CHEMISTRY CFE PRACTICE TEST (SAMPLE)

STUDY GUIDE



SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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Table of Contents

Copyright 1

Table of Contents 2

Introduction 3

How to Use This Guide 4

Questions 5

Answers 8

Explanations 10

Next Steps 15

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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.

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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!

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Questions

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1. Which rule states that electrons fill all empty orbitals in a subshell with parallel spins before pairing?

A. Hund's Rule

B. Aufbau Principle

C. Pauli Exclusion Principle

D. Heisenberg Uncertainty Principle

2. In the ideal gas law PV = nRT, what does V denote?

A. Temperature

B. Moles

C. Volume

D. Pressure

3. What defines a complex ion and what does a large formation constant (Kf) indicate regarding color changes?

A. A covalent molecule with no metal; large Kf indicates weak binding and no color changes.

B. A metal ion coordinated to ligands; large Kf indicates strong complex formation and often color changes.

C. A free ion in solution; large Kf indicates rapid hydrolysis.

D. A metal ion with no ligands; large Kf indicates colorless solution.

4. Planck's constant value?

A. 6.626 x 10^-34 Js

B. 3.00 x 10^8 m/s

C. 1.60 x 10^-19 C

D. 9.81 m/s^2

5. Magnesium is in group 2A; how many valence electrons does Mg have?

A. 2

B. 1

C. 8

D. 0

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6. The elements Boron, Silicon, Germanium, Arsenic, Antimony, and Tellurium belong to which category?

A. Noble Gases

B. Metals

C. Nonmetals

D. Metalloids

7. In a neutral atom, the number of electrons equals the number of what?

A. Neutrons

B. Mass number

C. Protons

D. Isotopes

8. What term describes a property that can be observed or measured without changing the substance?

A. Physical Property

B. Chemical Property

C. Physical Changes

D. Chemical Changes

9. At STP, one mole of any ideal gas occupies how many liters?

A. 24.0 L

B. 22.0 L

C. 22.4 L

D. 23.9 L

10. Compare Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.

A. Arrhenius acids donate H+ in water; Arrhenius bases donate OH-; Bronsted-Lowry acids donate H+ and Bronsted-Lowry bases accept H+; Lewis acids accept electron pairs; Lewis bases donate electron pairs.

B. Arrhenius acids donate H+ in water; Bronsted-Lowry acids donate H+; Lewis acids donate electron pairs.

C. Arrhenius acids donate OH-; Bronsted-Lowry acids donate H+; Lewis acids accept electrons.

D. Arrhenius acids donate H+ in water; Arrhenius bases donate OH-; Bronsted-Lowry acids donate H+; Bronsted-Lowry bases accept H+; Lewis acids accept electron pairs; Lewis bases donate electron pairs.

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Answers

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

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Explanations

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1. Which rule states that electrons fill all empty orbitals in a subshell with parallel spins before pairing?

A. Hund's Rule

B. Aufbau Principle

C. Pauli Exclusion Principle

D. Heisenberg Uncertainty Principle

Hund's Rule states that within a subshell with degenerate orbitals, electrons occupy empty orbitals singly with parallel spins before any pairing occurs. This maximizes the total spin and lowers the energy through exchange interactions, making the arrangement more stable. For example, in a p subshell with three orbitals, three electrons will first fill each orbital singly with the same spin before any pairing happens, so you'd have one electron in each of the three p orbitals. Only after those are occupied would electrons start to pair in the orbitals. This is exactly why configurations like 2p^3 place one electron in each of the three 2p orbitals with the same spin. The other rules describe different ideas: Aufbau explains the order of filling by energy, Pauli Exclusion says no two electrons can have the same set of quantum numbers, and the Heisenberg Uncertainty Principle concerns the limits of simultaneously knowing position and momentum. None of these specifically describe filling empty degenerate orbitals first with parallel spins—that distinction belongs to Hund's Rule.

2. In the ideal gas law PV = nRT, what does V denote?

A. Temperature

B. Moles

C. Volume

D. Pressure

V represents the volume—the space the gas occupies, i.e., the container's interior. In PV = nRT, P is pressure, n is number of moles, T is temperature, and R is the gas constant. Volume is what you change by resizing the container; it's measured in liters or cubic meters. If you increase V while keeping n and T fixed, the pressure must decrease to keep the equation balanced, and vice versa. Temperature, moles, and pressure are not what V stands for.

3. What defines a complex ion and what does a large formation constant (Kf) indicate regarding color changes?

A. A covalent molecule with no metal; large Kf indicates weak binding and no color changes.

B. A metal ion coordinated to ligands; large Kf indicates strong complex formation and often color changes.

C. A free ion in solution; large Kf indicates rapid hydrolysis.

D. A metal ion with no ligands; large Kf indicates colorless solution.

A complex ion is a metal ion that is coordinated to ligands, which donate electron pairs to the metal and form a coordinated assembly. The formation constant, Kf, tells how favorable that binding is; a large value means the equilibrium strongly favors the bound complex, so most of the dissolved species are the complex rather than the free metal ion. Binding often changes the metal's electronic environment, altering the energies of the transitions that light can undergo (such as d–d or charge-transfer transitions), which leads to observable color changes in the solution. So a large Kf not only signals strong complex formation but also the likelihood of a noticeable color shift upon complexation. Without ligands, there's no complex, and hydrolysis or color implications aren't captured by Kf for complex formation, which is why the described scenario centers on a metal ion coordinated to ligands and a strong, color-affecting complex formation.

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4. Planck's constant value?

