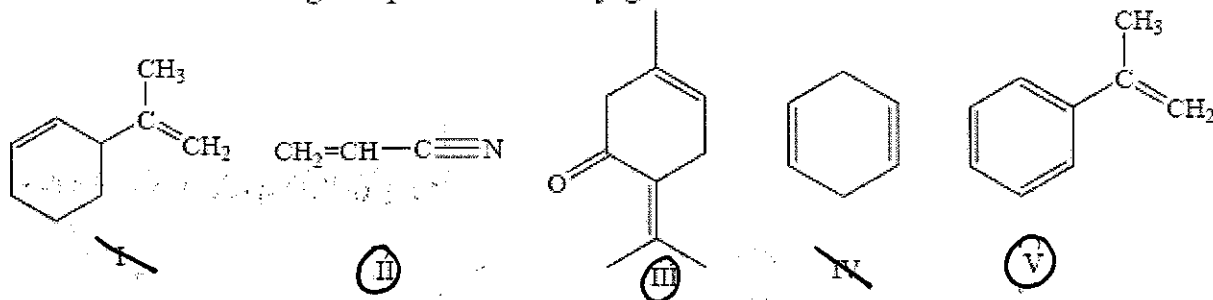


Key

1.)

Which of the following compounds are conjugated? = π σ π



~~a) All but IV~~

~~b) I, II, V~~

~~c) II, V~~

~~d) I, III, V~~

e) II, III, V

2.)

How many nodes are there in the **highest energy** molecular orbital of 1,3-butadiene?

~~a) 0~~

~~b) 1~~

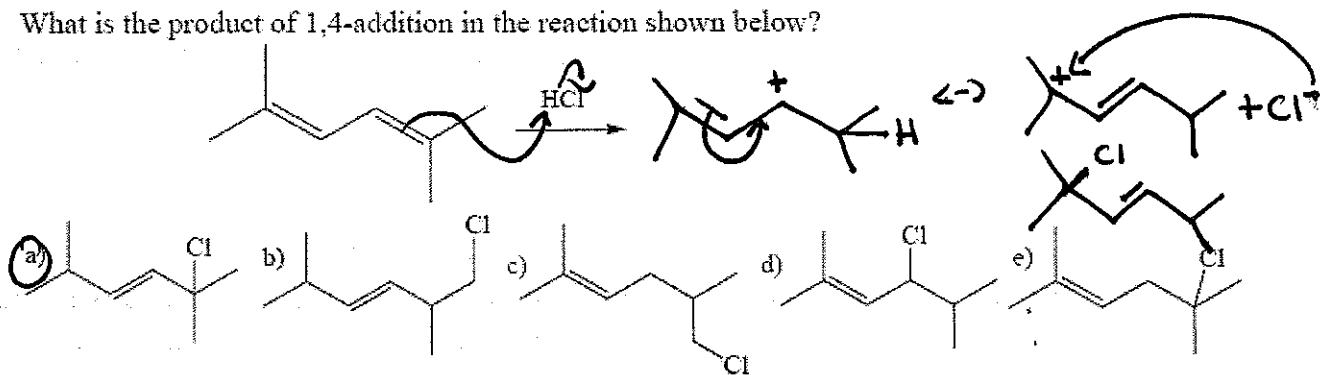
~~c) 2~~

d) 3

~~e) No correct answer shown.~~

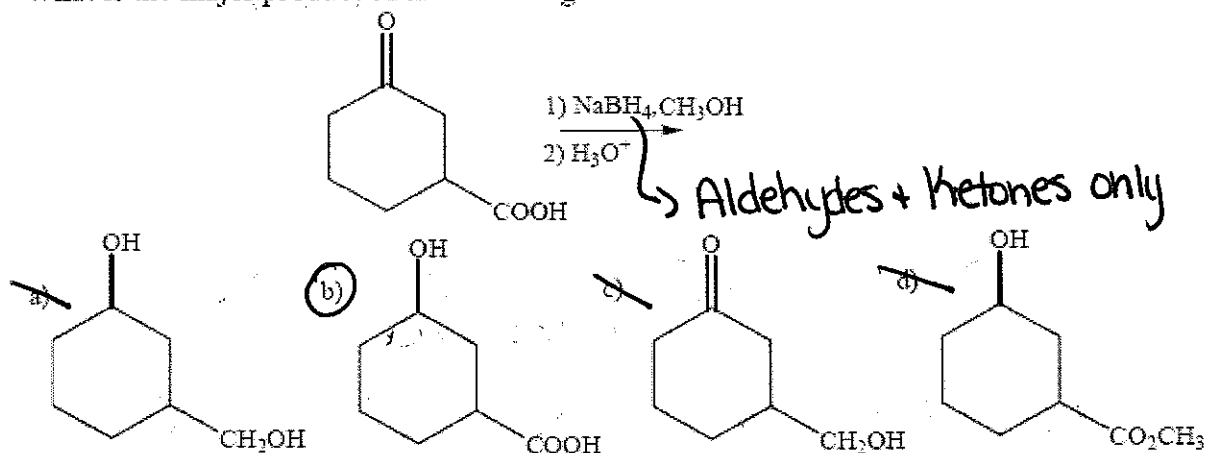
~~3.)~~

What is the product of 1,4-addition in the reaction shown below?



