# DIVE Chemistry Quarterly Exam 3 Practice (Sample)

## Study Guide


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# Questions

1. **What happens during the dissociation of a strong electrolyte?**
   - **A. It partially forms ions**
   - **B. It fully separates into ions**
   - **C. It does not form ions**
   - **D. It only dissolves without ion formation**

2. **In the absorption of light as described by the Beer-Lambert Law, what happens when the concentration of a solution increases?**
   - **A. The light absorption decreases**
   - **B. The light absorption remains unchanged**
   - **C. The light absorption increases**
   - **D. The light absorption fluctuates**

3. **In thermodynamics, which type of system can exchange both energy and matter with its surroundings?**
   - **A. Open system**
   - **B. Closed system**
   - **C. Isolated system**
   - **D. Equilibrium system**

4. **A solution that has the maximum amount of solute dissolved for a given temperature and pressure is termed _____.**
   - **A. saturated**
   - **B. unsaturated**
   - **C. supersaturated**
   - **D. concentrated**

5. **What distinguishes strong electrolytes from weak electrolytes?**
   - **A. Strong electrolytes partially dissociate**
   - **B. Weak electrolytes completely dissociate**
   - **C. Strong electrolytes completely dissociate**
   - **D. Weak electrolytes never dissociate**

**6. What is the role of activation energy in chemical reactions?**

- **A. It is the energy needed to form bonds between reactants**
- **B. It is the minimum energy required for reactants to undergo a reaction**
- **C. It is the energy threshold for products to revert to reactants**
- **D. It determines the equilibrium position of a reaction**

**7. Which property makes metals suitable for electrical wiring?**

- **A. High melting points**
- **B. Corrosion resistance**
- **C. Electrical conductivity**
- **D. Opacity**

**8. What characterizes a balanced chemical equation?**

- **A. A balanced equation has a different number of atoms on either side.**
- **B. A balanced equation contains only one type of atom.**
- **C. A balanced equation has the same number of atoms of each element on both the reactant and product sides.**
- **D. A balanced equation cannot be created for certain reactions.**

**9. What is the process of using electricity to split water into hydrogen and oxygen called?**

- **A. Electrolysis**
- **B. Electromagnetic processing**
- **C. Hydrolysis**
- **D. Electromotive force**

**10. In metallic bonding, the "sea of electrons" contributes to which of the following properties?**

- **A. Low density**
- **B. High melting points**
- **C. Insulation**
- **D. Low malleability**

# Answers

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

# Explanations

## 1. What happens during the dissociation of a strong electrolyte?

**A. It partially forms ions**

**B. It fully separates into ions**

**C. It does not form ions**

**D. It only dissolves without ion formation**

**During the dissociation of a strong electrolyte, the substance fully separates into its constituent ions when it is dissolved in a solvent, typically water. This process occurs because strong electrolytes, such as sodium chloride or potassium nitrate, have very high solubility in water and their ionic bonds are overcome by the interactions with water molecules. As a result, the entire structure of the electrolyte collapses into individual ions that disperse throughout the solution. This complete ionization is a defining characteristic of strong electrolytes, distinguishing them from weak electrolytes, which only partially dissociate into ions. The full production of ions in solution leads to a high electrical conductivity, which is another important property of strong electrolytes. Therefore, when a strong electrolyte is dissolved, it results in the formation of a fully ionized solution.**

## 2. In the absorption of light as described by the Beer-Lambert Law, what happens when the concentration of a solution increases?

**A. The light absorption decreases**

**B. The light absorption remains unchanged**

**C. The light absorption increases**

**D. The light absorption fluctuates**

**According to the Beer-Lambert Law, the absorption of light by a solution is directly proportional to the concentration of the absorbing species in that solution. This means that as the concentration of a solute increases, there are more molecules available to interact with the passing light. Consequently, the number of photons absorbed by the substance also increases. The Beer-Lambert Law is mathematically represented as A = εcl, where A is the absorbance, ε is the molar absorptivity coefficient (a constant specific to the substance), c is the concentration of the solution, and l is the path length of the light. As concentration (c) increases, the absorbance (A) increase linearly, assuming that all other factors remain constant. Thus, higher concentrations result in greater absorbance, indicating that more light is being absorbed. This principle illustrates the foundational relationship between concentration and light absorption in chemical solutions, making it essential in many applications, such as spectrophotometry, where determining concentration through absorbance is crucial.**

