Medical College Admission Test (MCAT) General Chemistry Practice Exam (Sample)

Study Guide

Everything you need from our exam experts!

Table of Contents

Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- **Practice answering questions under realistic conditions,**
- **Improve accuracy and speed,**
- **Review explanations to strengthen weak areas, and**
- **Approach the exam with greater confidence.**

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

How to Use This Guide

This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:

1. Start with a Diagnostic Review

Skim through the questions to get a sense of what you know and what you need to focus on. Don't worry about getting everything right, your goal is to identify knowledge gaps early.

2. Study in Short, Focused Sessions

Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations, and take breaks to retain information better.

3. Learn from the Explanations

After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.

4. Track Your Progress

Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.

5. Simulate the Real Exam

Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.

6. Repeat and Review

Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning.

7. Use Other Tools

Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.

There’s no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly — adapt the tips above to fit your pace and learning style. You've got this!

Questions

1. At lower temperatures, which combination of ΔH and ΔS indicates a spontaneous reaction?

A. -ΔH and -ΔS

B. -ΔH and +ΔS

C. +ΔH and -ΔS

D. +ΔH and +ΔS

2. For a second order reaction, what is the correct plot?

A. Concentration vs. time

B. Ln[A] vs. time

C. 1/[A] vs. time

D. $1/(2[A]^2)$ vs. time

3. Which of the following is considered a basic hydride?

A. HCl

B. NH_3

C. CaO

D. H_2O

4. What is the SI unit for electric current?

A. Volt

B. Ampere

C. Watt

D. Coulomb

5. What is a key criterion for making an effective buffer solution?

A. Using strong acids and bases

B. Selecting a weak acid with pKa far from desired pH

C. Using equal amounts of weak acid and its conjugate base

D. Mixing varying concentrations of different weak acids

6. Which of the following statements about the reduction potentials is true?

A. All reduction potentials are positive

B. Reduction potentials vary with temperature

C. Reduction potentials are extensive properties

D. Only one value exists for a given half reaction

7. When Q is greater than K, what direction does the reaction shift?

A. The reaction shifts to the right to form more products.

B. The reaction shifts to the left to form more reactants.

C. No shift occurs in the reaction.

D. The equilibrium constant decreases.

8. What is the primary function of a galvanic (voltaic) cell?

A. Convert electrical energy to chemical energy

B. Generate electron current using electric potential

C. Store chemical energy for later use

D. Balance half reactions in redox reactions

9. Which step involves breaking intermolecular bonds among solvent molecules during the solution formation process?

A. The first step

B. The second step

C. The third step

D. It does not occur

10. What does "mass percent" represent in a solution?

A. Volume of solute per total volume of solution

B. Mass of solute divided by mass of solution, multiplied by 100

C. Moles of solute divided by total moles of solution

D. Moles of solute per volume of solution

Answers

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

Explanations

1. At lower temperatures, which combination of ΔH and ΔS indicates a spontaneous reaction?

A. -ΔH and -ΔS

B. -ΔH and +ΔS

C. +ΔH and -ΔS

D. +ΔH and +ΔS

A spontaneous reaction is determined by the Gibbs free energy change (ΔG), which can be expressed as: $\Delta G = \Delta H - T\Delta S$ where ΔH represents the change in enthalpy, ΔS is the change in entropy, and T is the temperature in Kelvin. For a reaction to be spontaneous, ΔG must be negative. Evaluating the combinations of ΔH and ΔS: When ΔH is negative (exothermic), it contributes to making ΔG more negative, favoring spontaneity. Meanwhile, if ΔS is positive, this indicates an increase in disorder in the system, which also contributes to a negative ΔG when multiplied by the temperature (T). Specifically, the combination of negative ΔH and positive ΔS results in a situation where both factors push ΔG to become negative, particularly at lower temperatures, where the impact of TΔS is less pronounced. Therefore, this combination is the most favorable for spontaneity under these conditions. The other combinations present scenarios where either the enthalpy change or the entropy change might hinder spontaneity, such as an increase in enthalpy without a significant rise in entropy or both being

2. For a second order reaction, what is the correct plot?

A. Concentration vs. time

B. Ln[A] vs. time

C. 1/[A] vs. time

D. $1/(2[A]^2)$ vs. time

For a second order reaction, the relationship that governs the reaction kinetics can be expressed as the rate of reaction being proportional to the square of the concentration of the reactant. Specifically, for a reaction involving a single reactant A, the integrated rate law is given by the equation: $1/[A] = kt + 1/[A]_0$ In this equation, [A] is the concentration of the reactant at time t, k is the rate constant, and $[A]_0$ is the initial concentration. This means that if you plot 1/[A] versus time, you will obtain a straight line, indicating that the reaction follows second-order kinetics. This linear plot confirms the nature of the reaction and allows for the determination of the rate constant k from the slope of the line. The intercept will correspond to the inverse of the initial concentration. The other plotting options do not yield a linear relationship for a second order reaction: - A plot of concentration vs. time for a second order reaction does not yield a linear plot and is not useful for determining rate constants. - A plot of ln[A] vs. time is applicable to first order reactions, where the natural logarithm of concentration decreases linearly over time. -

