

Chemistry 220b-01  
Exam 3 (100 pts)  
Tuesday, April 5, 2011  
Chapters 12 – 19

Name \_\_\_\_\_

Write and sign the VU Honor Pledge:

signature

**This exam is closed book and closed notes**

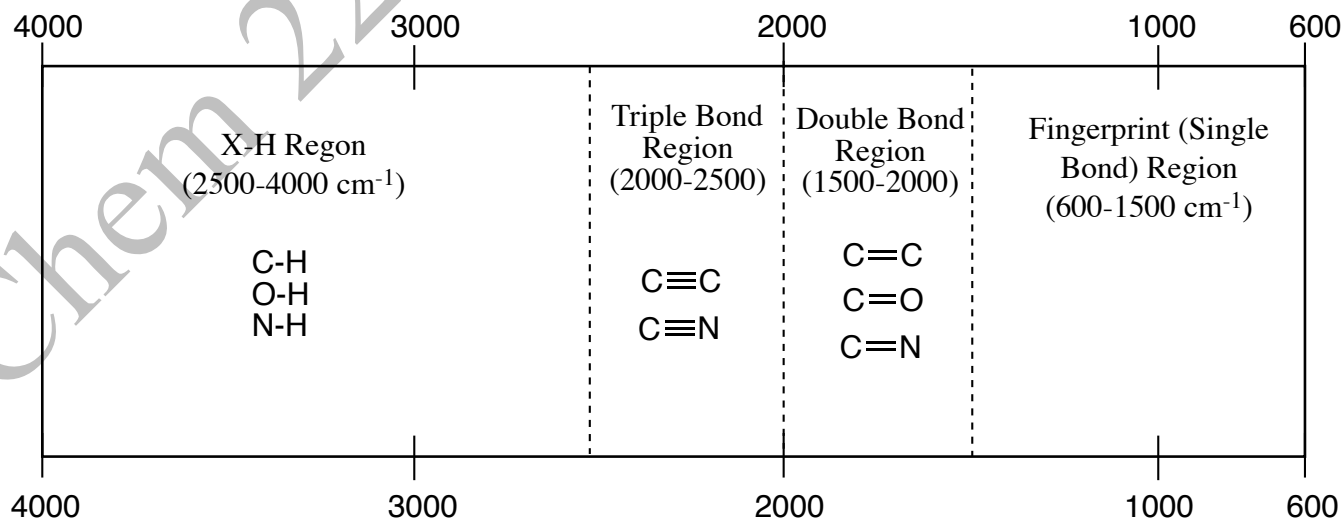
NOTE: It is difficult for me to give you partial credit if you do not show your work!

Neatness count

Stereochemistry counts are indicated

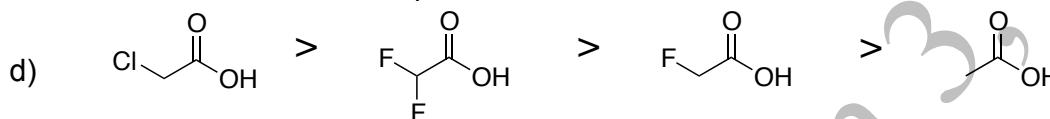
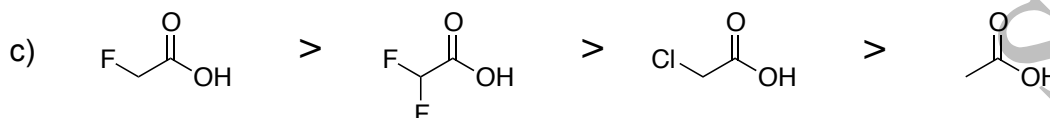
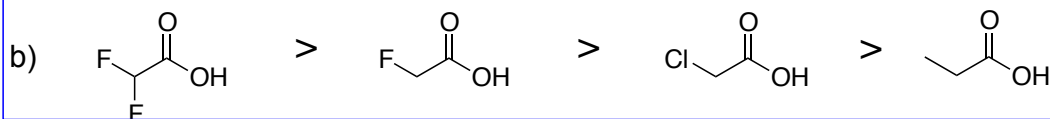
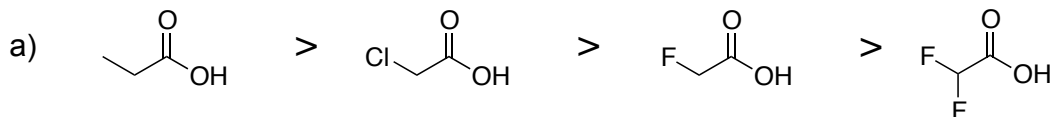
Good Luck !

