **B. Hydrochloric acid**
   - **C. Sodium hydroxide**
   - **D. Nitric acid**

5. **What is the main structural component of an atom?**
   - **A. Electrons surrounding a nucleus**
   - **B. Nucleus containing protons and neutrons**
   - **C. A cloud of energy**
   - **D. Only protons within the nucleus**

6. **What defines an unsaturated hydrocarbon?**
   - **A. It contains single bonds**
   - **B. It contains double bonds**
   - **C. It contains triple bonds**
   - **D. It contains only carbon and hydrogen atoms**

7. Which action would likely increase the rate of a chemical reaction?

A. Reducing particle size

B. Decreasing concentration

C. Lowering temperature

D. Adding an inhibitor

8. What is a notable feature of ionic lattice structures regarding their melting and boiling points?

A. They have low melting and boiling points

B. They have moderate melting points

C. They have high melting and boiling points

D. They vary significantly based on the metal used

9. When are salts formed in a chemical reaction?

A. During a combustion reaction

B. During a neutralization reaction

C. During a redox reaction

D. During a displacement reaction

10. As the size of a hydrocarbon molecule increases, what is the expected change in physical properties?

A. Melting and boiling points decrease

B. Melting and boiling points are unaffected

C. Melting point increases, boiling point decreases

D. Melting and boiling points increase

Answers

1. **C**
2. **B**
3. **B**
4. **C**
5. **B**
6. **B**
7. **A**
8. **C**
9. **B**
10. **D**

Explanations

1. What is the strongest attractive force in a metallic lattice?

A. Covalent bonds

B. Van der Waals forces

C. Electrostatic attraction between delocalized electrons and metal ions

D. Hydrogen bonds

In a metallic lattice, the strongest attractive force comes from the electrostatic attraction between delocalized electrons and metal ions. Metals consist of positive metal ions that are surrounded by a "sea" of delocalized electrons. These electrons are not bound to any specific ion but are free to move throughout the structure, creating a lattice of positive ions. This interaction is a result of the nature of metallic bonding, where these delocalized electrons act as a glue that holds the positively charged metal ions together. The strong electrostatic attraction between the negatively charged delocalized electrons and the positively charged metal ions is what gives metals their characteristic properties, such as electrical conductivity, malleability, and ductility. The other forces mentioned, such as covalent bonds, Van der Waals forces, and hydrogen bonds, are not the primary forces at play in a metallic lattice. Covalent bonds form between specific atoms sharing electrons, while Van der Waals forces and hydrogen bonds are much weaker intermolecular forces that play a role in different types of materials, particularly in non-metallic compounds. Thus, the presence of the strong electrostatic forces in metallic lattices distinctly defines their structural integrity and metallic properties.

2. What characteristic distinguishes alkenes from alkanes?

A. Alkenes contain only single bonds

B. Alkenes contain double bonds

C. Alkenes are more stable

D. Alkenes are less reactive

Alkenes are distinguished from alkanes primarily by the presence of double bonds between carbon atoms in their molecular structure. This characteristic fundamentally changes the properties and reactivity of alkenes when compared to alkanes, which exclusively contain single bonds. The double bond in alkenes allows for a different set of chemical reactions, making them more reactive than their alkane counterparts. This distinction is essential in organic chemistry, as it influences how alkenes participate in reactions such as addition reactions, where atoms or groups can be added across the double bond. Understanding this property helps in predicting the behavior of these compounds in various chemical contexts. In contrast, the other options mention aspects such as single bonds, stability, and reactivity, which do not accurately capture the defining feature that separates alkenes from alkanes. Alkanes, with their single bonds, are generally more stable and less reactive than alkenes due to the nature of the bonds present in each type of hydrocarbon.

