

Carbonyl Addition — Instructor Answer Key

Worked solutions and reasoning • For instructor review before publication

1. NaBH_4 followed by aqueous workup converts propanone to:

Answer: 2-Propanol

Reasoning: Hydride addition to a ketone gives a secondary alcohol.

2. NaBH_4 followed by workup converts ethanal to:

Answer: Ethanol

Reasoning: An aldehyde reduces to a primary alcohol.

3. During nucleophilic attack on $\text{C}=\text{O}$, π electrons move to:

Answer: Carbonyl oxygen

Reasoning: The $\text{C}=\text{O}$ π pair becomes a lone pair on oxygen.

4. After CH_3MgBr addition to formaldehyde and aqueous workup, product is:

Answer: Ethanol

Reasoning: Adding one carbon to formaldehyde gives ethanol after workup.

5. CH_3MgBr plus ethanal, then H_3O^+ , gives:

Answer: Propan-2-ol

Reasoning: The new methyl substituent creates a secondary alcohol.

6. NaBH_4 commonly reduces which functional group directly under standard conditions?

Answer: An aldehyde

Reasoning: NaBH_4 is commonly used for aldehydes and ketones, not simple esters/amides.

7. What initially forms after strong nucleophilic addition to a neutral ketone?

Answer: An alkoxide

Reasoning: Attack and π -bond shift produce a tetrahedral oxygen anion.

8. Why is water excluded from a typical Grignard addition before workup?

Answer: It protonates and destroys the Grignard reagent

Reasoning: Organomagnesium reagents are quenched by protic solvents.

9. What happens to the $\text{C}=\text{O}$ π bond during nucleophilic attack?

Answer: The π electron pair shifts onto oxygen as the nucleophile bonds to carbon.

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10. What alcohol class forms when a ketone is reduced with NaBH_4 ?

Answer: A secondary alcohol.

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