NCEA LEVEL 3 ORGANIC CHEMISTRY REACTION SCHEMES 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. Which reagent can reduce both aldehydes and ketones?

A. $NaBH_4$

B. $LiAlH_4$

C. $NaBH_4$ or $LiAlH_4$

D. H_2/Pd

2. In a Williamson ether synthesis, which substrate is most suitable for SN2 to form the ether?

A. Secondary alkyl halide

B. Tertiary alkyl halide

C. Aryl halide

D. Primary alkyl halide

3. What is the outcome when tert-butyl bromide reacts with water under heat?

A. SN2; tert-butanol

B. SN1; tert-butanol

C. E2; isobutene

D. SN1; tert-bromide

4. Which reagent converts Alcohol to Haloalkane under reflux?

A. $SOCl_2$ or PCl_3 or PCl_5 reflux

B. $KOH(aq)$ reflux

C. H_2O/H^+ and heat

D. Br_2

5. Which oxidant selectively stops at an aldehyde when oxidizing a primary alcohol?

A. PCC in suitable solvent

B. Jones oxidation

C. Both PCC and Jones

D. None of the above

6. A Wittig reaction between benzaldehyde and methylidenetriphenylphosphorane yields which product?

A. Styrene

B. Benzaldehyde

C. Benzyl alcohol

D. Ethyl benzoate

7. In acid-catalyzed hydration of an asymmetrical alkene, the hydroxyl group adds to which carbon in the major product?

A. On the less substituted carbon

B. On the more substituted carbon

C. On the primary carbon

D. On the tertiary carbon

8. Base hydrolysis of an amide yields which nitrogen-containing product?

A. Ammonia

B. Amine

C. Ammonium ion

D. Ether

9. In the nitration of toluene, besides the major para product, which other nitro product is formed in smaller amounts?

A. p-nitrobenzene

B. m-nitrotoluene

C. o-nitrotoluene

D. p-nitrotoluene

10. Jones oxidation of ethanol yields which product?

A. Ethanal

B. Acetic acid

C. Ethyl ether

D. Ethanol

Answers

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

Explanations

1. Which reagent can reduce both aldehydes and ketones?

A. NaBH4

B. LiAlH4

C. NaBH4 or LiAlH4

D. H2/Pd

Reducing aldehydes and ketones relies on hydride donors delivering a hydrogen to the carbonyl carbon, turning the C=O into an alcohol after workup. Sodium borohydride and lithium aluminum hydride are classic sources of hydride for this transformation. Sodium borohydride is milder and efficiently reduces both aldehydes (to primary alcohols) and ketones (to secondary alcohols) in typical solvents. Lithium aluminum hydride is stronger but achieves the same carbonyl reductions readily as well, though it can act on more functional groups under broader conditions. Because either reagent can accomplish the reduction of both types of carbonyls, the best answer is that sodium borohydride or lithium aluminum hydride can do it. Hydrogenation with H2 and a Pd catalyst is a different route and is not as universally reliable for these carbonyl reductions under standard conditions.

2. In a Williamson ether synthesis, which substrate is most suitable for SN2 to form the ether?

A. Secondary alkyl halide

B. Tertiary alkyl halide

C. Aryl halide

D. Primary alkyl halide

In a Williamson ether synthesis, the alkoxide attacks the alkyl halide in an SN2 process, so backside attack on a carbon with a good leaving group is key. SN2 works best when the carbon is not heavily hindered, allowing the nucleophile to approach directly. Primary alkyl halides are ideal because they offer minimal steric hindrance, enabling fast SN2 displacement of the halide by the alkoxide to form the ether. Secondary substrates can react but more slowly due to increased hindrance, while tertiary substrates are usually too hindered for SN2 and can lead to elimination instead. Aryl halides are not suitable for SN2 because the carbon bearing the halogen is sp2-hybridized, making backside attack very difficult. So the most suitable substrate for SN2 to form the ether is a primary alkyl halide.

3. What is the outcome when tert-butyl bromide reacts with water under heat?

A. SN2; tert-butanol

B. SN1; tert-butanol

C. E2; isobutene

D. SN1; tert-bromide

When a tertiary alkyl bromide is heated in water, the bond to the bromide can break to form a stable tertiary carbocation. This unimolecular ionization step is the rate-determining part of the process. Water then acts as the nucleophile, attacking the carbocation to form the oxonium intermediate, which is deprotonated by water to yield tert-butanol. The reasons this pathway wins are that a tertiary carbocation is highly stabilized, so SN1 is favored over SN2 (which would be hindered by the bulky tert-butyl group), and water is a weak base, so elimination via E2 is not competitive under these conditions. The major product is tert-butanol.

