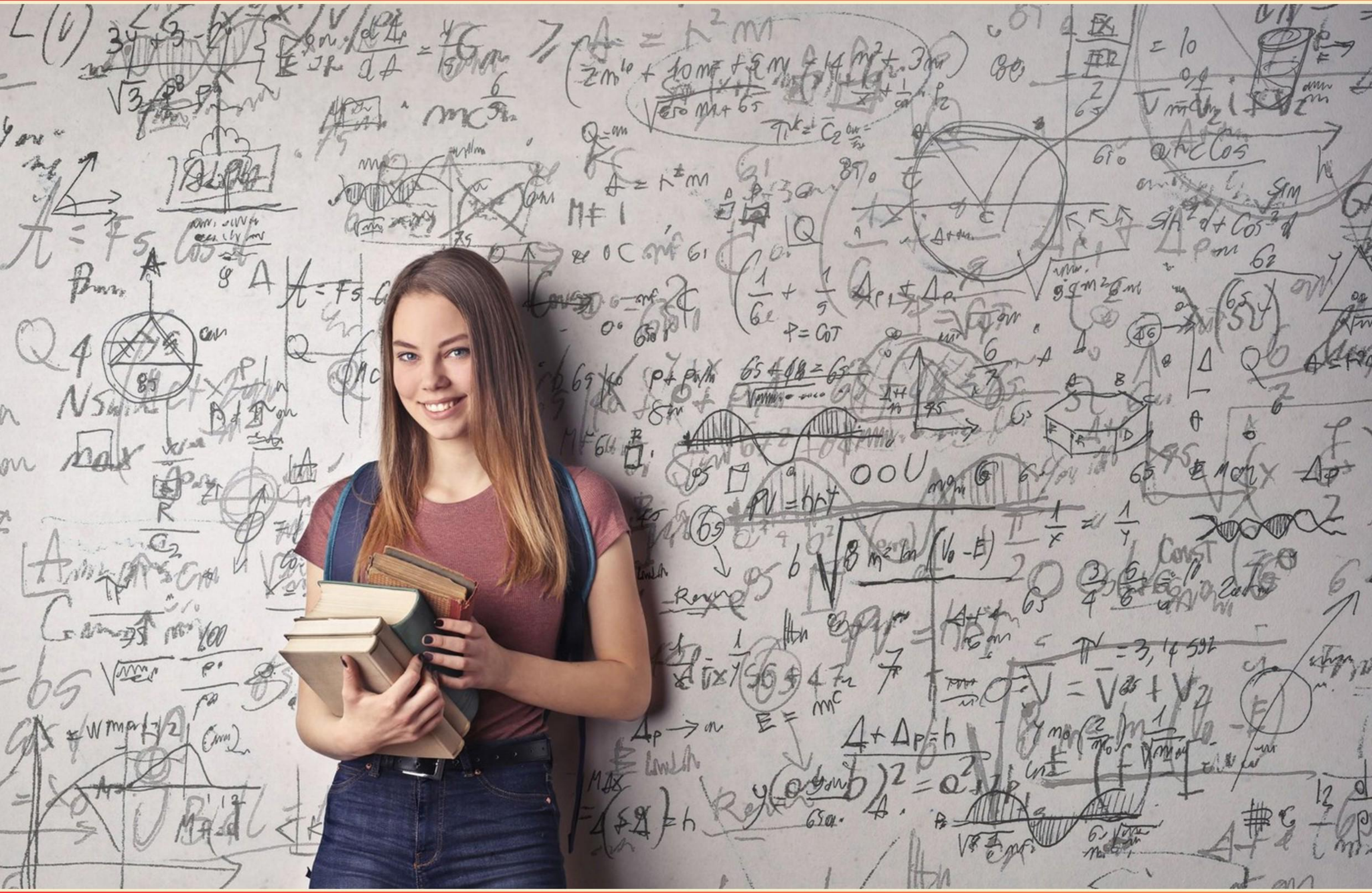
PCC CHEMISTRY COMPETENCY PRACTICE EXAM (SAMPLE)

STUDY GUIDE



SAMPLE STUDY GUIDE WITH LIMITED QUESTIONS

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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. **In a galvanic cell using Zn2+/Zn and Cu2+/Cu with standard reduction potentials E°(Zn2+/Zn) = -0.76 V and E°(Cu2+/Cu) = +0.34 V, what are E°cell and which metal serves as the anode and cathode?**
   A. E°cell = 1.10 V; Anode: Cu; Cathode: Zn
   B. E°cell = -1.10 V; Anode: Zn; Cathode: Cu
   C. E°cell = 1.34 V; Anode: Cu; Cathode: Zn
   D. E°cell = 1.10 V; Anode: Zn; Cathode: Cu

2. **Gamma rays are more penetrating than alpha or beta particles because which of the following is true?**
   A. They carry charge and interact strongly with matter; require dense shielding.
   B. They are high-energy photons with no charge; require dense shielding such as lead or concrete.
   C. They are slowed by magnetic fields, unlike alpha.
   D. They are charged and deflect easily in air.

