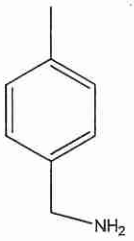
Organic 212 Test # 4 August 11, 2011

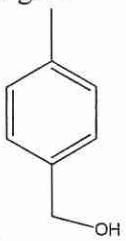
Name:_____

Directions: Mark out FOUR questions you choose not to work. Indicate VERY CLEARLY which questions you are not working. If questions are not crossed out, questions # 20 - # 23 will not be counted. Each question is worth 5 points. You must work question # 24.

Multiple Choice Questions: Work the following multiple choice questions circling the most correct answer. Questions do not have multiple answers.

1) Toluene is reacted with sulfuric acid and nitric acid and the product is reduced with tin and HCl to give an intermediate A. Compound A is treated with sodium nitrite and hydrochloric acid followed by reaction with cuprous cyanide to give compound B. Compound B is treated with lithium aluminum hydride to give the final product, Compound C. Which of the following structures is the product, Compound C, that the synthesis was designed to give?

a) 

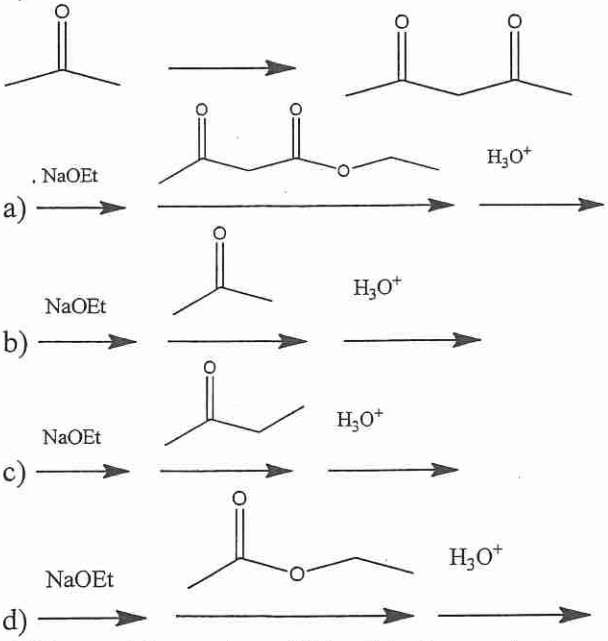
b) 

c) 

d) 

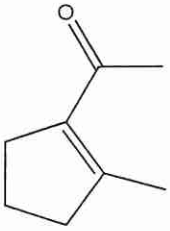
e) None of the answers above can be compound C.

2) What is the best reaction route for the following transformation?

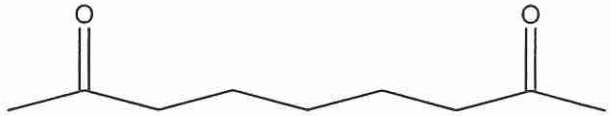


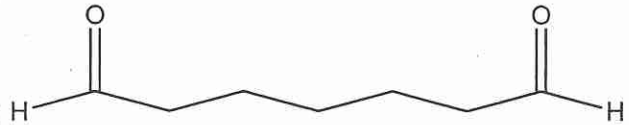
e) None of the routes will lead to the product.

3) Which reactant will lead to Compound D upon treatment with sodium hydroxide, heat and water?

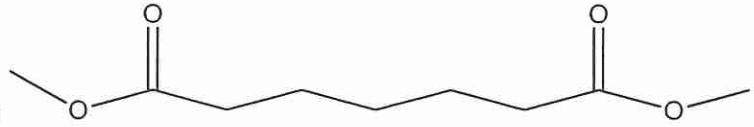


Compound D

a) 

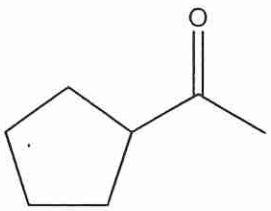
b) 

c) 

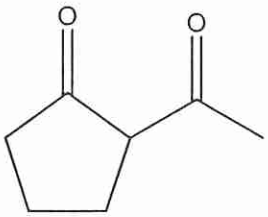
d) 

e) None of the structures listed above will give Compound D.

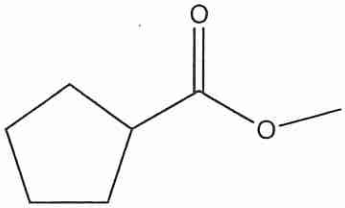
4) Arrange the following in order of decreasing acidity.



i



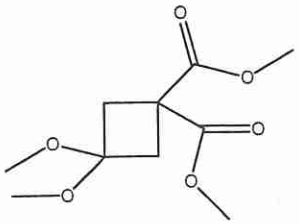
ii



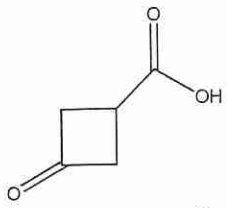
iii

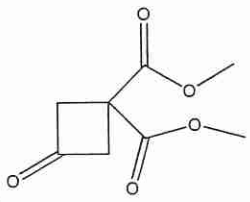
a) i > ii > iii
b) ii > iii > i
c) ii > i > iii
d) iii > ii > i
e) None of the answers above are correct.

