Chemistry CFE Practice Test (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. **What is the effect of a catalyst on activation energy and the overall energy profile (ΔH) of a reaction?**
    - **A. It has no effect on activation energy or ΔH**
    - **B. It lowers ΔH; increases activation energy**
    - **C. It increases activation energy; decreases ΔH**
    - **D. It lowers activation energy; does not change ΔH**

2. **Isotopes have the same number of protons.**
    - **A. They have different numbers of protons**
    - **B. They have different numbers of neutrons**
    - **C. They have the same number of protons**
    - **D. They have different numbers of electrons**

3. **The first step in determining percent composition is to determine:**
    - **A. the empirical formula of the compound**
    - **B. the molar mass of the entire compound**
    - **C. the molar mass of each element in the compound**
    - **D. the percent yield of the reaction**

4. **Which groups correspond to non-representative elements, the transition metals?**
    - **A. Groups 1A-8A**
    - **B. Groups 1B-2B**
    - **C. Groups 3-12**
    - **D. Lanthanide and Actinide series**

5. **What distinguishes enantiomers from diastereomers?**
    - **A. Enantiomers are identical to their mirror images.**
    - **B. Enantiomers are non-superimposable mirror images; diastereomers are non-mirror image stereoisomers.**
    - **C. Enantiomers are a subset of diastereomers.**
    - **D. Diastereomers are non-superimposable mirror images.**

6. The pH scale classifies solutions as acidic, neutral, or basic. Which of the following correctly matches the ranges?

A. 0-6 acidic, 7 neutral, 8-14 basic.

B. 1-5 acidic, 6 neutral, 7-9 basic.

C. 2-6 acidic, 7 neutral, 8-13 basic.

D. 0-6 acidic, 7 neutral, 8-14 basic.

7. What is Raoult's law and when does it apply?

A. P_solution = x_solvent P°_solvent; applies to ideal solutions with a single solvent and nonvolatile solute.

B. P_solution = x_solvent P°_solvent × total; (nonsense)

C. P_solution depends on solute volatility only.

D. P_solution is independent of temperature.

8. Which statement correctly defines a sigma bond and a pi bond?

A. Sigma bond is formed by end-to-end overlap along the bond axis; Pi bond is formed by sideways overlap above and below the bond axis

B. Pi bond is formed by end-to-end overlap along the bond axis; Sigma bond is formed by sideways overlap above and below the bond axis

C. Sigma bond is formed by resonance; Pi bond is formed by electronegativity differences

D. Sigma bond is present only in triple bonds; Pi bond is present only in double bonds

9. Which term describes the smallest unit of an ionic compound?

A. Ion

B. Atom

C. Formula Unit

D. Molecule

10. Which set of quantum numbers describes electron orbitals, and what does each indicate?

A. n, l, m_s, m_l; energy level, subshell shape, orbital orientation, and electron spin.

B. k, l, m_l, s; energy level, subshell shape, orbital orientation, and spin.

C. n, l, m_l, m_s; energy level, subshell shape, orbital orientation, and electron spin.

D. n, l, m_l; energy level, subshell shape, and orbital orientation.

Answers

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

Explanations

1. What is the effect of a catalyst on activation energy and the overall energy profile (ΔH) of a reaction?

- A. It has no effect on activation energy or ΔH
- B. It lowers ΔH; increases activation energy
- C. It increases activation energy; decreases ΔH
- D. It lowers activation energy; does not change ΔH

A catalyst changes the kinetics of a reaction, not its thermodynamics. It provides an alternate pathway with a lower energy barrier to reach the transition state, so the activation energy decreases. However, it does not alter the energies of the reactants or products themselves, so the overall energy change ΔH (the difference between products and reactants) remains the same. In other words, a catalyst makes the reaction go faster without changing how much energy is released or required overall, and it speeds up both the forward and reverse directions equally. This is why lowering the activation energy while leaving ΔH unchanged is the correct description.

