ACS ORGANIC CHEMISTRY PRACTICE TEST (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.

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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. A neutral atom with 12 protons and 12 electrons has what electric charge?

A. Positive

B. Negative

C. Double positive

D. No charge

2. What are the units for the specific heat capacity?

A. joules per degree Celsius

B. joules per gram

C. joules per gram per degree Celsius

D. calories per gram per degree Celsius

3. The reactivity order for nucleophilic acyl substitution is acid chloride > anhydride > ester > amide. True or false?

A. False

B. Not enough information

C. True

D. Depends on nucleophile

4. What does VSEPR stand for?

A. Valence Shell Electron Pair Repulsion

B. Valence Shell Electron Pair Rotation

C. Vacant Shell Electron Pair Repulsion

D. Valence Shell Energy Pair Repulsion

5. Reaction of a Grignard reagent with an epoxide yields what type of product?

A. Aldehyde

B. Extended alcohol after workup

C. Ketone

D. Vicinal diol

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6. Among halide leaving groups in substitution reactions, which is the best leaving group?

A. I- (best leaving group).

B. Br-

C. F-

D. Cl-

7. PBr3 converts alcohols to which product?

A. Alkyl chlorides

B. Alkyl bromides

C. Alkenes

D. Alcohols

8. Fischer esterification requires which two substrates and catalyst?

A. Alcohol and an aldehyde with base

B. Carboxylic acid and an alcohol with an acid catalyst

C. Ester and carboxylic acid with base

D. Amide and alcohol with acid catalyst

9. The hydration of a terminal alkyne with HgSO4/H2SO4 furnishes what product?

A. Aldehyde

B. Methyl ketone

C. Alcohol

D. Carboxylic acid

10. Which statement is NOT true about significant figures?

A. Zeros to the left of the first nonzero digit are significant.

B. Trailing zeros to the decimal are significant.

C. Zeros at the end of a number with a decimal point are never significant.

D. The number of sig figs in a product equals the least number of sig figs.

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Answers

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

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Explanations

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1. A neutral atom with 12 protons and 12 electrons has what electric charge?

A. Positive

B. Negative

C. Double positive

D. No charge

Electric charge is the sum of the charges of all the particles in the atom. Protons carry a +1 charge and electrons carry a -1 charge, while neutrons are neutral. With 12 protons and 12 electrons, the positive charges (+12) cancel the negative charges (-12), giving a net charge of zero. Neutrons don't affect the charge, so the atom is electrically neutral. If there were more protons than electrons, it would be positively charged; more electrons would make it negatively charged.

2. What are the units for the specific heat capacity?

A. joules per degree Celsius

B. joules per gram

C. joules per gram per degree Celsius

D. calories per gram per degree Celsius

Specific heat capacity is defined as the amount of energy required to raise the temperature of a given mass by a certain amount. To express that, the unit must include energy, mass, and temperature change. Using joules for energy, grams for mass, and degrees Celsius for the temperature change gives the unit joules per gram per degree Celsius (J/(g·°C)). This is the standard SI form, and since a degree Celsius and a kelvin have the same size, you can also write it as J/(g·K). The other options miss one of those pieces or use a different energy unit. For example, a unit without mass or without a temperature change isn't appropriate, and using calories changes the system unless you're specifically working in non-SI units.

3. The reactivity order for nucleophilic acyl substitution is acid chloride > anhydride > ester > amide. True or false?

A. False

B. Not enough information

C. True

D. Depends on nucleophile

In nucleophilic acyl substitution, how fast a derivative reacts mainly depends on two factors: how electrophilic the carbonyl carbon is and how good the leaving group will be after substitution. Acid chlorides have the most electrophilic carbonyl and chloride is an excellent leaving group, so nucleophiles attack them the fastest. Anhydrides come next: they have a decently good leaving group (carboxylate) and their carbonyls are still highly activated, but not as much as acid chlorides. Esters are slower because the leaving group is an alkoxide, which is a poorer leaving group, and the carbonyl is less activated due to resonance with the OR group. Amides are the slowest since the nitrogen lone pair strongly donates into the carbonyl, greatly stabilizing it and reducing electrophilicity, and the potential leaving group (amide) is very poor. For common nucleophiles and typical conditions, this qualitative order—acid chloride > anhydride > ester > amide—holds true. The exact rates can vary with the nucleophile and conditions, but the trend is consistent.

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4. What does VSEPR stand for?

A. Valence Shell Electron Pair Repulsion

B. Valence Shell Electron Pair Rotation

C. Vacant Shell Electron Pair Repulsion

D. Valence Shell Energy Pair Repulsion

The main idea is that VSEPR describes how electron pairs around a central atom arrange themselves to minimize repulsion. The acronym stands for Valence Shell Electron Pair Repulsion: "Valence" refers to the valence electrons involved in bonding, "Shell" means the electron orbitals around the atom, and "Electron Pair Repulsion" captures the key rule—pairs of electrons (both bonding and lone pairs) push away from each other, leading to particular molecular geometries. The other options use terms that don't fit this idea (rotation instead of repulsion, vacant shell instead of valence shell, and energy pair instead of electron pair), so they don't describe the concept correctly.

