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.

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. For a conjugate acid-base pair, which relation is correct at a given temperature?

A. Ka × Kb = Kw

B. Ka × Kw = Kb

C. Ka / Kb = Kw

D. Ka + Kb = Kw

2. What does the Atomic Mass Number represent?

A. Number of protons

B. Number of neutrons

C. Number of protons and neutrons

D. Number of electrons

3. Swern oxidation of a primary alcohol yields which product?

A. Alcohol

B. Carboxylic acid

C. Aldehyde

D. Ketone

4. Molar mass, as a concept, is defined as which of the following?

A. The mass of a single atom in grams.

B. The mass of the solvent per mole.

C. The mass per mole, expressed as g/mol.

D. The volume per mole, expressed as L/mol.

5. What are the values for STP?

A. 0 Celsius and 1 atm

B. 25 Celsius and 1 atm

C. -273 Celsius and 1 atm

D. 0 Celsius and 0.5 atm

6. A carbanion stabilized by resonance or hyperconjugation: which is more stable, a benzylic carbanion or a standard alkyl carbanion?

A. A standard alkyl carbanion is more stable due to hyperconjugation.

B. They are equally stable.

C. A benzylic carbanion is less stable due to resonance.

D. A benzylic carbanion is more stable due to resonance.

7. What is the sum of oxidation numbers for a neutral compound?

A. -1

B. 2

C. 1

D. 0

8. The Malonic ester synthesis uses diethyl malonate to form what type of product after alkylation and decarboxylation?

A. Substituted acetic acids (R-CH2-COOH)

B. Primary alcohols

C. Aldehydes

D. Ketones

9. Which statement correctly describes ionic bonding?

A. Covalent bonding occurs between a metal and a nonmetal.

B. Ionic bonding occurs between a metal and a nonmetal, with electron transfer.

C. Ionic bonds involve sharing electrons between two nonmetals.

D. Hydrogen bonds are formed by attraction to a lone pair.

10. Hydroboration-oxidation of an alkene yields what type of alcohol and is Markovnikov or anti-Markovnikov?

A. Anti-Markovnikov alcohol (BH3 adds to less substituted carbon)

B. Markovnikov alcohol

C. Ketone

D. Ether

Answers

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

Explanations

1. For a conjugate acid-base pair, which relation is correct at a given temperature?

A. Ka × Kb = Kw

B. Ka × Kw = Kb

C. Ka / Kb = Kw

D. Ka + Kb = Kw

Relates to how acid and base constants for conjugate pairs multiply to the autoionization constant of water. For an acid HA, Ka = [H+][A-]/[HA]. For its conjugate base A-, Kb = [HA][OH-]/[A-]. Multiplying these two expressions gives Ka × Kb = ([H+][A-]/[HA]) × ([HA][OH-]/[A-]) = [H+][OH-] = Kw, the water ion-product at that temperature. So the correct relation is that the product of Ka and Kb equals Kw. This is temperature-dependent (Kw changes with temperature), and it also underpins the familiar pKa + pKb = pKw relationship. The other proposed relations don't follow from the definitions of Ka and Kb.

2. What does the Atomic Mass Number represent?

A. Number of protons

B. Number of neutrons

C. Number of protons and neutrons

D. Number of electrons

The mass number is the total count of nucleons in the nucleus, which means protons plus neutrons. It equals Z + N, where Z is the number of protons (defining the element) and N is the number of neutrons. Electrons don't contribute to this count because their mass is negligible and they sit outside the nucleus. Different isotopes have the same number of protons but different numbers of neutrons, giving different mass numbers. So the mass number represents protons plus neutrons.

3. Swern oxidation of a primary alcohol yields which product?

A. Alcohol

B. Carboxylic acid

C. Aldehyde

D. Ketone

Swern oxidation is a mild, non-aqueous method that converts primary alcohols to aldehydes. The oxidant is generated from dimethyl sulfoxide (DMSO) and oxalyl chloride under cold conditions with a base. This setup oxidizes the alcohol to an aldehyde and then, under these conditions, there isn't leftover oxidizing power or water to push the aldehyde further to a carboxylic acid. That's why a primary alcohol ends up as an aldehyde in Swern oxidation. For a secondary alcohol, the oxidation stops at a ketone, reflecting the difference in hydrogen removal at the two possible sites.

4. Molar mass, as a concept, is defined as which of the following?

A. The mass of a single atom in grams.

B. The mass of the solvent per mole.

C. The mass per mole, expressed as g/mol.

D. The volume per mole, expressed as L/mol.

The main idea is that molar mass is the mass of one mole of a substance, expressed in grams per mole. This ties microscopic masses to a macroscopic amount of material: you can take the number of moles and multiply by this mass to get the total grams you have. For a pure element, the molar mass in g/mol equals the atomic mass in atomic mass units (amu). For a compound, you add up the atomic masses of all atoms in the formula, accounting for how many of each atom are present (for example, water has a molar mass about 18.015 g/mol: 2 × 1.008 for hydrogen plus 16.00 for oxygen). It's not the mass of a single atom in grams, and it isn't the mass of solvent per mole or a volume per mole—that would be molar volume. Therefore, the correct definition is the mass per mole, expressed as g/mol.

