13.13: SOLUTIONS TO ADDITIONAL EXERCISES

PHYSICAL PROPERTIES OF ALCOHOLS

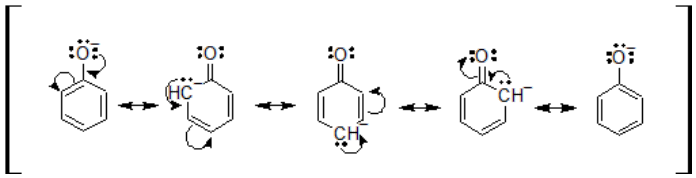
13-1

1. Compound 1 is more acidic than compound 2, since its conjugate base is stabilized by resonance.
2. Compound 1 is more acidic than compound 2 as the proton in question is bonded to a very electronegative atom (oxygen). When comparing the conjugate bases of both compounds, oxygen can stabilize a negative charge far better than the carbon atom of compound 2, allowing it to be a more stable conjugate base and stronger acid.
3. Compound 1 is more acidic than compound 2, since its conjugate base is stabilized by resonance.
4. Compound 2 is more acidic than compound 1. The halogen on compound 2 helps stabilize the negative charge of the conjugate base by withdrawing electron density through induction.

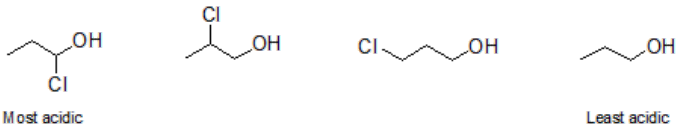
13-2

1. Proton 2 is more acidic than proton 1. The conjugate base formed by removing proton 2 is more stable than the conjugate base formed by removing proton 1, due to the strong induction effects by the halogens which withdraw electron density and stabilize the negative charge.
2. Proton 1 is more acidic than proton 2. The conjugate base formed by removing proton 1 is stabilized by resonance.

13-3 Resonance forms of the phenol conjugate base:



13-4



13-5

1. butan-1-ol is more soluble in water because it has a smaller hydrophobic region compared to pentan-1-ol, allowing butan-1-ol to interact with water better.
2. phenol is more soluble in water than cyclohexanol because of the more polar character of its ring. phenol is able to interact with water better than cyclohexanol due to the conjugated pi-system of electrons in its ring, which which gives it a more ionic character.
3. octan-1,3-diol is more soluble in water as it has two hydroxy groups, allowing it to form more hydrogen bonds and interact with water better than octan-1-ol.
4. hexan-1-ol is more soluble in water as it can hydrogen bond compared to alkyl halides, such as 1-chlorohexane, which are insoluble in water.

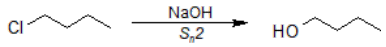
13-6

1. Water has a higher boiling point compared to ethanol as it participates in more hydrogen bonding with other water molecules, thus requiring more energy to break the intermolecular attractions between water molecules.
2. octan-1-ol has the higher boiling point compared to butan-1-ol. Both alcohols can H-bond, however the longer hydrophobic carbon chain tail of octan-1-ol experiences more van der Waal interactions compared to the shorter hydrophobic region of butan-1-ol leading to a higher boiling point.
3. Since hexan-1-ol can H-bond, it has a higher boiling point than hexan-2-one, which cannot H-bond.

SYNTHESIS OF ALCOHOLS

13-7

(a)



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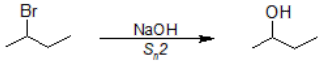

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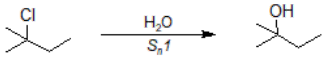

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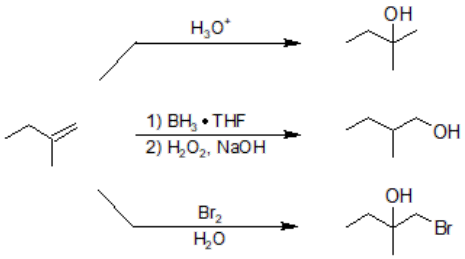

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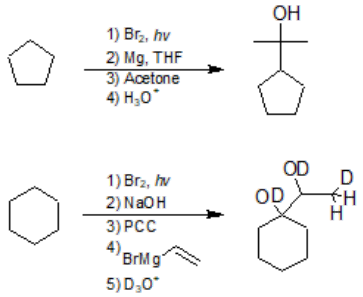

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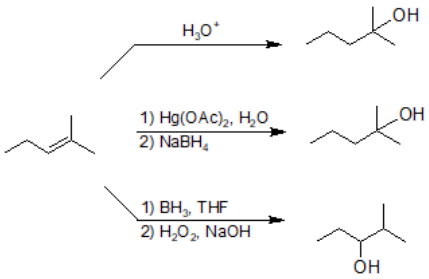

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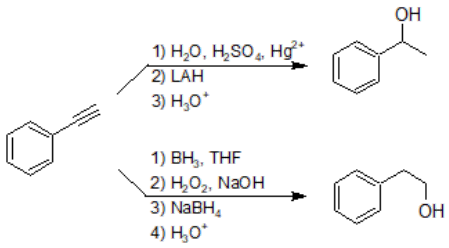
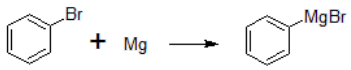