5. Reaction of a Grignard reagent with an epoxide yields what type of product?

A. Aldehyde

B. Extended alcohol after workup

C. Ketone

D. Vicinal diol

Grignard reagents open epoxides through a straightforward SN2 type attack, acting as a strong nucleophile to attack the less substituted carbon of the three-membered ring. This ring opening yields an alkoxide on the more substituted carbon that is coordinated to MgX. When you perform the workup with acid, that alkoxide is protonated to give an alcohol. The carbon framework of the epoxide is thus extended by the Grignard's R group, producing an extended alcohol after workup. This is distinct from forming an aldehyde or ketone (which happens when a Grignard reacts with carbonyl compounds) or creating a vicinal diol (which would require different steps). So the product is an extended alcohol after workup.

6. Among halide leaving groups in substitution reactions, which is the best leaving group?

A. I- (best leaving group).

B. Br-

C. F-

D. Cl-

When a leaving group departs, its ability to do so depends on how stable the leaving group is as an anion. A good leaving group is the conjugate base of a strong acid and is not highly basic. Among halides, the iodide ion is the most stable and most polarizable anion. HI is a very strong acid, so I− is a very weak base. That weak basicity means the negative charge is better stabilized once the group leaves, allowing it to depart readily in substitution reactions. The carbon–iodine bond is also the weakest among the four, so breaking it requires less energy, further helping the leaving process. By comparison, fluoride forms a hard, highly basic F−, which is poorly stabilized, making it a poor leaving group; chloride and bromide are intermediate, with bromide better than chloride but not as good as iodide.

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7. PBr3 converts alcohols to which product?

A. Alkyl chlorides

B. Alkyl bromides

C. Alkenes

D. Alcohols

PBr3 substitutes the hydroxyl group on an alcohol with bromide. The alcohol oxygen coordinates to phosphorus, turning the poor leaving group (OH) into a much better leaving group as a phosphorate ester. Then bromide ion attacks the carbon bearing the oxygen in an SN2 step, displacing the phosphite and forming the alkyl bromide. The byproduct is phosphorous acid (H3PO3). This is a classic way to transform alcohols into alkyl bromides, especially for primary and secondary alcohols; it does not produce alkyl chlorides or alkenes under these conditions, and it does not keep the molecule as an alcohol. If the alcohol is chiral, the SN2 displacement also tends to invert the stereochemistry at that carbon.

8. Fischer esterification requires which two substrates and catalyst?

A. Alcohol and an aldehyde with base

B. Carboxylic acid and an alcohol with an acid catalyst

C. Ester and carboxylic acid with base

D. Amide and alcohol with acid catalyst

Fischer esterification is an acid-catalyzed condensation between a carboxylic acid and an alcohol to form an ester and water. The acid catalyst protonates the carbonyl oxygen of the carboxylic acid, making the carbonyl carbon more electrophilic so the alcohol can attack. After alcohol addition and proton transfers, the tetrahedral intermediate collapses and water is expelled, regenerating the acid catalyst and yielding the ester. This is why the substrates must be a carboxylic acid and an alcohol, not an aldehyde or an amide, and why an acid catalyst is required rather than a base. In practice, using an excess of alcohol and removing water helps drive the reaction toward ester formation.

9. The hydration of a terminal alkyne with HgSO4/H2SO4 furnishes what product?

A. Aldehyde

B. Methyl ketone

C. Alcohol

D. Carboxylic acid

Hydration of terminal alkynes with mercuric sulfate in acid is a mercury-catalyzed, Markovnikov addition of water across the triple bond that forms an enol, which then tautomerizes to a ketone. For a terminal alkyne of the form R-C CH, water adds so that the hydroxyl group attaches to the internal carbon (the one bonded to R) and the hydrogen adds to the terminal carbon. The resulting enol rapidly tautomerizes to the ketone with the carbonyl carbon bearing the R group and a methyl group on the other side, giving the product R-CO-CH3. That is a methyl ketone. (Note: when the alkyne is acetylene itself, the reaction gives acetaldehyde, but for a general terminal alkyne the product is a methyl ketone.)

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10. Which statement is NOT true about significant figures?

A. Zeros to the left of the first nonzero digit are significant.

B. Trailing zeros to the decimal are significant.

C. Zeros at the end of a number with a decimal point are never significant.

D. The number of sig figs in a product equals the least number of sig figs.

Significant figures convey how precise a measurement is, and zeros only count as significant based on where they appear. Nonzero digits are always significant. Leading zeros (before the first nonzero digit) do not count as significant because they only place the decimal. Zeros at the end of a decimal number are significant, since they reflect the precision of the measurement; for example, 12.300 has five significant figures. When you multiply or divide, the result should be reported with as many significant figures as the factor with the fewest sig figs. The statement that zeros at the end of a number with a decimal point are never significant is not true, because those zeros can be significant and indicate the measurement's precision.

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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://acsorganicchem.examzify.com

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

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