5. What are the values for STP?

A. 0 Celsius and 1 atm

B. 25 Celsius and 1 atm

C. -273 Celsius and 1 atm

D. 0 Celsius and 0.5 atm

STP refers to the standard conditions used for gas calculations, defined as a temperature of 0°C (273.15 K) and a pressure of 1 atm. Under these conditions, an ideal gas has a molar volume of about 22.4 L per mole, which is a handy reference for gas-volume problems. Choosing 0°C and 1 atm matches that standard pairing. A temperature of 25°C with 1 atm is standard room conditions (often called RT) and gives a molar volume around 24.0 L per mole, not the STP value. A temperature of -273°C is absolute zero—particles cannot have a meaningful gas pressure there. A pressure of 0.5 atm is simply not the standard pressure used for STP. Some texts use 1 bar instead of 1 atm, which is close, but the classic STP definition is 0°C and 1 atm.

6. A carbanion stabilized by resonance or hyperconjugation: which is more stable, a benzylic carbanion or a standard alkyl carbanion?

A. A standard alkyl carbanion is more stable due to hyperconjugation.

B. They are equally stable.

C. A benzylic carbanion is less stable due to resonance.

D. A benzylic carbanion is more stable due to resonance.

Delocalization of negative charge makes a carbanion more stable. In a benzylic carbanion, the carbanionic center is next to a benzene ring, so the lone pair can overlap with the ring's pi system and the negative charge can be spread across the ring through resonance. This delocalization distributes electron density over several atoms, lowering the overall energy more effectively than any stabilization from hyperconjugation alone. A standard alkyl carbanion, by contrast, is stabilized only by hyperconjugation with adjacent C–H bonds and inductive effects, which are weaker. Hence the benzylic carbanion is more stable because resonance with the aromatic ring provides greater stabilization.

7. What is the sum of oxidation numbers for a neutral compound?

A. -1

B. 2

C. 1

D. 0

Oxidation numbers are bookkeeping charges assigned to atoms so that the total reflects the molecule's overall charge. In a neutral compound, there is no net charge, so the oxidation numbers must add up to zero. For example, in water, hydrogen is +1 on each hydrogen (total +2) and oxygen is -2, giving +2 + (-2) = 0. This same balance holds for any neutral molecule. If the species were an ion, the sum would equal that ion's charge, but for a neutral compound, the sum is zero.

8. The Malonic ester synthesis uses diethyl malonate to form what type of product after alkylation and decarboxylation?

A. Substituted acetic acids (R-CH_2-COOH)

B. Primary alcohols

C. Aldehydes

D. Ketones

Malonic ester synthesis builds a carbon chain by first making an enolate from an active methylene compound, then alkylating it, and finally hydrolyzing and decarboxylating to reveal a carboxylic acid with an extra methylene unit. With diethyl malonate, removing a proton gives a nucleophilic carbanion that attacks an alkyl halide to install the desired carbon framework. After hydrolysis of the esters to a dicarboxylic acid and heating to drive off CO_2, one carboxyl group is lost, leaving the remaining fragment as R-CH_2-CO_2H. So the product is a substituted acetic acid, where the alkyl group from the alkyl halide becomes attached as a methylene next to the carboxyl group. This sequence does not produce primary alcohols, aldehydes, or ketones, because the process culminates in a carboxylic acid after decarboxylation rather than forming those other carbonyl-containing species.

9. Which statement correctly describes ionic bonding?

A. Covalent bonding occurs between a metal and a nonmetal.

B. Ionic bonding occurs between a metal and a nonmetal, with electron transfer.

C. Ionic bonds involve sharing electrons between two nonmetals.

D. Hydrogen bonds are formed by attraction to a lone pair.

Ionic bonding occurs when a metal donates electrons to a nonmetal, producing positively charged cations and negatively charged anions. The electrostatic attraction between these oppositely charged ions holds the compound together in a solid lattice. This description matches the statement because it specifically involves a metal–nonmetal pair and an electron transfer that creates ions. Think of it this way: metals tend to lose electrons, nonmetals tend to gain them, and the resulting ions are pulled together by Coulombic forces. This is different from covalent bonding, which involves sharing electrons and typically occurs between two nonmetals. An ionic bond is not about sharing electrons between two nonmetals. Hydrogen bonding, on the other hand, is a specific type of intermolecular attraction involving hydrogen bonded to a highly electronegative atom and attracted to a lone pair on another molecule, not an ionic bond.

10. Hydroboration-oxidation of an alkene yields what type of alcohol and is Markovnikov or anti-Markovnikov?

A. Anti-Markovnikov alcohol (BH3 adds to less substituted carbon)

B. Markovnikov alcohol

C. Ketone

D. Ether

Hydroboration-oxidation gives an alcohol with anti-Markovnikov regiochemistry. In the hydroboration step, the boron atom adds to the less substituted carbon of the double bond and hydrogen adds to the more substituted carbon, doing so in a concerted, syn fashion. This preference arises because bulky boron prefers the less hindered carbon and no carbocation is formed. When the boron–carbon bond is then oxidized, the boron is replaced by a hydroxyl group. Since boron was attached to the less substituted carbon, the resulting alcohol places the OH on that same, less substituted carbon, giving an anti-Markovnikov product. The other options describe products that don't come from this sequence: a Markovnikov alcohol would arise from acid-catalyzed hydration, while ketones or ethers aren't formed by hydroboration-oxidation.

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!