Typical functional group regions of the infrared spectra:

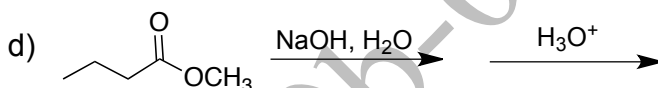
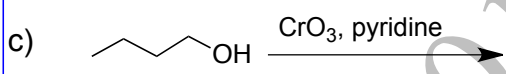
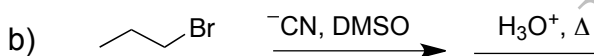
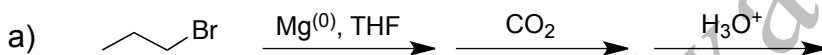


1-14. Multiple choice. Choose the best answer for the following questions. (4 pts each, 56 pts)

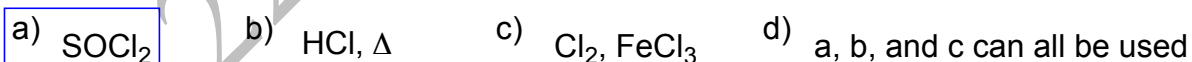
1. Which is the correct order of carboxylic acid acidity, from most acidic to least acidic.



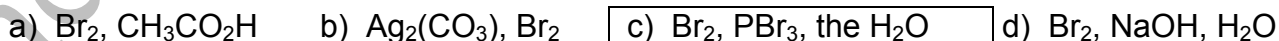
2. Which of the following is not a viable way to make butanoic acid?



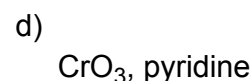
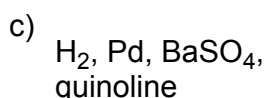
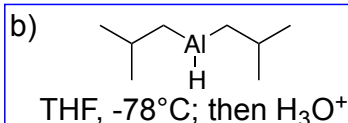
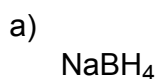
3. Which of the following reagents can be used for the preparation of an acid chloride from a carboxylic acid?



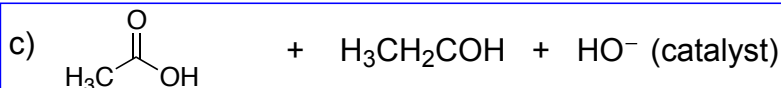
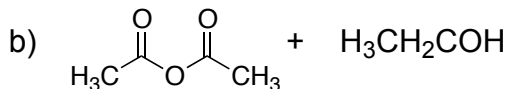
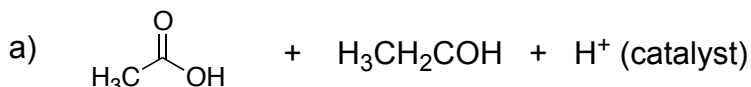
4. Which of the following reagents can be used to synthesize 2-bromopentanoic acid from pentanoic acid?



5. Which of the following reagents will reduce methyl butanoate to butanal?



6. Which of the following is *not* a viable way to prepare ethyl acetate?



d) a, b, and c are all viable ways to prepare ethyl acetate

7. Infrared spectroscopy can potentially distinguish amides from other carbonyl compounds because . . .

a) there are two strong carbonyl absorption typically between  $\sim 1600\text{-}1700\text{ cm}^{-1}$

b) there are two strong carbonyl absorption between  $\sim 1750\text{-}1850\text{ cm}^{-1}$

c) the carbonyl absorption is accompanied by a very broad absorption from  $2500\text{-}3300\text{ cm}^{-1}$ .

d) amides have a characteristic absorption at  $\sim 2250\text{ cm}^{-1}$ .