4. Which reagent converts Alcohol to Haloalkane under reflux?

A. SOCl2 or PCl3 or PCl5 reflux

B. KOH(aq) reflux

C. H2O/H+ and heat

D. Br2

Replacing the hydroxyl group on an alcohol with chloride is how you make a haloalkane. The reagents thionyl chloride (SOCl2), phosphorus trichloride (PCl3), or phosphorus pentachloride (PCl5) do this effectively by turning the poor leaving group OH into a much better leaving group and supplying chloride to complete the substitution. Mechanistically, SOCl2 reacts with ROH to form a chlorosulfite intermediate, which then undergoes chloride attack to give RCl while SO2 and HCl are expelled. With PCl3 or PCl5, the alcohol is converted to ROCl (or undergoes a sequence that ultimately yields RCl), with byproducts such as HCl and phosphate species. In all cases, chloride becomes the nucleophile that displaces the improved leaving group, giving the haloalkane. Performing the reaction under reflux provides the necessary energy to drive the substitution to completion and helps manage the evolved gases or byproducts, ensuring the process proceeds efficiently.

5. Which oxidant selectively stops at an aldehyde when oxidizing a primary alcohol?

A. PCC in suitable solvent

B. Jones oxidation

C. Both PCC and Jones

D. None of the above

The key idea is how strong the oxidant is and how much water is present. PCC (pyridinium chlorochromate) in a dry, non-aqueous solvent is a mild oxidant, so it converts a primary alcohol to an aldehyde and stops there under controlled conditions. The low water content prevents formation of the hydrated form that would lead to further oxidation to the carboxylic acid, so you get the aldehyde selectively. Jones oxidation uses chromium trioxide in aqueous acid, a much stronger, water-rich system. The aldehyde formed from a primary alcohol is readily oxidized further under these conditions to the carboxylic acid, so it does not stop at the aldehyde. Since Jones oxidation pushes beyond the aldehyde and PCC under proper conditions stops at the aldehyde, the method that selectively yields the aldehyde is PCC in a suitable solvent.

6. A Wittig reaction between benzaldehyde and methylidenetriphenylphosphorane yields which product?

A. Styrene

B. Benzaldehyde

C. Benzyl alcohol

D. Ethyl benzoate

The key idea is that a Wittig reaction forms an alkene by linking the carbonyl carbon of the aldehyde with the methylene carbon of the phosphorane ylide. Here, the ylide is methylidenetriphenylphosphorane, which provides a CH2 unit. When it reacts with benzaldehyde, that CH2 becomes the terminal carbon of the new double bond, while the carbonyl carbon becomes the other alkene carbon. The result is a vinyl benzene product, i.e., styrene (Ph–CH=CH2). The reaction also kicks out triphenylphosphine oxide as a byproduct. The other options don't fit this pattern: benzaldehyde would not remain unchanged, benzyl alcohol would come from reduction rather than a Wittig alkene-forming step, and ethyl benzoate would require forming an ester, not an alkene, product.

7. In acid-catalyzed hydration of an asymmetrical alkene, the hydroxyl group adds to which carbon in the major product?

A. On the less substituted carbon

B. On the more substituted carbon

C. On the primary carbon

D. On the tertiary carbon

Regioselectivity in acid-catalyzed hydration follows Markovnikov's rule: the hydroxyl group ends up on the more substituted carbon of the double bond. The double bond is first protonated to give the most stable carbocation. The proton adds to the carbon bearing more hydrogens (the less-substituted carbon), placing the positive charge on the more substituted carbon. Water then attacks this carbocation, and after deprotonation you obtain an alcohol where the OH is attached to the more substituted carbon. So the major product has the OH on the more substituted carbon.

8. Base hydrolysis of an amide yields which nitrogen-containing product?

A. Ammonia

B. Amine

C. Ammonium ion

D. Ether

Under base hydrolysis, an amide is cleaved in which the nitrogen ends up as the amine species released from the amide, typically ammonia (NH3). Mechanistically, hydroxide attacks the carbonyl, the amide portion leaves as NH2− which grabs a proton from water to form NH3. In strongly basic solution, ammonia remains as NH3 rather than being protonated to NH4+. Ammonium ion would arise mainly under acidic conditions. So the nitrogen-containing product in base hydrolysis is ammonia, not ammonium. Ether is unrelated, and a substituted amine would imply a different product.

9. In the nitration of toluene, besides the major para product, which other nitro product is formed in smaller amounts?

A. p-nitrobenzene

B. m-nitrotoluene

C. o-nitrotoluene

D. p-nitrotoluene

Methyl on toluene activates the ring for electrophilic substitution and directs new substituents to the ortho and para positions. In nitration, the nitronium ion adds mainly at the para position because it gives a resonance-stabilized intermediate with less steric clash, making para-nitrotoluene the major product. A smaller amount forms at the ortho position since that site is also activated by the methyl group, though steric hindrance slightly lowers its yield. The meta position is not favored by a methyl director, so meta-nitrotoluene is not produced in significant amounts. Therefore, the nitro product formed in smaller amounts is ortho-nitrotoluene.

10. Jones oxidation of ethanol yields which product?

A. Ethanal

B. Acetic acid

C. Ethyl ether

D. Ethanol

Jones oxidation is a strong oxidizing process that converts primary alcohols all the way to carboxylic acids. Since ethanol is a primary alcohol, it is oxidized to acetic acid (ethanoic acid) under Jones conditions. The aldehyde option would require milder or controlled oxidation that stops at the aldehyde, which isn't typical for Jones reagent. Ethyl ether would form from dehydration of ethanol, not oxidation, and ethanol itself is the starting material, not the product.

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://ncealvl3orgchemreactschemes.examzify.com

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