3. Which of the following is considered a basic hydride?

A. HCl

B. NH_3

C. CaO

D. H_2O

A basic hydride is defined as a hydride that can act as a base by accepting protons or donating electrons during a chemical reaction. In this case, calcium oxide (CaO) is the correct choice, as it is considered a basic hydride. CaO is formed from the combination of calcium and oxygen and has the ability to react with acids to produce salts and water. In the presence of water, CaO can form calcium hydroxide ($Ca(OH)_2$), which is a strong base. The basic nature of CaO is due to the tendency of calcium to donate electrons, facilitating reactions with protons from acids. On the other hand, hydrochloric acid (HCl) is an acid and does not act as a basic hydride. Ammonia (NH_3), while it can accept protons and is a Lewis base, is better classified as a molecular compound rather than a hydride in this context. Water (H_2O) is amphoteric; it can act as both an acid and a base, but it is also not considered primarily a basic hydride. Therefore, among the given options, CaO is the only hydride that fits the definition of being basic.

4. What is the SI unit for electric current?

A. Volt

B. Ampere

C. Watt

D. Coulomb

The SI unit for electric current is the Ampere. The Ampere is defined as one coulomb of electric charge passing through a conductor in one second. It serves as a fundamental unit in the International System of Units (SI) for quantifying electric current, which is a measure of the flow of electric charge. Understanding the context of this unit is essential. Electric current represents how much charge is flowing in an electrical circuit, making it a key parameter for electrical and electronic systems. This unit allows scientists and engineers to communicate and calculate current easily and consistently. When considering the other options, the Volt is the unit of electric potential or voltage, the Watt is the unit of power (equating to one Joule per second), and the Coulomb is the unit of electric charge. While these related quantities play significant roles in the field of electromagnetism, they are distinct from the definition of electric current itself. Thus, the Ampere's role as the unit of electric current is clear and fundamental in the study of chemistry and physics.

5. What is a key criterion for making an effective buffer solution?

A. Using strong acids and bases

B. Selecting a weak acid with pKa far from desired pH

C. Using equal amounts of weak acid and its conjugate base

D. Mixing varying concentrations of different weak acids

An effective buffer solution is characterized by its ability to resist changes in pH upon the addition of small amounts of acid or base. The correct answer highlights the importance of using equal amounts of a weak acid and its conjugate base, which establishes an optimal ratio for maintaining the desired pH. When a weak acid and its conjugate base are present in roughly equal concentrations, the buffer system can effectively neutralize added acids or bases. If an acid is added, the conjugate base can react with it to minimize the change in pH, and similarly, if a base is added, the weak acid can react to counteract the change. This is described by the Henderson-Hasselbalch equation, which shows that the pH of the buffer solution is determined by the ratio of the concentrations of the weak acid and its conjugate base. Using strong acids and bases, as mentioned in another option, would not create an effective buffer because strong acids and bases completely dissociate in solution and cannot provide the gradual pH control that weak acids and bases offer. Selecting a weak acid with a pKa far from the desired pH would result in poor buffering capacity, as the weak acid's ability to neutralize pH shifts is diminished. Lastly,

6. Which of the following statements about the reduction potentials is true?

A. All reduction potentials are positive

B. Reduction potentials vary with temperature

C. Reduction potentials are extensive properties

D. Only one value exists for a given half reaction

The statement that only one value exists for a given half-reaction is true because each half-reaction is defined by its standard reduction potential, which is a measure of the tendency of a species to gain electrons and be reduced. This value is specific to that half-reaction and is standardized under defined conditions (usually 25°C and 1 M concentration for solutes). Standard reduction potentials are typically reported in volts (V) and provide a consistent basis for comparing the reduction strengths of various chemical species. While the same half-reaction can exhibit different potentials under varying conditions (like concentration or temperature), the standard reduction potential is unique to each specific reaction under standard conditions. Consequently, if you consider a specific half-reaction, it will yield a single, defined reduction potential that can be referenced. The other statements do not hold true universally. While it's accurate that reduction potentials can vary with temperature, they are not all positive; some can be negative, indicating a lower tendency to gain electrons, and reduction potentials are not extensive properties, which depend on the amount of substance present. Hence, the correct understanding of half-reaction potentials is that each unique reaction possesses a singular standard value under standard conditions, solidifying the correctness of the chosen answer.