8. Which is the correct order of reactivity toward nucleophilic acyl substitution from most reactive to least reactive?

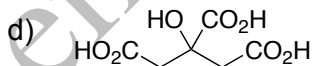
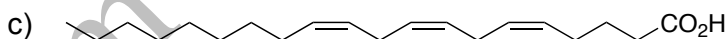
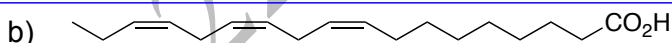
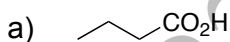
a) esters > acid chlorides > anhydrides > amides

b) anhydrides > acid chlorides > esters > amides

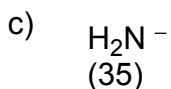
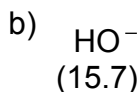
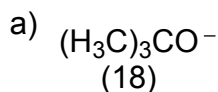
c) amides > esters > acid chlorides > anhydrides

d) acid chlorides > anhydrides > esters > amides

9. Which of the following is an  $\omega$ -3 fatty acid?



10. The  $\text{pK}_a$  of nitromethane is 10.2. Which of the following bases will favor the formation of the nitromethane anion? The  $\text{pK}_a$ 's of the conjugate acids are given in parentheses.



d) a, b, and c will all favor the formation of the nitromethane anion

11. Which reagent will reduce benzamide to benzylamine?



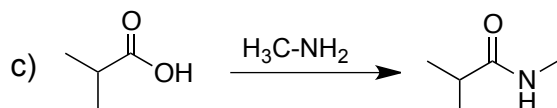
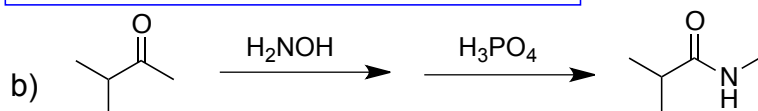
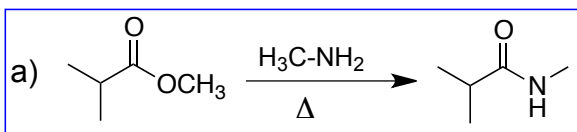
a)  $\text{NaBH}_4$

b) then  $\text{H}_3\text{O}^+$

c) then  $\text{H}_3\text{O}^+$

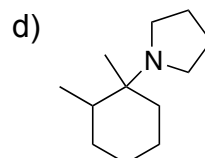
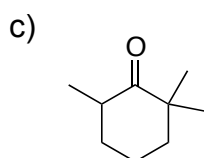
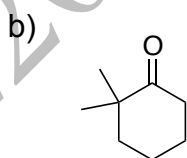
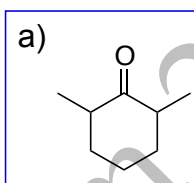
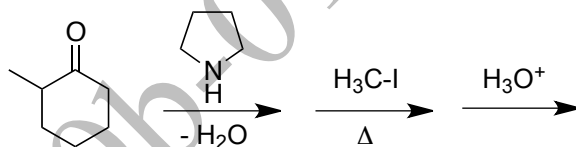
d)  $\text{LiAlH}_4$ , then  $\text{H}_3\text{O}^+$

