

PCC Chemistry Competency 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

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- 1. Which term describes an ion with a positive charge?**
 - A. Cation**
 - B. Anion**
 - C. Ionic Compound**
 - D. Physical Property**
- 2. The Balmer series for hydrogen produces spectral lines in which region of the electromagnetic spectrum?**
 - A. Ultraviolet**
 - B. Visible**
 - C. Infrared**
 - D. X-ray**
- 3. In a neutral atom, what is the relationship between the numbers of electrons and protons?**
 - A. # Electrons > # Protons**
 - B. # Electrons < # Protons**
 - C. # Electrons = # Protons**
 - D. # Electrons = # Neutrons**
- 4. In the MnO_4^- half-reaction MnO_4^- gains electrons. Which species is reduced in this half-reaction?**
 - A. MnO_4^-**
 - B. H_2O**
 - C. OH^-**
 - D. MnO_2**
- 5. In the balanced redox example, what is the oxidation half-reaction?**
 - A. $\text{MnO}_4^- + 8 \text{H}^+ + 5 \text{e}^- \rightarrow \text{Mn}^{2+} + 4 \text{H}_2\text{O}$**
 - B. $\text{CO}_2 \rightarrow \text{CO}_3^{2-} + \text{e}^-$**
 - C. $\text{C}_2\text{O}_4^{2-} \rightarrow 2 \text{CO}_2 + 2 \text{e}^-$**
 - D. $\text{MnO}_4^- \rightarrow \text{Mn}^{2+} + 5 \text{e}^-$**

- 6. What is the SI unit for length?**
- A. Kilogram (kg)**
 - B. Meter (m)**
 - C. Liter (L)**
 - D. Second (s)**
- 7. A compound is defined as**
- A. Two or more elements bound together with the same ratio of atoms**
 - B. A mixture of elements**
 - C. A molecule of two identical atoms only**
 - D. An element alone**
- 8. What is the hybridization of the central atom in CH₄, and how is it related to its molecular geometry?**
- A. sp² hybridization; trigonal planar.**
 - B. sp³ hybridization; tetrahedral geometry with bond angles about 109.5°.**
 - C. sp hybridization; linear.**
 - D. d²sp³ hybridization; distorted geometry.**
- 9. What term describes closeness of two or more measurements to each other?**
- A. Precision**
 - B. Accuracy**
 - C. Length**
 - D. Ionic Compound**
- 10. Mass Number is defined as what?**
- A. Number of electrons in the outer shell**
 - B. Number of protons in the nucleus**
 - C. Sum of protons and neutrons in the nucleus**
 - D. Total number of electrons in the atom**

Answers

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

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Explanations

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1. Which term describes an ion with a positive charge?

- A. Cation**
- B. Anion**
- C. Ionic Compound**
- D. Physical Property**

A positive-charged ion is called a cation. This happens when an atom loses one or more electrons, leaving more protons than electrons and giving the ion an overall positive charge. For example, Na^+ or Al^{3+} are cations. Anions are the opposite: negatively charged ions formed when atoms gain electrons, such as Cl^- . An ionic compound is a substance made of a lattice of cations and anions together, not a single ion. A physical property is a trait like color or melting point, not an ion's charge. So the term that describes an ion with a positive charge is cation.

2. The Balmer series for hydrogen produces spectral lines in which region of the electromagnetic spectrum?

- A. Ultraviolet**
- B. Visible**
- C. Infrared**
- D. X-ray**

When electrons drop to the $n = 2$ level, the photons emitted have energies that place them in the visible part of the spectrum. The Balmer series specifically involves transitions from higher levels ($n = 3, 4, 5, \dots$) down to $n = 2$. Those energy gaps produce wavelengths roughly in the 400-700 nm range, which we see as visible light (for example, H-alpha at about 656 nm and H-beta at about 486 nm). In contrast, transitions to the ground state ($n = 1$) lie in ultraviolet, and transitions to $n = 3$ fall in the infrared, which is why those series appear in those other regions.

3. In a neutral atom, what is the relationship between the numbers of electrons and protons?

- A. # Electrons > # Protons**
- B. # Electrons < # Protons**
- C. # Electrons = # Protons**
- D. # Electrons = # Neutrons**

In a neutral atom, the numbers of electrons and protons are equal. This keeps the overall charge at zero because protons are positively charged and electrons are negatively charged, and the charges cancel each other out when their counts match. Neutrons don't affect charge, so they don't influence this balance. If there were more electrons than protons, the atom would be negatively charged; if there were more protons than electrons, it would be positively charged. Thus, equality between electrons and protons is the condition for neutrality.

4. In the MnO_4^- half-reaction MnO_4^- gains electrons. Which species is reduced in this half-reaction?

A. MnO_4^-

B. H_2O

C. OH^-

D. MnO_2

In a redox half-reaction, reduction means gaining electrons, which lowers the oxidation state of the element involved. Here, the permanganate ion (MnO_4^-) is the species that gains electrons, so it is the one being reduced. Its manganese center drops from a high oxidation state (+7) to a lower state (commonly +2 in acidic solution, or +4 to MnO_2 in basic conditions). The other species listed don't gain electrons in this half-reaction; they may participate as protons, water, or hydroxide to balance the equation, but the actual reduction is occurring on MnO_4^- .