A. 6.626 x 10^-34 Js

B. 3.00 x 10^8 m/s

C. 1.60 x 10^-19 C

D. 9.81 m/s^2

Planck's constant sets the scale for quantum action and links energy to frequency through E = h f. Its value is about 6.626 × 10^-34 joule-seconds, which is why energies of photons are quantized in discrete multiples of h times the frequency. The units, joule-seconds, fit energy times time, matching how frequency (per second) combines with h to give energy. The other numbers are different constants: the speed of light, the elementary charge, and Earth's gravity. So the value that represents Planck's constant is 6.626 × 10^-34 J·s.

5. Magnesium is in group 2A; how many valence electrons does Mg have?

A. 2

B. 1

C. 8

D. 0

Valence electrons are the electrons in the outermost shell that participate in bonding. For main-group elements, their number equals the group number. Magnesium is in group 2A, and its electron configuration is [Ne] 3s^2, so the outermost shell has two electrons. That means magnesium has two valence electrons. This also explains why Mg typically loses two electrons to form Mg2+. The other options describe an incorrect outer-shell situation: one would imply only one outer electron, eight would indicate a full octet like a noble gas, and zero would mean no valence electrons at all.

6. The elements Boron, Silicon, Germanium, Arsenic, Antimony, and Tellurium belong to which category?

A. Noble Gases

B. Metals

C. Nonmetals

D. Metalloids

Metalloids are elements with properties between metals and nonmetals, sitting along the staircase boundary on the periodic table. The elements Boron, Silicon, Germanium, Arsenic, Antimony, and Tellurium lie right on that boundary, so they share that mixed character. Their hallmark is semiconducting behavior: they conduct electricity better than nonmetals but not as well as metals, and their conductivity can be tuned by temperature or by adding small amounts of impurities. This blend of traits—brittle solids with some metallic character and reliable, controllable conductivity—fits the metalloid category. Noble gases are inert and gaseous, which doesn't match these elements' solid, semi-metallic behavior. Ordinary metals are typically malleable and highly conductive, unlike these borderline elements. Nonmetals lack the semiconducting properties and mixed character these elements exhibit.

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7. In a neutral atom, the number of electrons equals the number of what?

A. Neutrons

B. Mass number

C. Protons

D. Isotopes

In a neutral atom, charges must balance so the net charge is zero. Protons in the nucleus carry a positive charge, and electrons surrounding the nucleus carry an equal amount of negative charge. For the atom to be neutral, the numbers must match, so the number of electrons equals the number of protons. Neutrons don't affect charge, so they don't determine neutrality. The mass number (protons plus neutrons) isn't the same as the number of electrons, and isotopes differ in neutron count rather than electron count, keeping the electron number equal to the proton number in a neutral atom.

8. What term describes a property that can be observed or measured without changing the substance?

A. Physical Property

B. Chemical Property

C. Physical Changes

D. Chemical Changes

Physical properties are characteristics you can observe or measure without altering the substance's chemical identity. This includes attributes like color, density, melting point, boiling point, and hardness. Because these measurements do not involve forming a new substance, the material remains unchanged. In contrast, chemical properties involve how a substance behaves in reactions and would change its composition (for example, flammability or tendency to rust). So, the term that describes a property you can observe or measure without changing the substance is a physical property.

9. At STP, one mole of any ideal gas occupies how many liters?

A. 24.0 L

B. 22.0 L

C. 22.4 L

D. 23.9 L

The idea here is the fixed molar volume of an ideal gas under standard conditions. Use PV = nRT with one mole at STP, where P is 1 atm and T is 273.15 K. Taking R as 0.0821 L·atm/(mol·K), the volume V is (1)(0.0821)(273.15)/1 ≈ 22.41 L, which rounds to about 22.4 L. So one mole of an ideal gas at STP occupies 22.4 liters. The other numbers reflect different conditions (for example, around room temperature the molar volume is closer to 24 L), so they don't apply to STP.

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10. Compare Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.

A. Arrhenius acids donate H+ in water; Arrhenius bases donate OH-; Bronsted-Lowry acids donate H+ and Bronsted-Lowry bases accept H+; Lewis acids accept electron pairs; Lewis bases donate electron pairs.

B. Arrhenius acids donate H+ in water; Bronsted-Lowry acids donate H+; Lewis acids donate electron pairs.

C. Arrhenius acids donate OH-; Bronsted-Lowry acids donate H+; Lewis acids accept electrons.

D. Arrhenius acids donate H+ in water; Arrhenius bases donate OH-; Bronsted-Lowry acids donate H+; Bronsted-Lowry bases accept H+; Lewis acids accept electron pairs; Lewis bases donate electron pairs.

Start from how each definition views what makes an acid or a base. Arrhenius sticks to solutions: acids produce H+ (often as H3O+) in water, and bases produce OH- in water. Bronsted-Lowry widens this to proton transfer: an acid donates a proton, a base accepts a proton, regardless of solvent. Lewis goes even broader: acids accept electron pairs, bases donate electron pairs. The statement captures all three ideas correctly: Arrhenius acids donate H+ in water; Arrhenius bases donate OH-; Bronsted-Lowry acids donate H+; Bronsted-Lowry bases accept H+; Lewis acids accept electron pairs; Lewis bases donate electron pairs. It also meshes with real examples—HCl in water is an Arrhenius and Bronsted-Lowry acid; NH3 can act as a Bronsted-Lowry base and a Lewis base by donating a lone pair; BF3 is a classic Lewis acid by accepting an electron pair. Other options misstate or omit aspects, such as restricting Arrhenius to water in more general contexts or switching the roles of Lewis acids and bases.

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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!

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