3. How is solubility defined in chemistry?

- A. The volume of solvent needed for a reaction
- **B. The ability of a substance to dissolve in a solvent**
- C. The concentration of an acid in a solution
- D. The amount of energy required to dissolve a substance

Solubility in chemistry is defined as the ability of a substance (typically a solid, liquid, or gas) to dissolve in a solvent, forming a homogeneous solution at a specified temperature and pressure. This definition emphasizes the interaction between the solute and solvent molecules, which leads to the solute dispersing evenly throughout the solvent. Understanding solubility is crucial in various chemical processes and applications, from creating solutions in the lab to comprehending natural phenomena such as the dissolution of minerals in water. The other options provided may relate to aspects of chemistry but do not accurately capture the definition of solubility. For instance, one option mentions the volume of solvent needed, which pertains to the method of preparing a solution rather than the definition of solubility itself. Another option refers to the concentration of an acid in a solution, which is a different characteristic than solubility. Lastly, discussing the amount of energy required to dissolve a substance refers to the thermodynamics of dissolution rather than the fundamental concept of solubility.

4. Which of the following is a common laboratory alkali?

- A. Sulfuric acid
- B. Hydrochloric acid
- **C. Sodium hydroxide**
- D. Nitric acid

Sodium hydroxide is recognized as a common laboratory alkali because it is a strong base that dissolves in water to produce hydroxide ions (OH^-). This characteristic gives sodium hydroxide its alkaline properties, making it useful in various laboratory applications, including titrations and neutralization reactions. It is also often used for pH adjustments and as a cleaning agent due to its ability to react with acids to form water and a salt. In contrast, sulfuric acid, hydrochloric acid, and nitric acid are all strong acids. They release hydrogen ions (H^+) in solution, leading to an acidic environment rather than an alkaline one. Thus, they do not fulfill the criteria for being classified as alkalis. Understanding the properties of bases and acids is crucial for recognizing their applications and roles in chemical reactions within a laboratory setting.

5. What is the main structural component of an atom?

A. Electrons surrounding a nucleus

B. Nucleus containing protons and neutrons

C. A cloud of energy

D. Only protons within the nucleus

The nucleus containing protons and neutrons is indeed the main structural component of an atom because it forms the central core that contains most of the atom's mass. Protons carry a positive charge, while neutrons are neutral, contributing to the overall stability of the nucleus. The nucleus is surrounded by a cloud of electrons, which occupy various energy levels around it, but it is the nucleus that serves as the defining structure, housing almost all of the atom's mass and determining its identity (through the number of protons, which defines which element an atom represents). In contrast, electrons, while critical to the behavior of atoms and molecules, are not considered a structural component in the same way the nucleus is, as they occupy space around the nucleus and are much less massive. A cloud of energy is more of a conceptual model used to describe electron behavior rather than a physical part of the atom's structure. Finally, only protons within the nucleus does not capture the presence of neutrons, which are equally important for the stability of the atom. This makes the nucleus essential for defining the structure and properties of an atom.

6. What defines an unsaturated hydrocarbon?

A. It contains single bonds

B. It contains double bonds

C. It contains triple bonds

D. It contains only carbon and hydrogen atoms

An unsaturated hydrocarbon is characterized by the presence of double or triple carbon-carbon bonds. In the case of option B, which states it contains double bonds, this is a key feature of unsaturated hydrocarbons, as they are capable of undergoing reactions that saturated hydrocarbons, which only contain single bonds, cannot. Unsaturated hydrocarbons include alkenes, which possess at least one double bond between carbon atoms, and alkynes, which contain at least one triple bond. The presence of these multiple bonds allows unsaturated hydrocarbons to react with more types of chemicals, making them chemically reactive compared to their saturated counterparts. The other options focus on single bonds or the presence of only carbon and hydrogen atoms, which do not define an unsaturated hydrocarbon. An unsaturated compound, by nature, must have fewer hydrogen atoms than the saturated counterpart, allowing it to have those double or triple bonds. This reactivity is what distinguishes unsaturated hydrocarbons in organic chemistry.