3. **What does BE stand for in the formal charge formula?**
   A. Bond energy of covalent bonds
   B. Bond energy used in calculating bond energies
   C. Electrons shared in ionic bonds
   D. Electrons shared in covalent bonds

4. **What is the net ionic equation for the precipitation reaction when BaCl2 and Na2SO4 are mixed in aqueous solution?**
   A. Ba2+ + 2Cl−   BaCl2(aq)
   B. BaSO4(s) precipitates directly from Ba2+ and SO4^2−
   C. Ba2+ + SO4^2−   BaSO4(s)
   D. Na+ + Cl−   NaCl

5. **Using VSEPR theory, what is the molecular geometry for a molecule with the formula AX2E2 (two bonding pairs and two lone pairs on the central atom)?**
   A. Bent (angular), approximately 104.5°.
   B. Linear, 180°.
   C. Trigonal planar, 120°.
   D. Tetrahedral, 109.5°.

6. Gas solubility in water generally changes with temperature in which way, and which law or concept is often invoked to explain gas solubility?

A. Gas solubility decreases with increasing temperature; Henry's law explains gas solubility.

B. Gas solubility increases with increasing temperature; Henry's law explains gas solubility.

C. Gas solubility is independent of temperature; Le Chatelier's principle explains gas solubility.

D. Gas solubility decreases with temperature; Charles's law explains gas solubility.

7. Why is the mole a useful counting unit?

A. It equals Avogadro's number of particles

B. It equals exactly 1 gram

C. It equals exactly 1 liter

D. It equals 12 particles

8. Which of the following correctly distinguishes ionic bonding from covalent bonding and gives two characteristic properties of each type?

A. Ionic bonding involves electron transfer and electrostatic attraction; covalent bonding involves electron sharing; Ionic: high melting points; conducts electricity when melted or dissolved. Covalent: lower melting points; poor conductors.

B. Ionic bonds share electrons; Covalent involves transfer; both have high melting points.

C. Ionic bonds form molecules; Covalent bonds form lattices; only ionic conduct electricity in solid state.

D. Both are identical; no difference.

9. Which of the following statements correctly describes Mn2+ color in aqueous solution?

A. Mn2+ is purple

B. Mn2+ is colorless

C. Mn2+ is pale pink

D. Mn2+ is blue

10. In which block of the periodic table do elements with partially filled d orbitals reside, and where are the noble gases located?

A. d-block; noble gases are in the s-block

B. p-block; noble gases are in the p-block

C. d-block; noble gases are located in the p-block

D. f-block; noble gases are in the p-block

Answers

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

Explanations

1. **In a galvanic cell using Zn2+/Zn and Cu2+/Cu with standard reduction potentials E°(Zn2+/Zn) = -0.76 V and E°(Cu2+/Cu) = +0.34 V, what are E°cell and which metal serves as the anode and cathode?**

   A. E°cell = 1.10 V; Anode: Cu; Cathode: Zn

   B. E°cell = -1.10 V; Anode: Zn; Cathode: Cu

   C. E°cell = 1.34 V; Anode: Cu; Cathode: Zn

   D. E°cell = 1.10 V; Anode: Zn; Cathode: Cu

In a galvanic cell, the substance with the higher reduction potential gets reduced at the cathode, while the other is oxidized at the anode. Here, copper has the higher reduction potential (+0.34 V) compared with zinc (-0.76 V). So Cu2+ will gain electrons at the cathode, and Zn will lose electrons at the anode. Calculate the standard cell potential using E°cell = E°cathode − E°anode: 0.34 − (−0.76) = +1.10 V. A positive value means a spontaneous, favorable reaction in this arrangement. Therefore, the anode is zinc and the cathode is copper, giving the overall reaction Zn + Cu2+   Zn2+ + Cu.