12. Which of the following is a viable way to synthesize *N*-methyl 2-methylpropionamide?



d) a, b, and c are viable ways to synthesize *N*-methyl 2-methylpropanamide

13. Choose the major product from the following reaction sequence.



14. The formation of a 6-membered ring by a Robinson annulation can be described as . . .

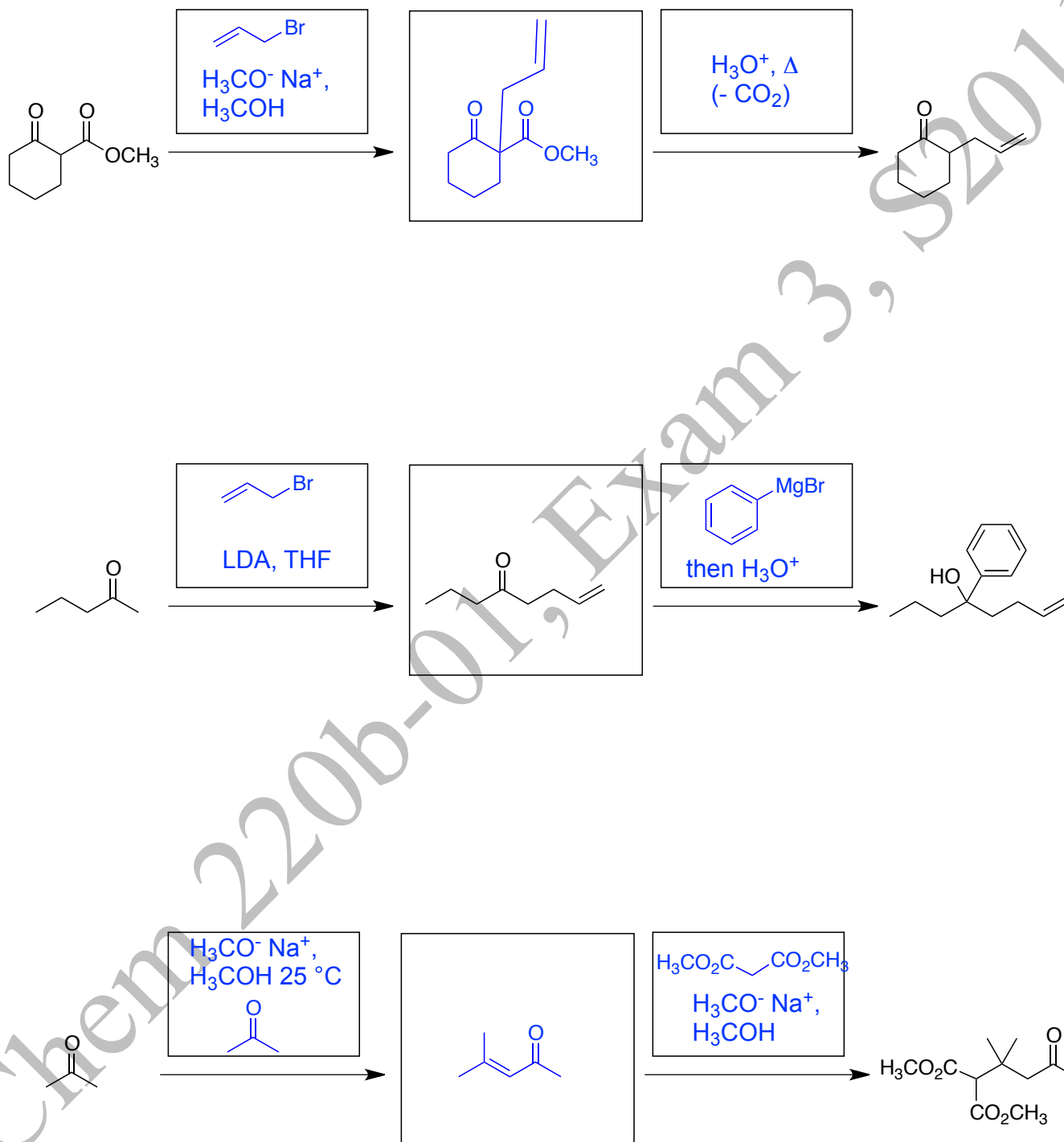
a) an intramolecular Michael addition.