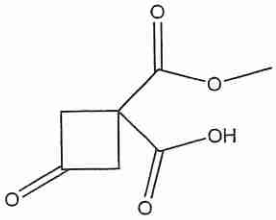
5) When the compound E shown below was heated in refluxing aqueous hydrochloric acid for 60 hrs, a product F was isolated in 97% yield. What is compound F?

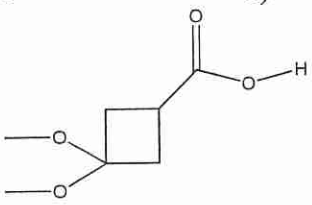


Compound E

a) 

b) 

c) 

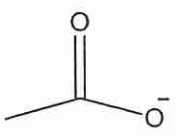
d) 

e) None of the answers are compound F.

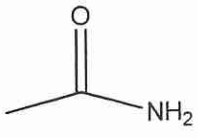
6) Which one, ethyl acetate or ethyl 2,2 – dimethylpropanoate, is more reactive towards saponification and why?

a) Ethyl acetate is more reactive due to more crowding in the transition state for ethyl 2,2-dimethylpropanoate.
b) Ethyl acetate is less reactive due to less crowding in the transition state for ethyl 2,2-dimethylpropanoate.
c) Ethyl 2,2-dimethylpropanoate is more reactive than ethyl acetate due to induction.
d) Ethyl 2,2-dimethylpropanoate is less reactive than ethyl acetate due to induction.
e) None of the answers above.

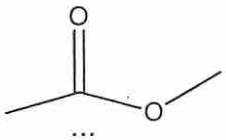
7) Put the following molecules in order of reactivity towards nucleophilic acyl substitution (most reactive first)



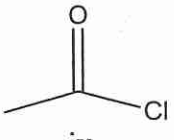
i



ii



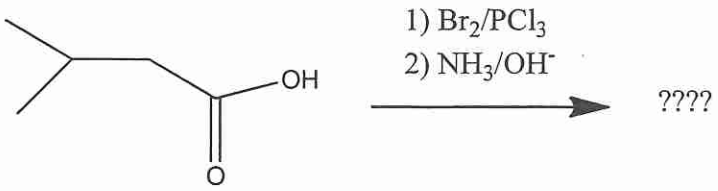
iii

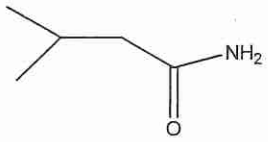


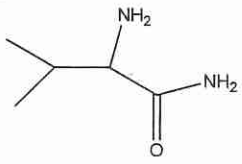
iv

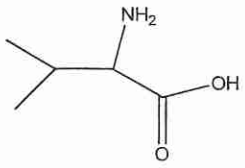
a) i > ii > iii > iv
b) iv > iii > ii > i
c) iii > i > ii > iv
d) ii > iv > iii > i
e) None of the answers above.

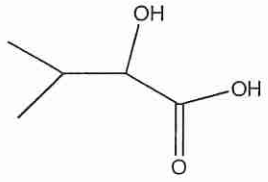
8) The Hell-Volhard-Zelinsky reaction has been used to prepare the amino acid valine from 3-methylbutanoic acid by the following procedure. What is the structure of valine?



a) 

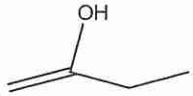
b) 

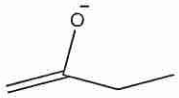
c) 

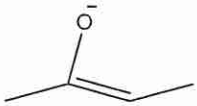
d) 

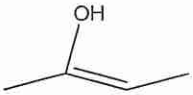
e) None of the products shown are valine.

9) What is the enolate formed if the 2-butanone is reacted with Lithium Diisopropyl Amide?

a) 

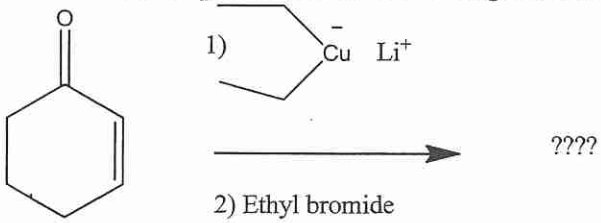
b) 

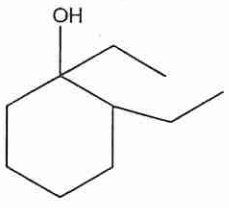
c) 

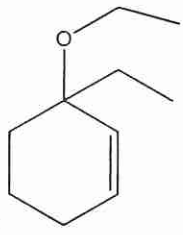
d) 

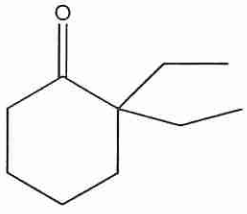
e) None of the drawings above are the enolate.