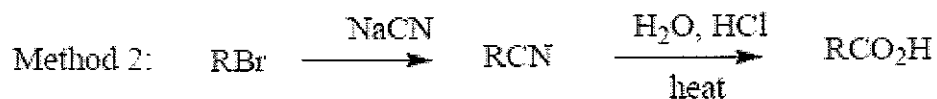
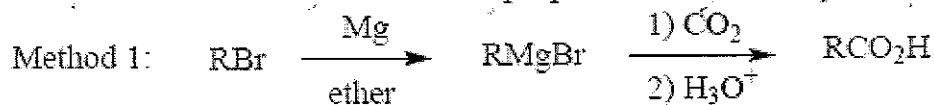
4.)

What is the major product of the following reaction?

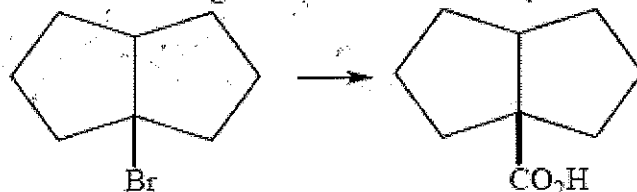


5.)

Compare the two methods shown for the preparation of carboxylic acids:



Which one of the following statements correctly describes this conversion?

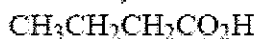


- ~~a)~~ Both method 1 and 2 are appropriate for carrying out this conversion.
- ~~b)~~ Neither method 1 nor 2 is appropriate for carrying out this conversion.
- c)** Method 1 will work well, but method 2 is not appropriate.
- ~~d)~~ Method 2 will work well, but method 1 is not appropriate.

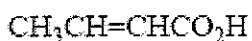
Formation of nitrile is $\text{S}_{\text{N}}2$: No $\text{S}_{\text{N}}2$ on 3°RX

6.)

Rank the following substances in order of decreasing acid strength (strongest to weakest).



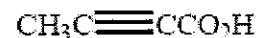
I



II



III



IV

a) IV > II > I > III

b) I > II > IV > III

c) III > I > II > IV

d) II > IV > I > III

> s Character => acidic

RCOOH > ROH

7.)

Carboxylic acids boil at considerably higher temperatures than do alcohols, ketones, or aldehydes of similar molecular weights. This is because they:

a) have a greater oxygen content.

b) are more acidic.

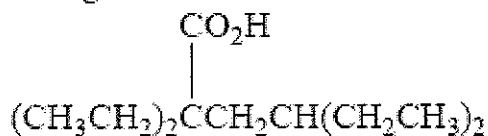
c) form stable hydrogen-bonded dimers.

d) are hydrophobic.

e) None of the above.

8.)

Which of the following is the correct IUPAC name for the compound shown?



a) 1,1,3-Triethylhexanoic acid

b) 2,2,4-Triethylhexanoic acid

c) 3,5-Diethyl-3-heptylcarboxylic acid

d) 3,5,5-Triethyl-6-hexanoic acid

e) None of the above.

9.)

Carboxylic acids are _____ acids than alcohols because _____.

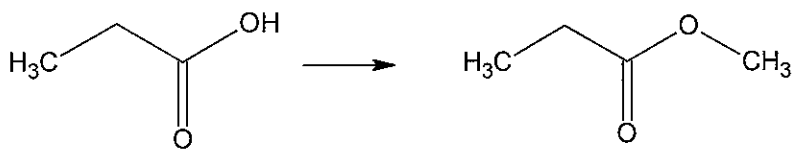
a) stronger; the carboxylate anion is destabilized by resonance

b) stronger; the carboxylate anion is stabilized by resonance

c) weaker; the alkoxide anion is more basic because of the alkyl group's inductive effect

d) weaker; the carbonyl group is more stabilized by resonance than the carboxylate anion

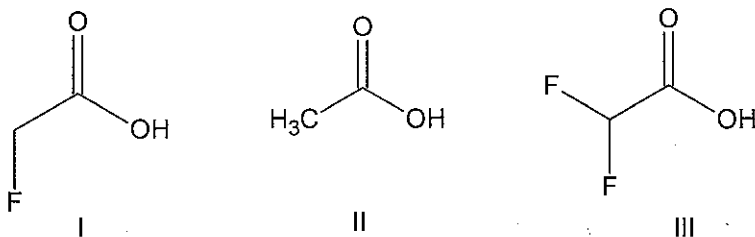
- 10.) What is the best choice of reagents to perform the following transformation?



