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

Study Guide

Everything you need from our exam experts!

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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. 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.

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. 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. Which of the following can lead to a decrease in the Gibbs free energy of a system?

A. Increasing the temperature
B. Increasing the enthalpy
C. Increasing the entropy
D. Decreasing the entropy

2. How does ΔG° behave when K is greater than 1?

A. ΔG° is less than 0
B. ΔG° is equal to 0
C. ΔG° is greater than 0
D. ΔG° is undefined

3. What periodic trend is observed in ionization energy as you move from top to bottom in a group?

A. Ionization energy increases
B. Ionization energy decreases
C. Ionization energy remains unchanged
D. Ionization energy fluctuates

4. What is the specific heat of water?

A. 1 cal/(g x °C)
B. 4.18 J/(g x °C)
C. 0.5 cal/(g x °C)
D. 2 J/(g x °C)

5. Which prefix represents one-thousandth (10^{-3})?

A. Micro
B. Centi
C. Milli
D. Deci

6. What is the standard reduction potential for hydrogen?

A. 0.00 V
B. 1.23 V
C. 0.77 V
D. -0.45 V

7. **What characterizes a dynamic equilibrium in a saturated solution?**
   - **A. Dissolution occurs rapidly**
   - **B. Equal rates of dissolution and precipitation**
   - **C. All solute is in solid form**
   - **D. Only the solvent is present**

8. **What is the first step in the formation of a solution regarding intermolecular bonds?**
   - **A. Forming bonds between solute and solvent**
   - **B. Breaking intermolecular bonds between solute molecules**
   - **C. Breaking intermolecular bonds between solvent molecules**
   - **D. Forming new solute molecules**

9. **Which type of potential is indicated by cell potential in a galvanic cell?**
   - **A. Oxidation potential**
   - **B. Equilibrium constant**
   - **C. Reduction potential**
   - **D. Hydration energy**

10. **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**

Answers

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

Explanations

1. Which of the following can lead to a decrease in the Gibbs free energy of a system?

- A. Increasing the temperature
- B. Increasing the enthalpy
- C. Increasing the entropy
- D. Decreasing the entropy

The option referring to increasing the entropy is correct, as it directly contributes to a decrease in the Gibbs free energy of a system, according to the Gibbs free energy equation: \[G = H - TS \] where \(G \) is Gibbs free energy, \(H \) is enthalpy, \(T \) is the absolute temperature, and \(S \) is entropy. When entropy increases, the term \(TS \) becomes larger, leading to a larger subtraction from the enthalpy term \(H \). This can either reduce the Gibbs free energy directly or lower the value of \(G \) in states that were previously unfavorable. In simpler terms, systems tend to favor configurations that have higher entropy because they are more disordered and statistically favorable, thus decreasing Gibbs free energy. In contrast, increasing the temperature can actually lead to a situation where \(TS \) increases, but it does not guarantee that the Gibbs free energy will decrease overall, as this depends on the balance with enthalpy changes. Increasing enthalpy generally has the opposite effect, as it raises the overall energy content of the system, potentially increasing Gibbs free energy. Decreasing entropy would certainly not favor lower Gibbs free energy and would instead suggest a movement towards

2. How does ΔG° behave when K is greater than 1?

- A. ΔG° is less than 0
- B. ΔG° is equal to 0
- C. ΔG° is greater than 0
- D. ΔG° is undefined

When the equilibrium constant (K) is greater than 1, it indicates that the products of a reaction are favored over the reactants at equilibrium. This preference for products suggests that the reaction is spontaneous under standard conditions, contributing to a negative change in Gibbs free energy (ΔG°). The relationship between ΔG° and K is defined by the equation: \[\Delta G^\circ = -RT \ln K \] In this equation, R is the gas constant and T is the temperature in Kelvin. When K is greater than 1, the natural logarithm of K (ln K) is positive, leading to a negative value for ΔG°. This negative ΔG° signifies that the reaction proceeds spontaneously in the forward direction toward products under standard conditions. Therefore, the correct conclusion is that when K is greater than 1, ΔG° is indeed less than 0, aligning with the understanding of spontaneous reactions and their favorability towards product formation at equilibrium.

3. What periodic trend is observed in ionization energy as you move from top to bottom in a group?

A. Ionization energy increases
B. Ionization energy decreases
C. Ionization energy remains unchanged
D. Ionization energy fluctuates

As you move from top to bottom within a group of the periodic table, ionization energy generally decreases. This trend can be attributed to several key factors. Firstly, as you go down a group, the number of electron shells increases. Each additional shell means that the outermost electrons are farther away from the nucleus. This increased distance reduces the effective nuclear charge that the outer electrons experience because there are more inner shell electrons between the nucleus and the outermost electrons. Secondly, electron shielding comes into play, as inner shell electrons repel outer shell electrons, further diminishing the attractive force from the nucleus. This shielding effect makes it easier for the outermost electron to be removed, leading to a lower ionization energy. Consequently, it requires less energy to remove an electron from an atom as one moves down a group due to this increased distance and shielding effect. The combination of these factors explains why ionization energy decreases from top to bottom in a group on the periodic table.

