TEST FOUR SKILLS/OBJECTIVES / OUTCOMES / COMPETENCIES

- The list should not be viewed as exhaustive; anything that is addressed in the notes and is not designated either in the notes or in the lectures as "not test responsible" should be considered to be fair game for test assessment.

		TEST FOUR	**Self-Assessment**	**Graded Assessment**
19	Amines	1. Nomenclature: Name amines, and draw structures given names. 2. Physical Properties: Predict and rank relative boiling points and solubilities of amines compounds relative to other organic structures. 3. Contrast physical properties of amines with those of ammonium salts. 4. Acid-Base: Predict and rank basicities of amines and acidity of ammoniums relative to other bases and acids. 5. Determine nitrogen atom hybridization and lone-pair hybridizaton; and apply to amine basicity and ammonium acidity. 6. Amine Reactions: Predict the products or identify starting materials for for reactions (including multi-step reactions) of amines, including with proton donors (acid-base); carbonys (imine formation); alkyl halides (alkylation and polyalkylation); acid chlorides (amide formation); carboxylic acids (acylation, amide formation); and carbonyl in the presence of H+/NaBH3CN (reductive amination). 7. Amine Synthesis: Demonstrate understanding of amine synthesis. This could involve predicting a product, specifying a starting material, designating an appropriate reactant, or proposing an effective synthesis. Major amine precursors include carbonyls (reductive amination; 1º, 2º, or 3º amines possible); amides (1º, 2º, or 3º amines); nitro compounds (1º); alkyl halides and ammonia (1º), and nitriles (1º). 8. Mechanisms: Be able to draw mechanisms for reactions including acid-base reactions; alkylation; polyalkylation; and acylation. 9. Draw the starting materials that would react to produce a given product. 10. Synthesis Design: Given a starting chemical, suggest reactants or sequences of reactions/reactants that could transform the starting material into a target product. 11. Retrosynthesis: Design syntheses of targets, given a restricted pool of allowed starting materials.	1. In-lecture problems 2. Practice sets online 3. Practice Tests 4. Sapling homework problems 5. Book practice problems	Sapling homework Test 4 Final Exam
20, 21	Carboxylic Acids and Carboxylic Acid Derivatives	12. Nomenclature: Name carboxylic acids, esters, and carboxylates; and draw structures given names. 13. Physical Properties: Predict and rank relative boiling points and solubilities of carboxylic acids relative to other organic structures. 14. Acid-Base: Predict and rank acidity of carboxylic acids and basicity of carboxylates relative to other bases and acids. 15. Diagnose how electron donors or withdrawers impact acidity/basicity. 16. Determine which version of an amino acid monomer exists at different pH's 17. Carboxylic Acid Synthesis: Use chemical equations to demonstrate understanding of carboxylic acid synthesis reactions, including: hydrolysis of acid chlorides, anhydrides, esters, or amides under neutral, acidic, or basic conditions; oxidation of alcohol, alkene, or alkyl benzenes; carboxylation of Grignard reagents; hydrolysis of nitriles; or hydrolysis/decarboxylation of 1,3-diesters. 18. Carboxylic Acid Reactions: Use chemical equations to demonstrate understanding of carboxylic acid reactions, including direct or indirect conversion to acid chlorides; anhydrides; esters; amides. 19. Interconversions among Carboxylic Acids and Derivatives: Use chemical equations to predict products, identify starting materials, and design pathways for interconversions between carboxylic acids, acid chlorides; anhydrides; esters; amides, and carboxylates. 20. Mechanisms: Be able to draw mechanisms for interconversions between carboxylic acids, acid chlorides; anhydrides; esters; amides, and carboxylates, including "downhill" reactions and acid-catalyzed "lateral" conversions within the ClAvENO series. 21. Draw the starting materials that would react to produce a given product. 22. Synthesis Design: Given a starting chemical, suggest reactants or sequences of reactions/reactants that could transform the starting material into a target product. 23. Retrosynthesis: Design syntheses of targets, given a restricted pool of allowed starting materials.	1. In-lecture problems 2. Practice sets online 3. Practice Tests 4. Sapling homework problems 5. Book practice problems	Test 4 Final Exam