- a.) $\text{CH}_3\text{OH}, \text{H}_2\text{SO}_4$ b.) $\text{CH}_3\text{I}, \text{H}_2\text{SO}_4$ c.) NaOCH_3 d.) CH_3Li

Fischer Esterification

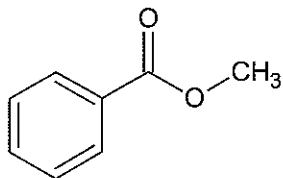
- 11.) Rank the following compounds in order of **decreasing** acidity (most acidic \rightarrow least acidic).



- a.) I>II>III b.) II>III>I c.) III>I>II d.) III>II>I

more induction \Rightarrow acidic

- 12.) Which method would **not** be an acceptable synthesis of the following compound?



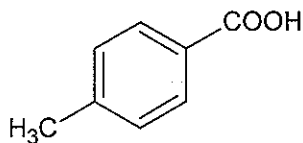
- a.) Benzoic acid + methanol + acid catalyst
 b.) Benzoyl chloride + methanol
 c.) Benzoic anhydride + methanol + acid catalyst
 d.) Benzanamide + methanol + acid catalyst

Order of Reactivity

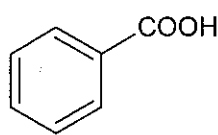
13.) Which of the following is a correct order of activity towards ethanol?

- ~~a)~~ Anhydride > Ester > Acid Chloride
- ~~b)~~ Ester > Amide > Anhydride
- ~~c)~~ Acid Chloride > Ester > Anhydride
- d.) Acid Chloride > Anhydride > Ester

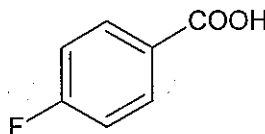
14.) Rank the following benzoic acids in order of **increasing** acidity (least acidic \rightarrow most acidic).



1



2



3

- ~~a)~~ 3 < 2 < 1
- ~~b)~~ 2 < 1 < 3
- ~~c)~~ 2 < 3 < 1
- d.) 1 < 2 < 3
- ~~e)~~ 1 < 3 < 2

e^- w/donator \Rightarrow acidity
 e^- domater $= <$ acidity

15.) Reactions of aldehydes and ketones are classified as _____ while reactions of carboxylic acid derivatives are classified as _____.

- ~~a)~~ elimination : nucleophilic substitution
- ~~b)~~ nucleophilic substitution : nucleophilic addition
- ~~c)~~ nucleophilic addition : elimination
- d.) nucleophilic addition : nucleophilic substitution

No l.g.

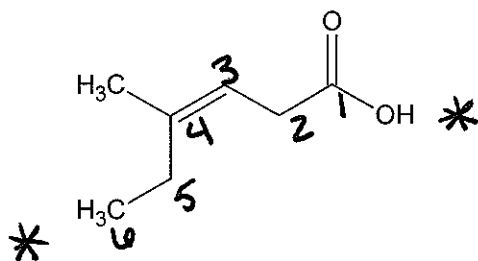
l.g.

16.) Which of the following has the **highest** boiling point?

- ~~a)~~ pentane
- ~~b)~~ 1-pentanol
- ~~c)~~ 2-pentanol
- d.) pentanoic acid

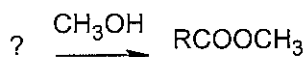
H-Bond Dimers

17.) Name the following compound.



- ~~a.) E-4-ethyl-3-pentenoic acid~~ ~~c.) Z-4-ethyl-3-pentenoic acid~~
~~b.) E-4-methyl-3-hexenoic acid~~ d.) Z-4-methyl-3-hexenoic acid

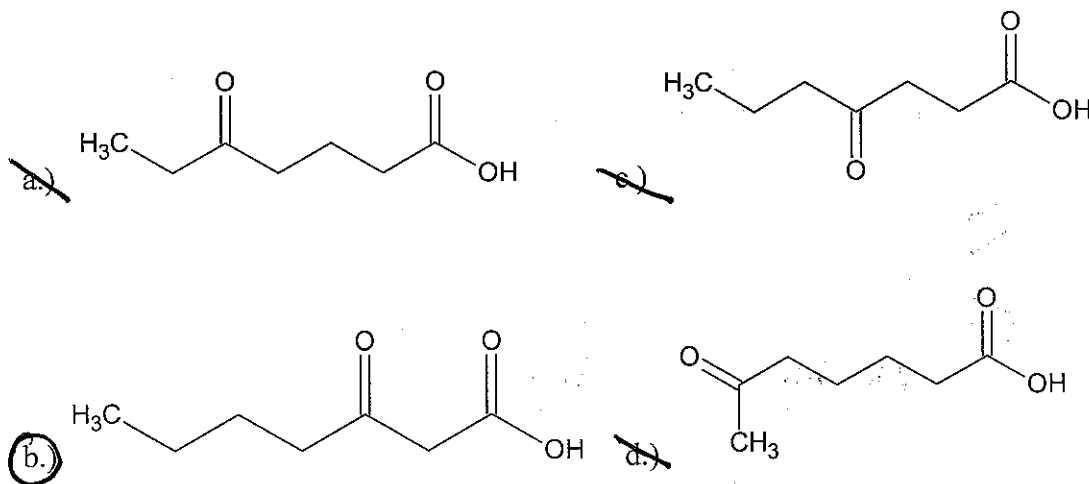
18.) Choose the correct starting material for the following conversion.