7. Which action would likely increase the rate of a chemical reaction?

A. Reducing particle size

B. Decreasing concentration

C. Lowering temperature

D. Adding an inhibitor

Reducing particle size is a correct action to increase the rate of a chemical reaction. When the particle size of reactants is decreased—such as by grinding a solid into a finer powder—there is an increase in the surface area available for collisions between reactant particles. This higher surface area allows more frequent collisions to occur, therefore providing more opportunities for effective reactions to take place. The rate of reaction is directly proportional to the number of collisions; hence, a reduction in particle size leads to an accelerated reaction. In contrast, decreasing concentration would reduce the number of reactant particles in a given volume, leading to fewer collisions per unit time and a slower reaction rate. Lowering the temperature typically decreases the kinetic energy of the particles, resulting in fewer effective collisions between them; hence, the reaction slows down. Adding an inhibitor serves to slow down a reaction by interfering with the reactants or the catalytic process, effectively decreasing the rate of the reaction.

8. What is a notable feature of ionic lattice structures regarding their melting and boiling points?

A. They have low melting and boiling points

B. They have moderate melting points

C. They have high melting and boiling points

D. They vary significantly based on the metal used

Ionic lattice structures are composed of positively and negatively charged ions arranged in a repeating three-dimensional pattern. This arrangement creates a strong electrostatic attraction between the oppositely charged ions, which is known as ionic bonding. The notable feature of ionic compounds is that these strong attractions result in a high amount of energy being required to break the ionic bonds during melting or boiling. As a result, ionic compounds typically exhibit high melting and boiling points. The high energy requirement underscores the strength of the ionic bonds present in the lattice. In contrast, compounds with weaker intermolecular forces, such as covalent compounds or metals, usually possess lower melting and boiling points due to requiring less energy to separate their particles. While it is true that the melting and boiling points can vary among different ionic compounds, the defining characteristic of ionic lattices is their generally high melting and boiling points, which is rooted in the nature of the ionic bonds present.

9. When are salts formed in a chemical reaction?

A. During a combustion reaction

B. During a neutralization reaction

C. During a redox reaction

D. During a displacement reaction

Salts are formed specifically during neutralization reactions. In a neutralization reaction, an acid reacts with a base to produce salt and water. The acid provides hydrogen ions (H^+) while the base provides hydroxide ions (OH^-). When these ions combine, they form water, and the remaining ions from the acid and base combine to form a salt. For instance, if hydrochloric acid (HCl) reacts with sodium hydroxide ($NaOH$), sodium chloride ($NaCl$) is produced along with water. This clear process of acid-base interaction demonstrates the formation of salt as a direct product of a neutralization reaction. While other types of reactions like combustion, redox, and displacement may involve the transformation of compounds and elements, they do not primarily focus on the interaction between acids and bases to yield a salt. Therefore, the most accurate scenario for the formation of salts is during a neutralization reaction.

10. As the size of a hydrocarbon molecule increases, what is the expected change in physical properties?

A. Melting and boiling points decrease

B. Melting and boiling points are unaffected

C. Melting point increases, boiling point decreases

D. Melting and boiling points increase

As the size of a hydrocarbon molecule increases, the physical properties related to melting and boiling points generally exhibit an increasing trend. This can be attributed to the larger molecular size leading to a greater surface area, which allows for increased van der Waals forces or London dispersion forces between molecules. In smaller hydrocarbons, these intermolecular forces are weaker, resulting in lower melting and boiling points. However, as the hydrocarbon chain grows in size, the number of carbon atoms increases, thereby enhancing the intermolecular interactions. As a result, more energy is required to overcome these forces when transitioning from solid to liquid (melting) or liquid to gas (boiling), leading to higher melting and boiling points. Thus, the relationship between molecular size and melting/boiling points aligns with the observed trend that larger hydrocarbons tend to have higher melting and boiling points compared to their smaller counterparts.