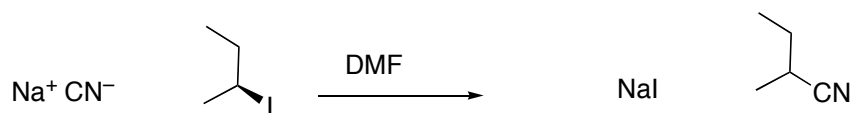


Section 1. Multiple choice - ten questions 4 points each

Questions 1-2 refer to the following reaction



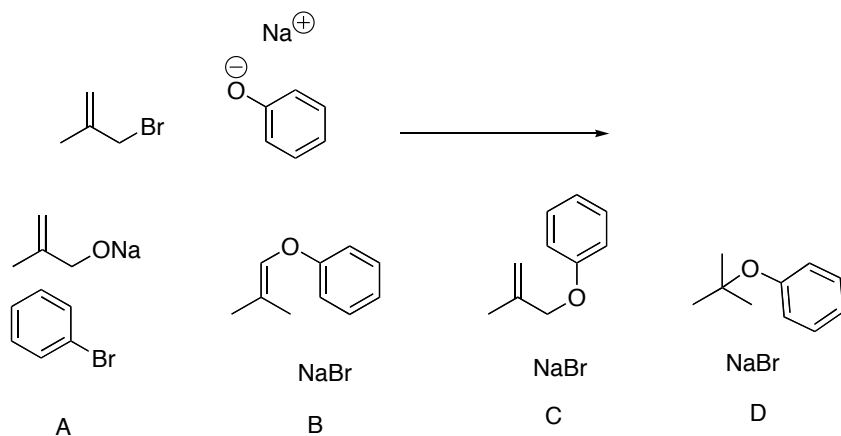
1. This reaction would be classified as an:

- A. Elimination B. Substitution C. Addition
D. Condensation E. Rearrangement

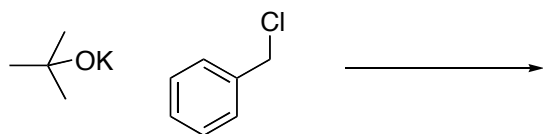
2. Which of the following species in the reaction above could be classified as a nucleophile

- A. CN^- , B. $\text{CH}_3\text{CH}_2\text{CHICH}_3$ C. Na^+
D. $\text{CH}_3\text{CH}_2\text{CH}(\text{CN})\text{CH}_3$ E. None of these

3. What is the product of the following substitution

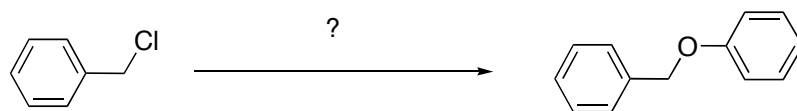


4. The product of the following reaction is likely to be:



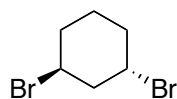
- A. B. C. D.
- E. No reaction

5. The best reagent to accomplish the following transformation could be:



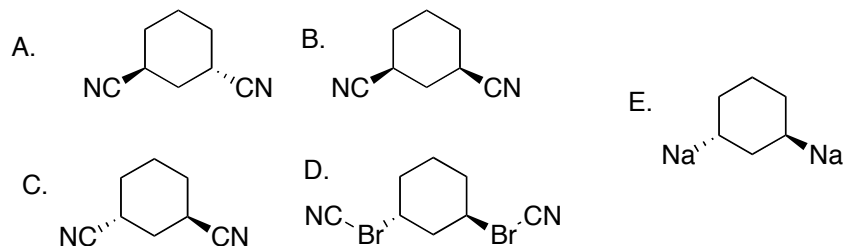
- A. B. C. NaOH D.
- E. None, the reaction cannot be done in one step

6. The correct name for the following molecule is:

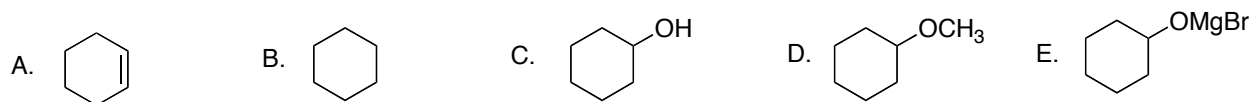
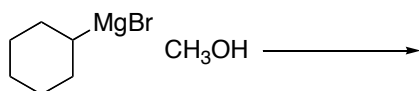


- A. R,R-1,3-dibromocyclohexane B. R,S-1,3-dibromocyclohexane C. 1,3-dibromohexane D. R,S-1,5-dibromocyclohexane E. S,S-1,3-dibromocyclohexane

7. The major product of reacting the molecule in 6 above with sodium cyanide in dimethyl formamide (DMF) would be



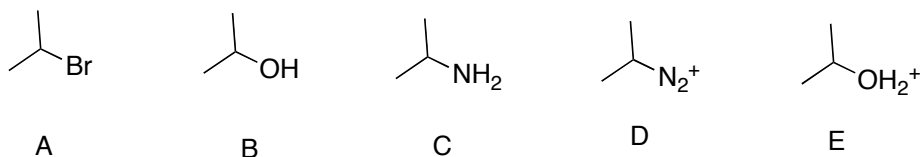
8. Reaction of the following Grignard reagent with methanol gives:



9. Which of the following statements about the $\text{S}_{\text{N}}1$ mechanism is correct?

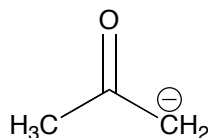
- A. The leaving group is 'pushed off' by the incoming nucleophile
- B. The nucleophile attaches to form an intermediate which then loses a leaving group
- C. The leaving group dissociates (leaves) leaving behind a carbocation
- D. The leaving group dissociates (leaves) leaving behind a free radical
- E. The $\text{S}_{\text{N}}1$ mechanism involves a single reaction step

10. Which of the following would be the worst leaving group?



Section 2. Longer answers

11. (20) The anion below results from reaction of 2-propanone with strong base. Experimentally, this anion reacts as a nucleophile, but both the oxygen and carbon show nucleophilic behavior.

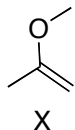


a. Draw a second resonance structure for this anion showing how the negative charge can be delocalized onto oxygen (5 points)

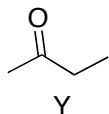
b. Which atom would you expect to be more nucleophilic? Oxygen or Carbon? (2 points)
Explain your reasoning (3 points)

c. Show, using curly arrows:

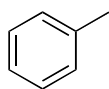
i. the S_N2 reaction of this anion with iodomethane (CH_3I) to give product X (5 pts)



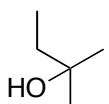
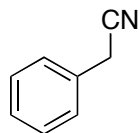
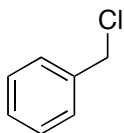
ii. the S_N2 reaction of this anion with iodomethane to give product Y (5 pts)



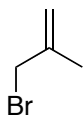
12. Fill in the blanks in the following substitution reactions. For each reaction predict the expected mechanism (Sn1, Sn2 or radical) and give your reasoning



Br₂/light



HCl



DMSO



13. Draw structures for the following

a) 2R,3S-2,3-dibromobutane

b) 3S,4S-3,4-dichloropentane

c) R-3-methylcyclohexene

d) S-3-iodo-1-pentyne

e) Which (if any) of the compounds a)-d) is chiral?