- ~~a.) anhydride~~ ~~b.) acid chloride~~ ~~c.) amide~~ d.) a and b

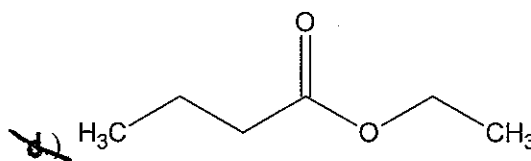
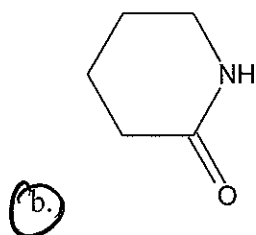
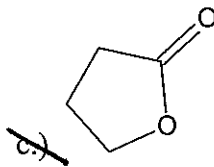
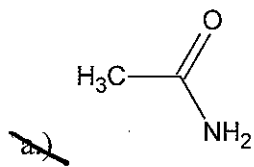
order of reactivity

19.) Which of the following would decarboxylate the fastest?



β -ketoacid

20.) Which of the following is a lactam?

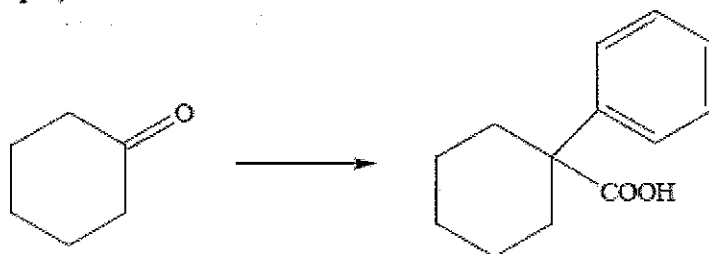


Lactam = Cyclic Amide

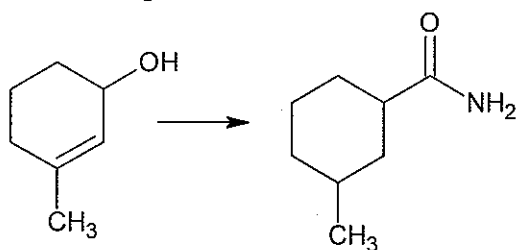
Short Answer Lactone = Cyclic Ester

1.)

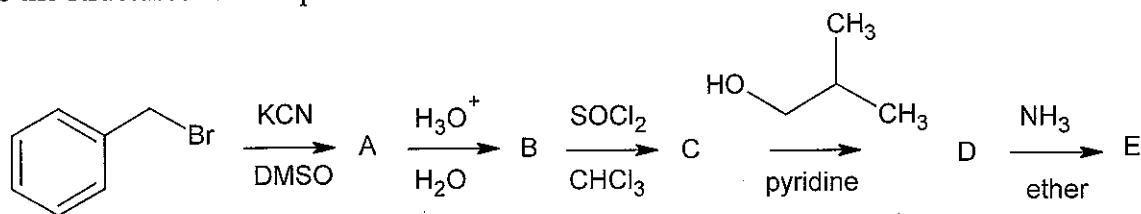
Complete the following synthesis. Show all reagents, reaction conditions, and intermediate compounds. (10 pts)



2.) Complete the following synthesis. Show all reagents, reaction conditions, and intermediate compounds.



3.) Provide the structures for compounds A \rightarrow E below.



4.) Explain why amides are less basic and less nucleophilic than amines. Explain why imides are more acidic than amides.

5.) Explain why two moles of nitrogen compound are needed when synthesizing an amide from an acid chloride or an acid anhydride and why this is not the case for an ester.

6.) Explain why two moles of Grignard reagent are needed when synthesizing an alcohol from an acid chloride or an ester but not when synthesizing an alcohol from an aldehyde or ketone.

7.) Explain the trend that is observed in carboxylic acid derivative reactivity.

8.) Classify each of the products below, determine what reaction was used to synthesize each product, and show the mechanism for the formation of each.