b) an intramolecular Claisen condensation

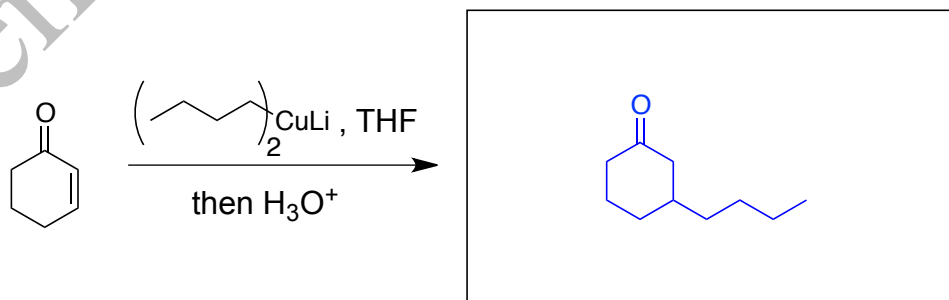
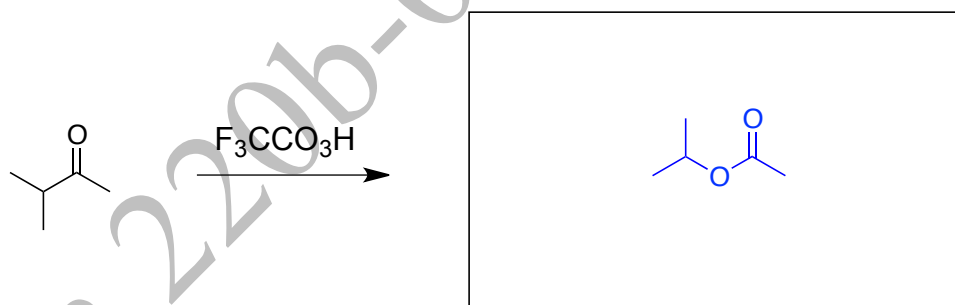
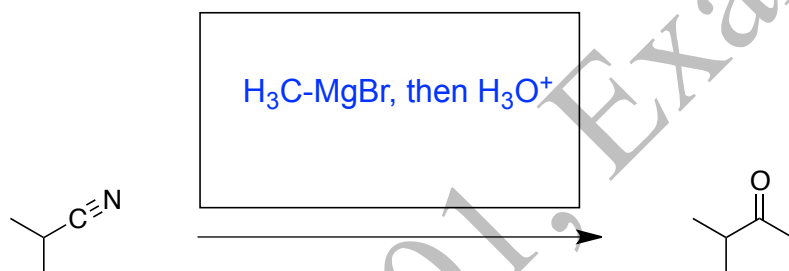
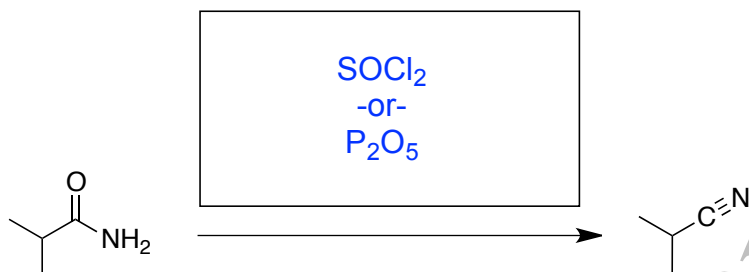
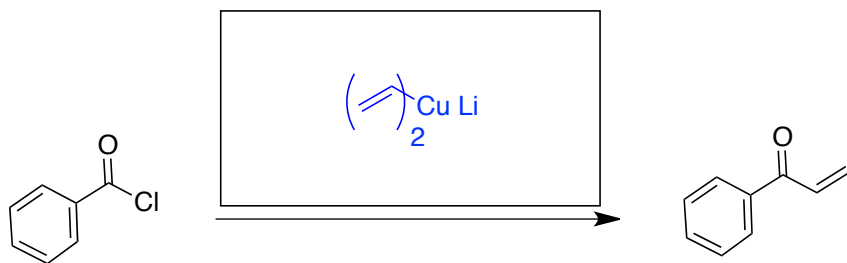
c) a sequential intermolecular Michael addition followed by an intramolecular aldol condensation.

d) any sequence of reactions that form a 6-membered ring.