## 3. In thermodynamics, which type of system can exchange both energy and matter with its surroundings?

**A. Open system**

**B. Closed system**

**C. Isolated system**

**D. Equilibrium system**

**An open system is defined as one that can exchange both energy and matter with its surroundings. This means that both heat transfer and mass transfer can occur, allowing for interactions that can significantly influence the system's thermodynamic properties. For instance, consider a boiling pot of water: steam (which is matter) leaves the pot into the air, and energy in the form of heat is also imparted to the surrounding environment. This characteristic enables open systems to dynamically respond to changes in their environment, making them fundamental to many physical and chemical processes. In contrast, a closed system can exchange energy, such as heat, but not matter with its surroundings. An example of a closed system might be a sealed container of gas that can absorb or release heat but cannot allow gas to escape or enter. An isolated system is one that can neither exchange energy nor matter with its environment, such as a thermos that keeps both its contents and thermal energy enclosed. Lastly, an equilibrium system refers to a state where the macroscopic properties remain constant over time; it doesn't define the ability of the system to exchange energy or matter but rather its condition at a specific moment. Thus, distinguishing the characteristics of open systems highlights their versatility in exchanging both energy and matter with the environment.**

## 4. A solution that has the maximum amount of solute dissolved for a given temperature and pressure is termed _____.

**A. saturated**

**B. unsaturated**

**C. supersaturated**

**D. concentrated**

**A solution that contains the maximum amount of solute that can be dissolved at a specific temperature and pressure is termed saturated. In a saturated solution, the solute is in equilibrium with its solid form, meaning that no more solute can dissolve in the solvent without changing the conditions, such as increasing temperature or pressure. This concept is essential in understanding how solubility behaves under different environmental factors. When saturation is reached, any additional solute will not dissolve and may settle at the bottom or remain undissolved. The terms unsaturated, supersaturated, and concentrated describe different states of solutions. An unsaturated solution contains less solute than the maximum that can dissolve, while a supersaturated solution contains more solute than is normally possible at that temperature and pressure, often achieved through specific processes. A concentrated solution generally refers to a solution with a high amount of solute but does not specify whether it is saturated or unsaturated. Therefore, the defining characteristic of a saturated solution is its maximum solute capacity under given conditions.**

## 5. What distinguishes strong electrolytes from weak electrolytes?

**A. Strong electrolytes partially dissociate**

**B. Weak electrolytes completely dissociate**

**C. Strong electrolytes completely dissociate**

**D. Weak electrolytes never dissociate**

**Strong electrolytes are characterized by their ability to completely dissociate into their constituent ions when dissolved in water. This complete dissociation results in a solution that can conduct electricity very effectively due to the high concentration of free-moving ions. Examples of strong electrolytes include salts like sodium chloride (NaCl) and potassium nitrate ($KNO_3$), which fully break apart into positive and negative ions. In contrast, weak electrolytes do not completely dissociate in solution; they only partially ionize, resulting in a lower concentration of ions compared to strong electrolytes. This partial ionization limits their ability to conduct electricity. Common weak electrolytes include weak acids like acetic acid ($CH_3COOH$) and weak bases like ammonia ($NH_3$). Thus, the distinction lies in the degree of dissociation in solution: strong electrolytes fully dissociate while weak electrolytes do so only partially. The choice stating that strong electrolytes completely dissociate captures the essence of what sets them apart from weak electrolytes.**

## 6. What is the role of activation energy in chemical reactions?

**A. It is the energy needed to form bonds between reactants**

**B. It is the minimum energy required for reactants to undergo a reaction**

**C. It is the energy threshold for products to revert to reactants**

**D. It determines the equilibrium position of a reaction**

**Activation energy plays a crucial role in determining whether a chemical reaction can proceed. It is defined as the minimum energy required for reactants to collide successfully and initiate a reaction. This energy is necessary to overcome the energy barrier that separates the reactants from the products, enabling the rearrangement of atoms and bonds during the reaction process. When reactants collide, they must possess enough kinetic energy to overcome this activation energy barrier for the reaction to take place. If the energy of the colliding molecules is below this threshold, they will not be able to react, no matter how frequently they collide. Once the activation energy is reached, the reactants can transform into products through a series of intermediate processes. In summary, the correct choice highlights activation energy as the critical factor that must be achieved for a reaction to occur, emphasizing its importance in the kinetics of chemical reactions. The other options mentioned different concepts related to chemical bonding and reaction dynamics that do not accurately define the specific role of activation energy in reactions.**

