SDSU Chemistry Placement Practice Test (Sample)

Study Guide

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Questions

1. What is the formula for calculating density?

A. Density = volume/mass

B. Density = mass × volume

C. Density = mass/volume

D. Density = volume + mass

2. What is the molecular formula for glucose?

A. $C_6H_{12}O_6$

B. $C_5H_{10}O_5$

C. $C_4H_8O_4$

D. $C_7H_{14}O_7$

3. What must be true to effectively balance a chemical equation?

A. Equal mass on both sides

B. Equal number of atoms on each side

C. Proportional mass on both sides

D. Equal reactants and products

4. Which factor does NOT affect the rate of a chemical reaction?

A. Concentration of reactants

B. Temperature

C. Color of reactants

D. Presence of a catalyst

5. Which law states that the rate of a reaction is proportional to the concentration of the reactants?

A. Rate Law

B. Le Chatelier's Principle

C. Bernoulli's Principle

D. Equilibrium Law

6. What is the common name for sulfuric acid, a widely used chemical?

- **A. Vinegar**
- **B. Battery acid**
- **C. Hydrochloric acid**
- **D. Acetic acid**

7. Graham's Law is used to compare:

- **A. Masses of solids**
- **B. Volumes of gases**
- **C. Temperatures of liquids**
- **D. Pressures of gases**

8. What occurs during the process of melting?

- **A. A solid turns into a gas**
- **B. A liquid turns into a solid**
- **C. A solid turns into a liquid**
- **D. A gas turns into a liquid**

9. Which of the following indicates a chemical change?

- **A. Melting of ice**
- **B. Boiling of water**
- **C. Rust forming on iron**
- **D. Breaking of glass**

10. In which state of matter are the particles most closely packed?

- **A. Gas**
- **B. Liquid**
- **C. Solid**
- **D. Plasma**

Answers

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

Explanations

1. What is the formula for calculating density?

A. Density = volume/mass

B. Density = mass × volume

C. Density = mass/volume

D. Density = volume + mass

The formula for calculating density is mass divided by volume. Density is a measure of how much mass is contained in a given unit of volume. It quantitatively expresses how tightly matter is packed within a substance. By using mass in the numerator and volume in the denominator, we obtain a value that represents the amount of matter per unit of space, typically expressed in grams per cubic centimeter (g/cm³) or kilograms per cubic meter (kg/m³). This understanding is fundamental in various scientific applications, including chemistry, physics, and engineering, where knowledge about the properties of materials is necessary. Thus, the correct formulation for density provides a clear relationship between mass and its occupying space, thereby explaining the behavior of physical substances.

2. What is the molecular formula for glucose?

A. $C_6H_{12}O_6$

B. $C_5H_{10}O_5$

C. $C_4H_8O_4$

D. $C_7H_{14}O_7$

The molecular formula for glucose is represented as $C_6H_{12}O_6$. This formula indicates that each molecule of glucose contains six carbon (C) atoms, twelve hydrogen (H) atoms, and six oxygen (O) atoms. Glucose is a simple sugar and an important carbohydrate in biology, serving as a primary energy source for most organisms. The structural arrangement of these atoms in glucose is such that it forms a six-membered ring structure, commonly represented in its cyclic form. This configuration allows for various biochemical reactions, including those in cellular respiration, where glucose is metabolized to release energy. In contrast, the other formulas listed do not accurately reflect the composition of glucose. For instance, $C_5H_{10}O_5$ implies a five-carbon sugar (pentose) rather than the six-carbon structure of glucose, while $C_4H_8O_4$ and $C_7H_{14}O_7$ indicate incorrect ratios of carbon to hydrogen to oxygen for glucose. Thus, the correct representation of glucose as $C_6H_{12}O_6$ highlights its specific molecular composition essential for its role in biological processes.

3. What must be true to effectively balance a chemical equation?

A. Equal mass on both sides

B. Equal number of atoms on each side

C. Proportional mass on both sides

D. Equal reactants and products

To effectively balance a chemical equation, it is essential to have an equal number of atoms on each side of the equation. This principle is rooted in the law of conservation of mass, which states that matter cannot be created or destroyed in a chemical reaction. Therefore, when a chemical reaction occurs, the total number of each type of atom before the reaction must be equal to the total number of each type of atom after the reaction. This means that, when balancing a chemical equation, one needs to ensure that for every type of atom present in the reactants, there is an equal amount in the products. By doing so, the equation reflects a true representation of the reaction, where the mass of the reactants equals the mass of the products. While having equal mass on both sides (equal mass on both sides) might seem related, it does not address the fundamental principle of atomic conservation that is more directly captured by the need for an equal number of atoms. Similarly, proportional mass and the requirement for equal quantities of reactants and products are not necessary for balancing the equation effectively. Balancing focuses solely on ensuring that the counts of each atom are the same on both sides of the equation.

4. Which factor does NOT affect the rate of a chemical reaction?

A. Concentration of reactants

B. Temperature

C. Color of reactants

D. Presence of a catalyst

The color of reactants does not have a direct impact on the rate of a chemical reaction. The rate of a reaction is primarily influenced by factors that affect the frequency and energy of collisions between molecules. For example, an increase in the concentration of reactants raises the likelihood that molecules will collide, which typically speeds up the reaction. Similarly, increasing the temperature increases the energy of the molecules, leading to more effective collisions and a faster reaction rate. The presence of a catalyst also plays a crucial role, as it lowers the activation energy required for the reaction, thereby increasing the rate without being consumed in the process. In contrast, the color of the reactants does not influence the efficiency of molecular collisions or the activation energy. While color might indicate something about the chemical composition or energy levels of electrons in certain cases, it does not inherently affect the kinetic energy or the collisional dynamics that are foundational to reaction rates.