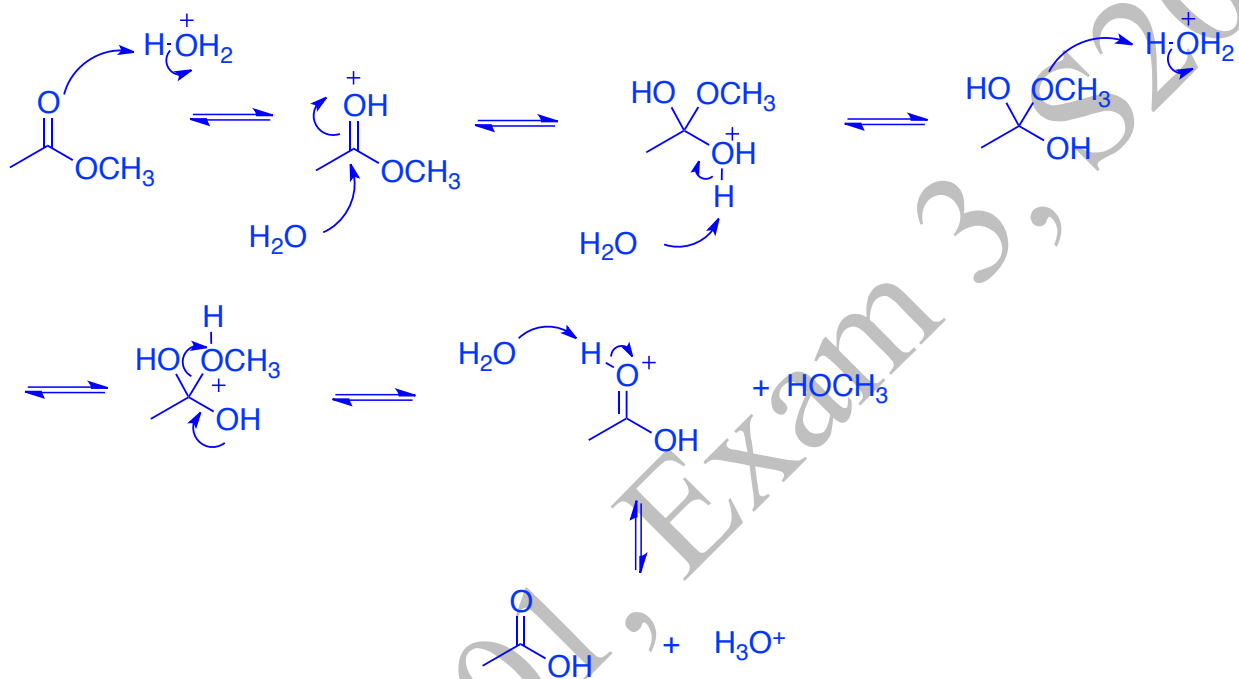
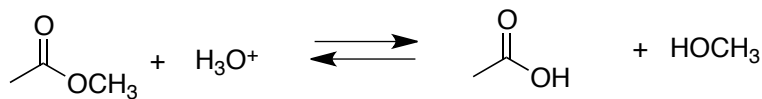
15. The following transformations cannot be done in one step. Provide all necessary reagents and show the intermediate of the reaction sequences. (18 pts)



16. Provide the missing reagent(s) or product for each of the following transformations. (15 pts)



17. Draw a complete mechanism for the acid-catalyzed hydrolysis of methyl acetate to acetic acid and methanol (11 pts).



Problem 1-14: \_\_\_\_\_ (56 pts)

15: \_\_\_\_\_ (18 pts)

16: \_\_\_\_\_ (15 pts)

17: \_\_\_\_\_ (11 pts)

Total out of 100: \_\_\_\_\_