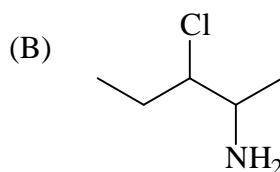


Key to Practice Exam 4

1. (A) isopropyl butanoate



2. (D)

3. (A)

4. benzoyl chloride (note since the product is amide which is the most stable of all acid derivatives, other reagents that are more reactive than amide can also be used. e.g. an ester, or an anhydride)

5. (B)

6. (C) (note weakest first. The < should have been used in the question instead of >)

7. Follow the idea that negative attacks positive. The anhydride will open the ring and forms an amide and an acid in the same molecule.

8. This is a reduction of ester. A stronger reducing agent LiAlH_4 is needed. NaBH_4 is too weak. Thus the answer is (C)

9. (B) Arylamines are less basic than alkylamines. In (B) the lone pair of electrons on N is further delocalized onto C=O on the ortho- position.

10. (B)

11. $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$. (first $\text{S}_\text{N}2$ to give nitrile, which is hydrolyzed to an acid.)

12. (A) (the first step forms diazonium ion, which leaves as nitrogen gas and replaced by Br in CuBr . It is still negative attacks positive!)

13. (B) HCl dissolves the amine in aqueous layer, the neutral toluene stays in ether.

14. acid chloride is the most reactive, therefore the reaction should proceed to give ester.

15. (C). Follow the two step "addition-elimination" sequence, the O18 should come off as by-product ethanol.

Part 2:

1. (A) Still the same mechanism: Addition followed by elimination. Under basic condition, the negative HO^- attacks $\text{C}=\text{O}$, the $\text{C}=\text{O}$ opens up to give $\text{C}-\text{O}$, which then reforms $\text{C}=\text{O}$ and displaces CH_3O^- as the leaving group. Note the CH_3O^- is a poor leaving group however it takes a H^+ from the acid formed and gives the stable CH_3OH .

(B) HO^- is used up and not regenerated. Thus not a catalyst.

(C) Only the last step is not reversible. Stronger base CH_3O^- and acid gives weaker base $\text{C}_{17}\text{H}_{35}\text{COO}^-$ (why is this weaker than CH_3O^- ?) and weaker acid CH_3OH . The other steps are all reversible.

2. Much stronger H-bonding between two molecules of acid--forming H-bonding dimer.

3. Take bromobenzene convert it to its Grignard reagent. The carbon becomes negative. Now add 2 equivalents of this Grignard reagent to phenylacetate. Following negative attacks

positive, the first molecule of Grignard reagent attacks phenylacetate to give a methyl phenyl ketone. We know ketone also reacts with Grignard reagent, thus the second molecule of Grignard reagent adds again to ketone's positive carbon and converts it to the C-O⁻. Add some acid to this and the final product is alcohol.

4. Nitrogen lone pair can be more easily donated to C=O, contributing to the second resonance structure. This structure has C-O single bond character. Thus C-O bond is weakened (between C-O and C=O strength) A weaker bond has lower IR frequency.
5. Alpha cleavage leads to a cation on the Carbon next to N, which is stabilized by the lone pair on the nitrogen. The stable ion thus accounts for the abundant peak-- base peak in this case.