2. Isotopes have the same number of protons.

- A. They have different numbers of protons
- B. They have different numbers of neutrons
- C. They have the same number of protons
- D. They have different numbers of electrons

Isotopes are variants of the same element that share the same number of protons, which fixes the element's identity. Because the protons determine which element it is, isotopes belong to the same element even though their masses differ. The difference among isotopes comes from the number of neutrons, so they have different mass numbers while keeping the same proton count. That's why the statement about having the same number of protons is the correct description. If you think about the other possibilities: having a different number of protons would change the element itself, not just the isotope. Having different numbers of neutrons is true for isotopes, but it's the neutrons that vary, not the protons, which is why the proton count is the defining feature. The number of electrons would match the proton count in a neutral atom, so isotopes can share the same electron count as well; changing electrons would reflect ionization, not a change in isotope.

3. The first step in determining percent composition is to determine:

A. the empirical formula of the compound

B. the molar mass of the entire compound

C. the molar mass of each element in the compound

D. the percent yield of the reaction

Percent composition shows how the mass of a compound is split among its elements. To find these percentages, you first determine the mass contributed by each element in one mole of the compound. Look at the formula, count how many atoms of each element are present, and multiply by that element’s atomic mass to get the mass that element contributes per mole. Add those partial masses to get the total molar mass of the compound, then divide each element’s contributed mass by the total and multiply by 100 to obtain its percent composition. For example, in CO2 there is 1 carbon (12.01 g/mol) and 2 oxygens (2 × 15.999 g/mol = 31.998 g/mol), giving a total of about 44.01 g/mol; carbon contributes 12.01 g, which is about 27.3%, and oxygen contributes about 72.7%. The essential starting step is determining the masses contributed by each element.

4. Which groups correspond to non-representative elements, the transition metals?

A. Groups 1A-8A

B. Groups 1B-2B

C. Groups 3-12

D. Lanthanide and Actinide series

Non-representative elements are not in the main s- and p-blocks of the periodic table. The transition metals occupy the central d-block, the part of the table between the alkaline earth metals and the main-group p-block elements. Their defining feature is partially filled d orbitals, which gives them variable oxidation states, versatile chemistry, and typical metallic properties. The lanthanide and actinide series are the inner transition metals tucked below; they’re also non-representative but belong to a different block (the f-block) than the main transition-metal groups. So, the groups that correspond to the transition metals are the central d-block elements.

5. What distinguishes enantiomers from diastereomers?

A. Enantiomers are identical to their mirror images.

B. Enantiomers are non-superimposable mirror images; diastereomers are non-mirror image stereoisomers.

C. Enantiomers are a subset of diastereomers.

D. Diastereomers are non-superimposable mirror images.

The key idea is chirality and how molecules relate to their mirror images. Enantiomers are non-superimposable mirror images, meaning you cannot perfectly align one with the other even if you rotate, and they have opposite configurations at all chiral centers. Diastereomers, on the other hand, are stereoisomers that are not mirror images of each other; they may share some chiral-center configurations and differ at others, and they usually have different physical properties. So the distinguishing feature is whether the pair is a true mirror image that cannot be superimposed (enantiomers) or simply a different arrangement of atoms that is not a mirror image (diastereomers). This makes the given statement the best description: enantiomers are non-superimposable mirror images; diastereomers are non-mirror image stereoisomers. A quick note on why the alternatives don’t fit: claiming enantiomers are identical to their mirror images contradicts the whole idea of chirality, and saying diastereomers are non-superimposable mirror images would describe enantiomers, not diastereomers.

6. The pH scale classifies solutions as acidic, neutral, or basic. Which of the following correctly matches the ranges?

A. 0-6 acidic, 7 neutral, 8-14 basic.

B. 1-5 acidic, 6 neutral, 7-9 basic.

C. 2-6 acidic, 7 neutral, 8-13 basic.

D. 0-6 acidic, 7 neutral, 8-14 basic.

The pH scale measures how acidic or basic a solution is, with lower values being more acidic, 7 exactly neutral, and higher values more basic. At room temperature, the commonly used ranges are 0–6 for acidic, 7 for neutral, and 8–14 for basic. This matches the standard classification because it includes the full span of values from highly acidic (near 0) through neutral (7) to highly basic (up to 14). Other ranges that start acidic at 1 or 2 miss the most acidic values near 0, or that place neutral at a value other than 7 or define basic only starting above 9 don’t align with the usual scale.