5. In the balanced redox example, what is the oxidation half-reaction?

A. $\text{MnO}_4^- + 8 \text{H}^+ + 5 \text{e}^- \rightarrow \text{Mn}^{2+} + 4 \text{H}_2\text{O}$

B. $\text{CO}_2 \rightarrow \text{CO}_3^{2-} + \text{e}^-$

C. $\text{C}_2\text{O}_4^{2-} \rightarrow 2 \text{CO}_2 + 2 \text{e}^-$

D. $\text{MnO}_4^- \rightarrow \text{Mn}^{2+} + 5 \text{e}^-$

The main idea is to identify the half-reaction that releases electrons. In a redox balancing process, the oxidation half shows a species losing electrons, so its oxidation state must increase. Here, the oxidation occurs when oxalate ($\text{C}_2\text{O}_4^{2-}$) is converted to carbon dioxide (CO_2). The carbon atoms go from an oxidation state of +3 in $\text{C}_2\text{O}_4^{2-}$ to +4 in CO_2 , which is an increase, meaning electrons are released. That half-reaction is written with electrons on the product side: $\text{C}_2\text{O}_4^{2-} \rightarrow 2 \text{CO}_2 + 2 \text{e}^-$. It shows two electrons produced, consistent with the oxidation of oxalate. The other options don't fit as the oxidation half: one shows a species gaining electrons (reduction), another would imply no change in oxidation state, and another depicts oxidation of permanganate in a way that isn't the oxidation half for this balance.

6. What is the SI unit for length?

A. Kilogram (kg)

B. Meter (m)

C. Liter (L)

D. Second (s)

Length is measured in the SI system using the meter. The meter is the standard reference for distance, defined in modern terms by the speed of light in a vacuum. Kilogram measures mass, not length; second measures time; liter measures volume (not a base SI unit for length). Because the question asks for the SI unit of length, the meter is the correct choice.

7. A compound is defined as

- A. Two or more elements bound together with the same ratio of atoms**
- B. A mixture of elements**
- C. A molecule of two identical atoms only**
- D. An element alone**

A compound is formed when two or more elements are chemically bound in a fixed ratio of atoms. This definite combination gives a substance with properties different from its constituent elements, and you can't change the composition without breaking bonds or creating a different compound. For example, water is built from hydrogen and oxygen in a 2:1 ratio and their atoms are chemically bonded, so it's a compound. The other ideas don't fit as well: a mixture of elements is just physically combined and can vary in composition, with no chemical bonds forming a new substance; a molecule made of two identical atoms is a diatomic molecule of one element, not a compound; and an element alone is a pure substance consisting of only one type of atom, not a combination of different elements.

8. What is the hybridization of the central atom in CH₄, and how is it related to its molecular geometry?

- A. sp² hybridization; trigonal planar.**
- B. sp³ hybridization; tetrahedral geometry with bond angles about 109.5°.**
- C. sp hybridization; linear.**
- D. d²sp³ hybridization; distorted geometry.**

The central carbon in CH₄ uses sp³ hybridization. This comes from mixing one 2s orbital with the three 2p orbitals to create four equivalent sp³ hybrids. Each sp³ hybrid forms a sigma bond with a hydrogen 1s orbital, giving four C-H bonds. Since there are four regions of electron density and no lone pairs on carbon, the electron-pair geometry is tetrahedral, which fixes the molecular geometry to a tetrahedral shape with bond angles of about 109.5°. The other descriptions would imply fewer regions of electron density or an unusual hybridization that doesn't match methane's symmetrical, four-bond structure.

9. What term describes closeness of two or more measurements to each other?

- A. Precision**
- B. Accuracy**
- C. Length**
- D. Ionic Compound**

Precision is the degree to which repeated measurements yield the same result. When several measurements of the same quantity come out very close to each other, they are precise, even if they aren't hitting the exact true value. For example, weighing the same object multiple times might give 2.00 g, 2.01 g, and 2.02 g, which shows high precision because the results cluster together. Accuracy, by contrast, refers to how close those measurements are to the true value. The other options don't describe this idea: length is just a measurement, not a measure of repeatability, and an ionic compound is a chemical substance, not a measurement concept.

10. Mass Number is defined as what?

- A. Number of electrons in the outer shell**
- B. Number of protons in the nucleus**
- C. Sum of protons and neutrons in the nucleus**
- D. Total number of electrons in the atom**

Mass number is the total count of nucleons in the nucleus, which means the sum of protons and neutrons. This number identifies the isotope of an element, since protons determine the element's identity (atomic number) while neutrons can vary, changing the mass number. The correct description is the one that states protons plus neutrons in the nucleus. For example, carbon-12 has 6 protons and 6 neutrons (mass number 12), whereas carbon-14 has 6 protons and 8 neutrons (mass number 14). The other statements describe electrons or just protons, which do not account for the mass contributed by neutrons in the nucleus.

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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://pccchemcompetency.examzify.com>

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

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