## 7. Which property makes metals suitable for electrical wiring?

**A. High melting points**

**B. Corrosion resistance**

**C. Electrical conductivity**

**D. Opacity**

**The property that makes metals suitable for electrical wiring is electrical conductivity. Metals are characterized by their ability to allow electric current to flow through them efficiently due to the presence of free-moving electrons. This high electrical conductivity means that when a voltage is applied, electrons can easily move through the metal, enabling the effective transmission of electricity. While high melting points can be advantageous in certain applications where conductivity needs to be maintained at high temperatures, it is not the primary reason these materials are chosen for wiring. Corrosion resistance is important in some settings to prevent degradation over time, but it is not a universal property of all metals used for electrical wiring. Opacity, which refers to the property of not allowing light to pass through, is irrelevant to the function and effectiveness of electrical wiring. Thus, electrical conductivity stands out as the key characteristic that makes metals well-suited for conducting electricity in wires.**

## 8. What characterizes a balanced chemical equation?

**A. A balanced equation has a different number of atoms on either side.**

**B. A balanced equation contains only one type of atom.**

**C. A balanced equation has the same number of atoms of each element on both the reactant and product sides.**

**D. A balanced equation cannot be created for certain reactions.**

**A balanced chemical equation is defined by having the same number of atoms of each element on both the reactant and product sides. This principle is based on the law of conservation of mass, which states that matter cannot be created or destroyed in a chemical reaction. Therefore, when writing a balanced equation, one must ensure that all atoms present in the reactants are accounted for in the products, maintaining equal quantities of each element throughout the reaction. This balance is crucial for accurately representing chemical reactions and predicting the products formed. In doing so, it allows chemists to understand stoichiometry, enabling them to calculate the amounts of reactants needed and products formed in a reaction. The necessity of balancing equations reflects the foundational principles of chemistry, where every atom has to be conserved during the process.**

## 9. What is the process of using electricity to split water into hydrogen and oxygen called?

**A. Electrolysis**

**B. Electromagnetic processing**

**C. Hydrolysis**

**D. Electromotive force**

**The process of using electricity to split water into hydrogen and oxygen is known as electrolysis. This occurs when an electric current is passed through water, leading to the decomposition of water molecules into their constituent elements. During electrolysis, water ($H_2O$) is separated into hydrogen gas ($H_2$) and oxygen gas ($O_2$), typically at two electrodes: the anode and the cathode. The significance of electrolysis lies in its applications, particularly in producing hydrogen as a clean fuel source, as well as generating oxygen, which can be utilized in various industrial processes. The conditions necessary for electrolysis include the presence of an electrolyte, which enhances conductivity, allowing for efficient current flow through the water. The other options refer to different concepts: electromagnetic processing involves the use of electromagnetic waves rather than electrical current to manipulate materials; hydrolysis is a chemical reaction where water is used to break down substances but is not necessarily facilitated by electricity; and electromotive force refers to the energy provided by a cell or battery to drive electric current through a circuit, but does not specifically describe the process of splitting water.**

## 10. In metallic bonding, the "sea of electrons" contributes to which of the following properties?

**A. Low density**

**B. High melting points**

**C. Insulation**

**D. Low malleability**

**In metallic bonding, the "sea of electrons" refers to the delocalized electrons that are free to move around within a lattice of metal cations. This unique arrangement contributes significantly to the properties of metals. High melting points are a result of the strong forces of attraction between the positively charged metal ions and the delocalized electrons. These metallic bonds are generally quite strong, requiring a considerable amount of energy to break them apart, which translates to high melting points. As these metallic bonds hold the lattice structure of the metal together, a higher temperature is necessary to provide the energy needed for the ions to overcome this attractive force and move freely, transitioning from solid to liquid. In contrast, while a metallic structure can influence density, insulation, and malleability, these aspects do not arise from the sea of electrons in the same way that high melting points do. Metals typically have high densities due to closely packed metal ions, metals are good conductors due to their free electrons rather than insulators, and malleability is a property that results from the ability of metal atoms to shift in position without breaking bonds, which indicates that metals can actually be quite malleable rather than exhibiting low malleability. Thus, the strong metallic bonds originating from the**