2. **Gamma rays are more penetrating than alpha or beta particles because which of the following is true?**

   A. They carry charge and interact strongly with matter; require dense shielding.

   B. They are high-energy photons with no charge; require dense shielding such as lead or concrete.

   C. They are slowed by magnetic fields, unlike alpha.

   D. They are charged and deflect easily in air.

Gamma rays are uncharged, high-energy photons. Because they have no electric charge, they don't interact with matter by electric forces the way charged particles do, so they pass through many materials with little attenuation. Their energy is removed mainly through photon-matter interactions—photoelectric effect, Compton scattering, and, at higher energies, pair production—which depend on the material's density and atomic number. Dense shielding like lead or concrete increases the likelihood of these interactions and thus reduces the gamma-ray beam. That's why gamma radiation requires thick, dense shielding. The other ideas—gamma rays carrying charge and interacting strongly, being slowed by magnetic fields, or deflected easily in air—don't fit because gamma rays have no charge, magnetic fields don't slow them, and they're not easily deflected in air.

3. **What does BE stand for in the formal charge formula?**

   A. Bond energy of covalent bonds

   B. Bond energy used in calculating bond energies

   C. Electrons shared in ionic bonds

   D. Electrons shared in covalent bonds

The main idea is understanding what BE stands for in the formal charge formula. BE means bonding electrons—the electrons that participate in covalent bonds and are shared between atoms. In the formal charge calculation, you count half of BE because each bond is shared, so each atom effectively owns one of the two electrons in that bond. For a single covalent bond, BE is 2 electrons, and you assign 1 electron to each atom's bond count. Ionic bonds don't involve sharing electrons, so they don't contribute to BE in this context. That's why BE specifically refers to electrons shared in covalent bonds, not bond energy or electrons shared in ionic bonds.

4. What is the net ionic equation for the precipitation reaction when BaCl2 and Na2SO4 are mixed in aqueous solution?

A. Ba2+ + 2Cl−   BaCl2(aq)

B. BaSO4(s) precipitates directly from Ba2+ and SO4^2−

C. Ba2+ + SO4^2−   BaSO4(s)

D. Na+ + Cl−   NaCl

When two aqueous solutions react to form a solid, the net ionic equation keeps only the ions that actually form the precipitate and removes the spectator ions that don't participate in the solid formation. Here, BaCl2 provides Ba2+ and Cl−, while Na2SO4 provides Na+ and SO4^2−. The sulfate ion and the barium ion combine to make BaSO4, which is insoluble and precipitates. The sodium and chloride ions remain in solution and do not take part in the solid formation, so they're removed in the net ionic form. Thus the net ionic equation is Ba2+ + SO4^2− BaSO4(s).

5. Using VSEPR theory, what is the molecular geometry for a molecule with the formula AX2E2 (two bonding pairs and two lone pairs on the central atom)?

A. Bent (angular), approximately 104.5°.

B. Linear, 180°.

C. Trigonal planar, 120°.

D. Tetrahedral, 109.5°.

The main idea here is how lone pairs influence molecular shape in VSEPR theory. With four electron domains around the central atom, the electron-domain geometry is tetrahedral, but two of those domains are lone pairs. The two bonding pairs occupy positions that minimize repulsion, resulting in a bent (angular) molecular geometry. The presence of lone pairs pushes the bonds closer together, lowering the bond angle from the tetrahedral 109.5° to about 104.5°, a pattern seen in water. The other shapes correspond to different counts of bonding vs lone pairs: two bonds with no lone pairs would be linear (180°), three bonds with no lone pairs would be trigonal planar (120°), and four bonds with no lone pairs would be tetrahedral (109.5°).

6. Gas solubility in water generally changes with temperature in which way, and which law or concept is often invoked to explain gas solubility?

A. Gas solubility decreases with increasing temperature; Henry's law explains gas solubility.

B. Gas solubility increases with increasing temperature; Henry's law explains gas solubility.

C. Gas solubility is independent of temperature; Le Chatelier's principle explains gas solubility.

D. Gas solubility decreases with temperature; Charles's law explains gas solubility.

Gas solubility in water is governed by Henry's law, which says the amount of gas dissolved in a liquid is proportional to the gas's partial pressure above the liquid. The temperature dependence comes from how the dissolution process behaves energetically: for most gases, dissolving them in water is exothermic, so heating the system supplies energy that favors the gas leaving the solution and returning to the gas phase. As temperature goes up, the dissolved amount at a given partial pressure drops. That's why solubility decreases with increasing temperature. The other ideas don't fit the typical behavior: claiming solubility increases with temperature contradicts the common exothermic dissolution trend; Le Chatelier's principle is a general rule about shifts in equilibrium but doesn't specify the exact quantitative relation for gas dissolution; Charles's law relates a gas's volume to temperature at constant pressure and isn't about how much gas stays dissolved in a liquid.