7. When Q is greater than K, what direction does the reaction shift?

A. The reaction shifts to the right to form more products.

B. The reaction shifts to the left to form more reactants.

C. No shift occurs in the reaction.

D. The equilibrium constant decreases.

When the reaction quotient (Q) is greater than the equilibrium constant (K), this indicates that the concentration of products is higher than what is present at equilibrium relative to the concentrations of reactants. In this situation, the system is not at equilibrium and will adjust to restore balance. To achieve this balance, the reaction will shift in the direction that decreases the concentration of products and increases the concentration of reactants. This means that the system shifts to the left, favoring the formation of more reactants until Q decreases and approaches K, eventually reaching equilibrium. This concept is rooted in Le Chatelier's principle, which states that if a system at equilibrium is disturbed, the system will respond by attempting to counteract that disturbance and restore equilibrium. Therefore, when Q is greater than K, the reaction shifts left to form more reactants, moving towards restoring the equilibrium state.

8. What is the primary function of a galvanic (voltaic) cell?

A. Convert electrical energy to chemical energy

B. Generate electron current using electric potential

C. Store chemical energy for later use

D. Balance half reactions in redox reactions

In a galvanic (or voltaic) cell, the primary function is to generate electricity through spontaneous redox reactions. When a galvanic cell operates, it facilitates a chemical reaction in which reactants undergo oxidation and reduction. This process creates a flow of electrons due to the difference in electric potential between the anode and the cathode, enabling the cell to produce an electric current. Electrons are released from the anode, where oxidation occurs, and travel through an external circuit to the cathode, where reduction takes place. This movement of electrons constitutes an electric current. Thus, the galvanic cell efficiently converts the chemical energy of the reactants into electrical energy. While other options mentioned relate to aspects of electrochemistry or energy conversion, they do not capture the primary role of a galvanic cell as accurately as generating electron current using electric potential. For instance, converting electrical energy to chemical energy describes the function of an electrolytic cell, while storing chemical energy pertains to batteries rather than the direct function of galvanic cells. Balancing half-reactions is an important part of understanding redox reactions, but it is not the primary function of the cell itself.

9. Which step involves breaking intermolecular bonds among solvent molecules during the solution formation process?

A. The first step

B. The second step

C. The third step

D. It does not occur

The step that involves breaking intermolecular bonds among solvent molecules during the solution formation process is indeed the second step. In the context of solution formation, specifically when a solute is dissolved in a solvent, the process can be broken down into three key steps. In the first step, solute particles are separated from each other, which involves overcoming the forces that hold the solute together. This step requires energy and is essential for allowing solute particles to disperse in the solvent. The second step, which is the correct answer, requires breaking the intermolecular forces among solvent molecules. This step is crucial because, for the solute to be integrated into the solvent, the solvent must make space for the solute particles. Breaking these intermolecular bonds between solvent molecules involves energy input, and it allows the solute to interact with the solvent effectively. In the third step, new interactions are formed between the solute and solvent molecules. This step often results in a release of energy, as new bonds are formed which stabilizes the solution. Thus, the second step is specifically focused on disrupting the interactions among solvent molecules to facilitate the solute's introduction into the solvent, making it critical in the overall process of solution formation.

10. What does "mass percent" represent in a solution?

A. Volume of solute per total volume of solution

B. Mass of solute divided by mass of solution, multiplied by 100

C. Moles of solute divided by total moles of solution

D. Moles of solute per volume of solution

Mass percent is a measure of the concentration of a solute in a solution, expressed as the mass of the solute divided by the mass of the entire solution, and then multiplied by 100 to convert it into a percentage. This quantifies how much of the total mass of the solution is made up of the solute, providing a clear understanding of the relative proportions of solute and solvent. To further elaborate, when calculating mass percent, you sum the mass of the solute (the substance being dissolved) and the mass of the solvent (the substance doing the dissolving) to find the total mass of the solution. By dividing the mass of the solute by this total mass and then multiplying by 100, you obtain a percentage that makes it easier to compare concentrations of different solutions, independent of their volumes. The other options refer to different ways of expressing concentration, but they do not align with the specific definition of mass percent. For example, one option involves volume, which pertains to a different form of concentration measurement, while others involve moles, which relate to the amount of substance but not to mass specifically. Mass percent is distinct in that it solely relies on mass rather than volume or mole quantity.

Next Steps

Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.

As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.

If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.

Or visit your dedicated course page for more study tools and resources:

https://mcat-generalchemistry.examzify.com

We wish you the very best on your exam journey. You've got this!