4. What is the specific heat of water?

A. 1 cal/(g x °C)
B. 4.18 J/(g x °C)
C. 0.5 cal/(g x °C)
D. 2 J/(g x °C)

The specific heat of water is commonly known to be 4.18 joules per gram per degree Celsius (J/(g x °C)). This value represents the amount of heat energy required to raise the temperature of 1 gram of water by 1 degree Celsius. Water has a high specific heat capacity, which is important for various biological and environmental processes. Its high specific heat allows water to absorb a significant amount of heat without experiencing a large increase in temperature, which is crucial for maintaining stable temperatures in living organisms and in habitats. The option stating 1 cal/(g x °C) can also be considered correct as 1 calorie is approximately equal to 4.184 joules; however, when it comes to the most commonly accepted value in scientific contexts, 4.18 J/(g x °C) is typically used and recognized, especially for use in calculations involving heat transfer. Thus, the specific heat of water signifies its ability to stabilize temperatures and is a fundamental concept in both chemistry and physics.

5. Which prefix represents one-thousandth (10^{-3})?

A. Micro

B. Centi

C. Milli

D. Deci

The prefix that represents one-thousandth (10^{-3}) is indeed Milli. In the metric system, the prefix "milli" indicates a factor of \(10^{-3}\), or 0.001. This means that one millimeter is one-thousandth of a meter, one milliliter is one-thousandth of a liter, and so forth. Understanding these prefixes is essential for working with measurements in various scientific contexts, including chemistry. In contrast, the prefix "micro" denotes one-millionth (10^{-6}), "centi" refers to one-hundredth (10^{-2}), and "deci" corresponds to one-tenth (10^{-1}). Each of these prefixes helps convey specific orders of magnitude, which is crucial in scientific communication and calculations. Therefore, the correct representation of one-thousandth in the metric system is given by the prefix milli.

6. What is the standard reduction potential for hydrogen?

A. 0.00 V

B. 1.23 V

C. 0.77 V

D. -0.45 V

The standard reduction potential for hydrogen ions to hydrogen gas is defined as 0.00 V. This is a reference point against which other reduction potentials are measured. The half-reaction for the reduction of hydrogen ions can be written as: \[\text{2H}^+ (aq) + 2e^- \rightarrow \text{H}_2 (g) \] In electrochemistry, the standard reduction potential indicates how readily a substance gains electrons, with the higher values representing a greater tendency to be reduced. Since hydrogen is commonly used as the reference electrode in standard reduction potential tables, it has a defined potential of 0.00 V. This serves as the baseline for measuring other half-reactions.   This means that any other standard reduction potential listed would either be positive or negative based on how that substance compares to hydrogen in terms of its willingness to gain electrons. Therefore, the choice that states 0.00 V represents the standard reduction potential for hydrogen is accurate and properly reflects its role as a reference in electrochemical series.

7. What characterizes a dynamic equilibrium in a saturated solution?

A. Dissolution occurs rapidly
B. Equal rates of dissolution and precipitation
C. All solute is in solid form
D. Only the solvent is present

A dynamic equilibrium in a saturated solution is characterized by equal rates of dissolution and precipitation. At this point, the concentrations of solute and solvent remain constant because the rate at which solid solute dissolves into the solution is the same as the rate at which dissolved solute reverts back to solid form. This balance is crucial to understand in the context of solubility and saturation, as it indicates that further addition of solute will not increase the amount dissolved in the solution. In a saturated solution, while dissolution may occur rapidly initially, once saturation is reached, it is the equilibrium between dissolution and precipitation that defines the state of the solution. This means that options referring to rapid dissolution or assumptions about the form of solute present are not accurate representations of this equilibrium. Notably, the presence of all solute in solid form or only solvent would not correspond to the definition of a saturated solution, where both states of matter coexist.

8. What is the first step in the formation of a solution regarding intermolecular bonds?

A. Forming bonds between solute and solvent
B. Breaking intermolecular bonds between solute molecules
C. Breaking intermolecular bonds between solvent molecules
D. Forming new solute molecules

The first step in the formation of a solution involves breaking intermolecular bonds between solute molecules. When a solute is introduced into a solvent, the solute particles must separate from one another to interact properly with the solvent. This process requires energy to overcome the attractive forces holding the solute molecules together, which is why breaking the intermolecular bonds between solute molecules is essential. Once these bonds are broken, the solute particles can then disperse throughout the solvent. Following this initial step, the solute particles can begin to interact with the solvent molecules, leading to the formation of attractive interactions between them. This interaction is crucial for the solute to become fully solvated, or surrounded by solvent molecules. Understanding this sequence is vital because it highlights the necessity of disrupting the existing structure of the solute before it can successfully mix with the solvent. This foundational concept is essential in solutions chemistry, particularly when considering processes like dissolution and solvation.

9. Which type of potential is indicated by cell potential in a galvanic cell?

- **A. Oxidation potential**
- **B. Equilibrium constant**
- **C. Reduction potential**
- **D. Hydration energy**

In a galvanic cell, the cell potential reflects the ability of the cell to drive an electrochemical reaction and is directly related to the reduction potentials of the half-reactions involved. The cell potential (often represented as E°cell) is calculated by taking the difference between the reduction potentials of the cathode and the anode. The correct answer identifies that the type of potential indicated by cell potential in a galvanic cell is the reduction potential, which is a measure of the tendency of a species to gain electrons and thereby be reduced. In essence, a higher reduction potential indicates a greater likelihood of a species to be reduced, contributing to the overall cell potential when coupled with an oxidation half-reaction. In this context, focusing on reduction potentials is vital because the functioning of a galvanic cell hinges on the reduction of one species and the oxidation of another. This interplay creates a flow of electrons through an external circuit, which is what generates electrical energy. Understanding this concept is central to mastering the principles of electrochemistry and galvanic cells.

10. 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. -

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!