5. Which law states that the rate of a reaction is proportional to the concentration of the reactants?

A. Rate Law

B. Le Chatelier's Principle

C. Bernoulli's Principle

D. Equilibrium Law

The concept that the rate of a chemical reaction is proportional to the concentration of the reactants is captured by the Rate Law. This law quantifies the relationship between the concentration of reactants and the rate at which a reaction occurs. In a rate law expression, the rate of the reaction is commonly represented as a function of the concentration of each reactant raised to a power that reflects its contribution to the reaction's speed. This relationship helps chemists understand how changes in concentration affect the overall speed of the reaction, allowing them to predict and manipulate reaction rates in various chemical processes. The other options do not pertain to this specific relationship. Le Chatelier's Principle deals with the response of a system at equilibrium to changes in concentration, pressure, or temperature, rather than the rate of the reaction. Bernoulli's Principle describes fluid dynamics and the behavior of fluids in motion, which is unrelated to chemical reactions. Lastly, the Equilibrium Law outlines the relationship between the concentrations of reactants and products at equilibrium but does not address reaction rates directly. Thus, the Rate Law is the correct choice for this question regarding the rate of reaction and reactant concentration.

6. What is the common name for sulfuric acid, a widely used chemical?

A. Vinegar

B. Battery acid

C. Hydrochloric acid

D. Acetic acid

The common name for sulfuric acid is recognized as battery acid. This designation comes from its prevalent use in lead-acid batteries, which are commonly found in automobiles and other vehicles. Sulfuric acid serves as the electrolyte in these batteries, facilitating the necessary chemical reactions that produce electrical energy. Understanding the context of sulfuric acid's applications helps establish why "battery acid" is the correct choice. It highlights the practicality and industrial significance of sulfuric acid, particularly in energy storage and automotive industries. Other options, such as vinegar and acetic acid, pertain to entirely different substances and uses. Hydrochloric acid, while also an important chemical, is not synonymous with sulfuric acid and is employed primarily in industrial applications for cleaning and metallurgical processes.

7. Graham's Law is used to compare:

A. Masses of solids

B. Volumes of gases

C. Temperatures of liquids

D. Pressures of gases

Graham's Law is a principle that relates to the diffusion and effusion rates of gases. It states that the rate of diffusion of a gas is inversely proportional to the square root of its molar mass. This means that lighter gases will diffuse faster than heavier gases. The law applies specifically to gases because it measures how quickly different gases will spread out or pass through a tiny opening, known as effusion. In the context of the choices provided, comparing volumes of gases is the correct application as Graham's Law directly involves the behavior of gases and their rates of diffusion or effusion. Understanding the relationship established by Graham's Law allows you to predict how the volumes of different gases respond under similar conditions, which is fundamental for studying gas behavior in chemistry. The other options do not accurately align with the scope of Graham's Law: masses of solids, temperatures of liquids, and pressures of gases are not the focus of this particular law, as it is specifically concerned with gaseous substances and their rates of movement.

8. What occurs during the process of melting?

A. A solid turns into a gas

B. A liquid turns into a solid

C. A solid turns into a liquid

D. A gas turns into a liquid

During the process of melting, a solid transforms into a liquid. This transition occurs when the solid absorbs sufficient energy, usually in the form of heat, to overcome the intermolecular forces holding its particles in a fixed, rigid structure. As the temperature increases and reaches the solid's melting point, the particles gain kinetic energy, allowing them to break free from their fixed positions and move more freely, which characterizes a liquid state. This process is essential in understanding phase changes, as it illustrates one of the key transitions between states of matter. The other options present different phase changes: a solid turning into a gas describes sublimation, a liquid turning into a solid is freezing, and a gas turning into a liquid is condensation. Each of these represents distinct physical processes that differ fundamentally from melting.

9. Which of the following indicates a chemical change?

A. Melting of ice

B. Boiling of water

C. Rust forming on iron

D. Breaking of glass

A chemical change involves a transformation that alters the composition of a substance, resulting in the formation of new substances. The formation of rust on iron is a clear example of a chemical change. This process, known as oxidation, occurs when iron reacts with oxygen in the presence of moisture, producing iron oxide (rust). The original iron cannot simply be recovered; instead, it has transformed into a different chemical substance. In contrast, the melting of ice and the boiling of water are physical changes. During these processes, the substances involved change their states (from solid to liquid for ice, and from liquid to gas for water) but do not change their chemical identities. Breaking of glass is also a physical change, as it alters the shape and size of the glass without changing its chemical composition. Therefore, the rusting of iron is the only option that signifies a chemical change characterized by a new product being formed.

10. In which state of matter are the particles most closely packed?

A. Gas

B. Liquid

C. Solid

D. Plasma

In a solid state of matter, the particles are closely packed together, resulting in a fixed shape and volume. The strong intermolecular forces in solids hold the particles in fixed positions relative to one another, leading to a structured arrangement. This close packing of particles provides solids with their rigidity and resistance to compression, as there is minimal empty space between the particles. In contrast, in liquids, while the particles are still close together, they can move past one another, allowing liquids to flow and take the shape of their container but not changing volume significantly. In gases, the particles are much farther apart compared to solids and liquids, with minimal interaction between them, leading to a high degree of freedom and movement. Plasma, the fourth state of matter, is similar to gases but consists of ionized particles and has distinct properties, such as responsiveness to electromagnetic fields. Thus, the unique characteristics of solids arise directly from the close packing of their particles, making them the state of matter where particles are most closely packed together.