7. Why is the mole a useful counting unit?

A. It equals Avogadro's number of particles

B. It equals exactly 1 gram

C. It equals exactly 1 liter

D. It equals 12 particles

The main idea is that the mole provides a practical way to count particles by linking a fixed number of them to a macroscopic amount we can weigh. One mole contains Avogadro's number of particles, about 6.022 × 10^23. With this fixed count, the amount of substance we have in grams (using the molar mass in g/mol) directly tells us how many particles are present: mass in grams divided by molar mass in g/mol gives moles, and moles multiplied by the molar mass gives mass. This creates a consistent bridge between the tiny world of atoms and the measurements we can make in the lab, so a mole of carbon has the same number of particles as a mole of any other substance, even though their masses are different. The other options don't fix a particle count: a gram is a mass, a liter is a volume, and twelve particles is an arbitrary small number.

8. Which of the following correctly distinguishes ionic bonding from covalent bonding and gives two characteristic properties of each type?

A. Ionic bonding involves electron transfer and electrostatic attraction; covalent bonding involves electron sharing; Ionic: high melting points; conducts electricity when melted or dissolved. Covalent: lower melting points; poor conductors.

B. Ionic bonds share electrons; Covalent involves transfer; both have high melting points.

C. Ionic bonds form molecules; Covalent bonds form lattices; only ionic conduct electricity in solid state.

D. Both are identical; no difference.

The key idea is how electrons are arranged and how that affects structure and properties. Ionic bonding comes from electrons being transferred from a metal atom to a nonmetal, creating oppositely charged ions that attract each other strongly and form a lattice. Covalent bonding comes from sharing electrons between atoms, creating molecules (or network structures) held together by those shared electrons. That distinction helps explain the properties chosen. Ionic compounds have high melting (and boiling) points because the electrostatic forces between the many ions in the lattice are very strong, so a lot of energy is needed to break the lattice. They conduct electricity when melted or dissolved because the ions are free to move and carry charge. Covalent compounds, on the other hand, generally have lower melting points since the forces between molecules are weaker than the ionic lattice, and they are poor conductors because neutral molecules don't provide free charge carriers. Why the other statements don't fit: mixing up electron transfer with sharing gets the bonding picture wrong, and assigning high melting points to covalent bonds isn't generally true. Saying ionic compounds only conduct electricity in the solid state is incorrect (they conduct when molten or dissolved), and claiming covalent bonds form lattices or that both types are identical misses the fundamental differences in bonding and behavior.

9. Which of the following statements correctly describes Mn2+ color in aqueous solution?

A. Mn2+ is purple

B. Mn2+ is colorless

C. Mn2+ is pale pink

D. Mn2+ is blue

Colors of transition-metal ions in aqueous solution come from electronic transitions between d-orbitals that are split by the water ligand field. For Mn2+ in water, the ion forms an aqua complex with a d5 configuration in an octahedral-like field. The five d electrons are arranged with parallel spins (high spin), and the d–d transitions are both spin-forbidden and Laporte-forbidden, so the chances of absorbing visible light are very small. Because only a tiny amount of light is absorbed, the solution looks almost colorless, but there is a faint absorption in the red part of the spectrum. The leftover transmitted light gives the solution a pale pink tint, which is the observed color for Mn2+ in aqueous solution. This weak coloration contrasts with other metal ions that have stronger, more noticeable colors due to more allowed transitions.

10. In which block of the periodic table do elements with partially filled d orbitals reside, and where are the noble gases located?

A. d-block; noble gases are in the s-block

B. p-block; noble gases are in the p-block

C. d-block; noble gases are located in the p-block

D. f-block; noble gases are in the p-block

This question tests how blocks on the periodic table map to the subshell being filled by valence electrons. Elements with partially filled d orbitals are in the d-block because their outer electrons occupy the d subshell, which is the hallmark of transition metals. Noble gases have a complete outer p subshell, so they sit in the p-block. Therefore, the described pairing is that the d-block contains elements with partially filled d orbitals, and the noble gases are located in the p-block. (Note that helium is sometimes shown with the s-block in some diagrams, but the general placement for noble gases is the p-block.)

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!