ORGANOMETALLIC REAGENTS FOR ALCOHOL SYNTHESIS

13-12

(a)



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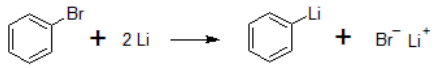

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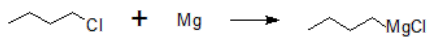
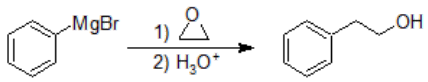


(d) $2\ CH_3Li + CuI \longrightarrow (CH_3)_2CuLi + LiI$

13-13

(a)



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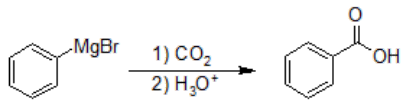

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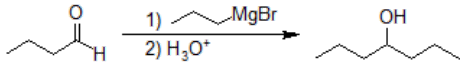

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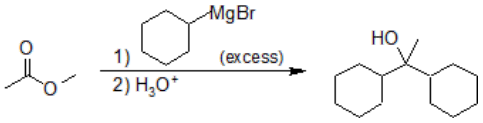

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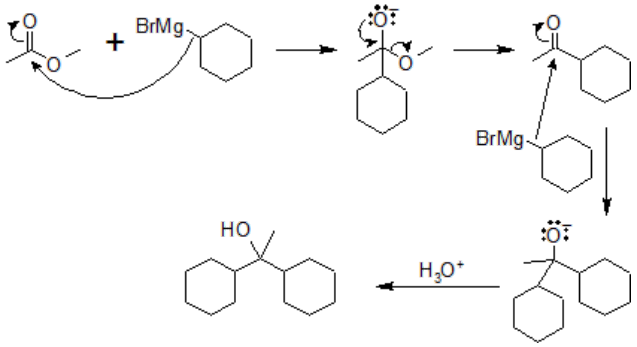
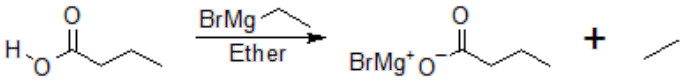


13-16

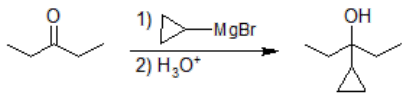
When you react an acid with an organometallic reagent, you will get a salt since organometallics are strong bases and will deprotonate the acid, before even getting a chance to attack the carbonyl carbon.



ADDITION OF ORGANOMETALLIC REAGENTS TO CARBONYL COMPOUNDS

13-17

(a)



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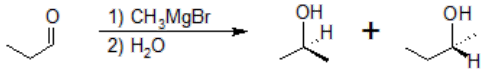

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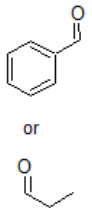

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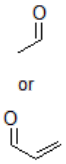
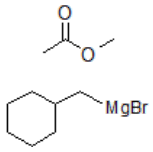


(c)

13-19

(a)



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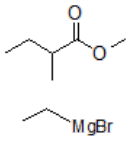

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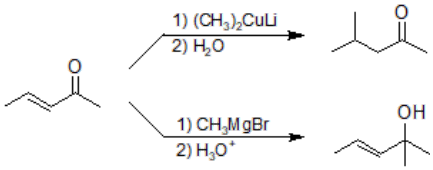


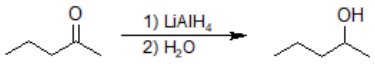
REDUCTION OF THE CARBONYL GROUP

13-21

1. Reduction
2. Oxidation
3. Oxidation
4. Reduction

13-22

(a)



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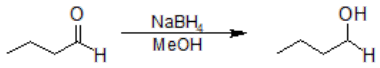
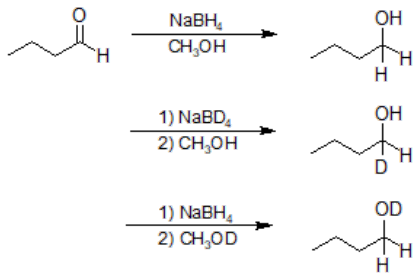


13-23



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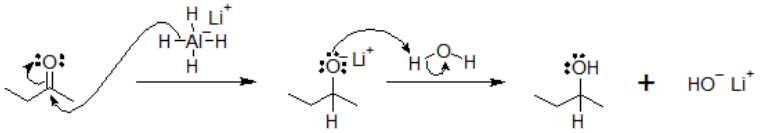

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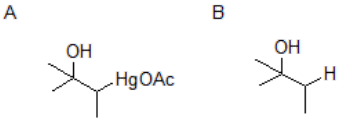
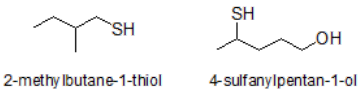


THIOLS (MERCAPTANS)

13-26



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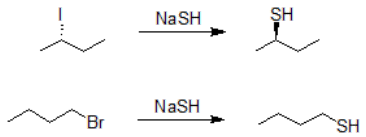

13-28