7. What is Raoult's law and when does it apply?

A. P_solution = x_solvent P°_solvent; applies to ideal solutions with a single solvent and nonvolatile solute.

B. P_solution = x_solvent P°_solvent × total; (nonsense)

C. P_solution depends on solute volatility only.

D. P_solution is independent of temperature.

Raoult's law says the partial vapor pressure of a component in an ideal solution equals its mole fraction times the vapor pressure of the pure component: P_i = x_i P_i°. When there is a single volatile component (the solvent) and a nonvolatile solute, the solute does not contribute to the vapor pressure. Therefore the total vapor pressure of the solution is just the solvent's partial pressure: P_solution = x_solvent P°_solvent. This is why the statement is correct: it reflects the ideal-solution behavior in a simple case where only one component drives vapor pressure. The other ideas aren't right here: in an ideal solution with a nonvolatile solute, the pressure isn't an arbitrary "total" factor and isn't determined by solute volatility (the solute doesn't vaporize). Vapor pressure also depends on temperature, so P_solution is not independent of temperature. If the solute were volatile, its own partial pressure would contribute to P_solution, so the simple form shown wouldn't be the full description.

8. Which statement correctly defines a sigma bond and a pi bond?

A. Sigma bond is formed by end-to-end overlap along the bond axis; Pi bond is formed by sideways overlap above and below the bond axis

B. Pi bond is formed by end-to-end overlap along the bond axis; Sigma bond is formed by sideways overlap above and below the bond axis

C. Sigma bond is formed by resonance; Pi bond is formed by electronegativity differences

D. Sigma bond is present only in triple bonds; Pi bond is present only in double bonds

Understanding how sigma and pi bonds form helps explain why this pairing is correct. A sigma bond arises from end-to-end overlap of orbitals along the line between the two nuclei, so electron density is concentrated directly along that bond axis. A pi bond comes from sideways overlap of adjacent p orbitals, placing electron density above and below the bond axis rather than along it. This is why a single bond is typically a sigma bond, and in double and triple bonds you have one sigma bond plus one or two pi bonds. The statement accurately captures this distinction: sigma from end-to-end overlap along the axis, pi from sideways overlap above and below the axis. The other ideas—that pi bonds come from resonance or electronegativity differences, or that pi bonds exist only in certain bond orders—don't reflect how orbital overlap actually builds covalent bonds.

9. Which term describes the smallest unit of an ionic compound?

A. Ion

B. Atom

C. Formula Unit

D. Molecule

In ionic compounds, the structure is a crystal lattice of alternating cations and anions rather than a discrete covalently bonded molecule. The smallest unit that represents the compound's composition in this lattice is the formula unit—the simplest whole-number ratio of ions that yields a neutral assembly. For example, in sodium chloride the simplest ratio is one sodium ion for every chloride ion, so the formula unit is NaCl. This differs from a molecule, which would be a discrete, covalently bonded group of atoms. An atom is a single element, and an ion is a charged particle; the smallest unit that captures the composition of an ionic compound in the solid state is the formula unit.

10. Which set of quantum numbers describes electron orbitals, and what does each indicate?

A. n, l, m_s, m_l; energy level, subshell shape, orbital orientation, and electron spin.

B. k, l, m_l, s; energy level, subshell shape, orbital orientation, and spin.

C. n, l, m_l, m_s; energy level, subshell shape, orbital orientation, and electron spin.

D. n, l, m_l; energy level, subshell shape, and orbital orientation.

The four quantum numbers n, l, m_l, m_s specify an electron's state in an atom. n determines the energy level and roughly the size of the orbital. l identifies the subshell type and the orbital's shape (0 for s, 1 for p, 2 for d, 3 for f). m_l gives the orbital's orientation in space within that subshell, with values from -l to +l. m_s describes the electron's intrinsic spin direction, with possible values of +1/2 or -1/2. Together, these four numbers uniquely describe the orbital and the spin state of the electron. This set uses the standard symbols and order, corresponding to energy level, subshell shape, orbital orientation, and electron spin. Other options either replace n with an unfamiliar symbol, omit the spin quantum number, or position the spin value before the orbital orientation, which does not align with how these quantum numbers are defined.

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://chemistrycfe.examzify.com

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