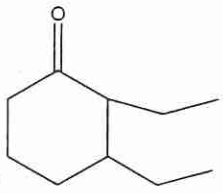
10) What is the product of the following reaction scheme (disregard stereochemistry)?



a) 

b) 

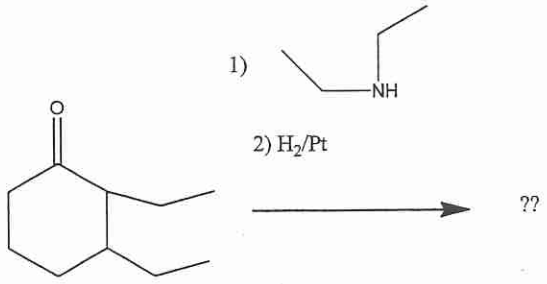
c) 

d) 

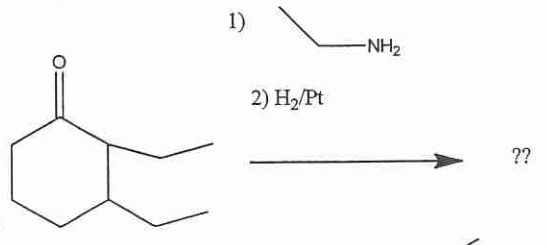
e) None of the drawings above would be the product.

11) What reaction below will furnish a tertiary amine as the product?

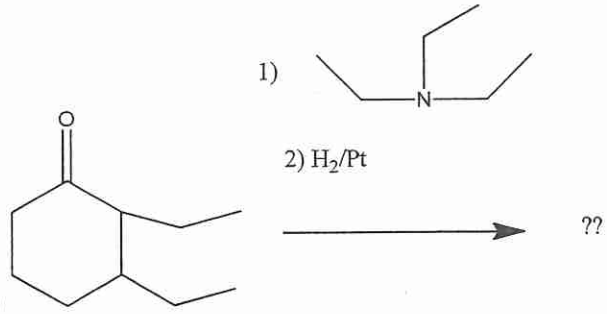
a)



b)

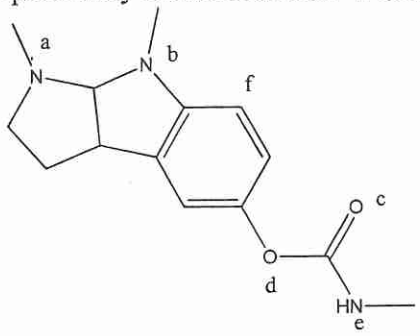


c)



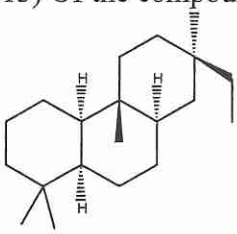
d) More than one of the reactions above will furnish a tertiary amine.
e) None of the reactions above will furnish a tertiary amine.

12) Physostigmine, an alkaloid obtained from a West African plant, is used in the treatment of glaucoma. Treatment of physostigmine with methyl iodide gives a quaternary ammonium salt. Which atom will react first with methyl iodide?

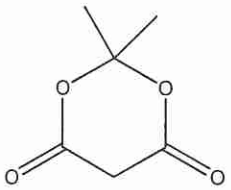


a) a
b) b
c) c
d) a, b, and c are all equally reactive and will all react with the methyl iodide at the same rate.
e) None of the answers above.

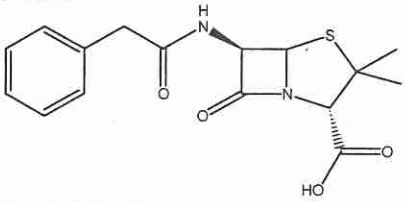
13) Of the compounds below, which answer correctly identifies the products?



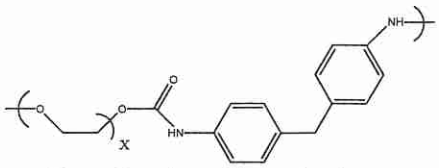
Rosane



Meldrum's acid



Penicillin G

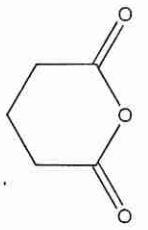


Spandex (small portion)

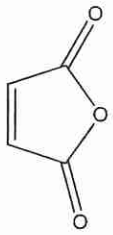
a) Rosane is a sesquiterpenoid, Meldrum's acid is an active hydrogen compound, Penicillin G is a lactam, and Spandex is a polyurethane.
b) Rosance is a diterpenoid, Meldrum's acid is a polyester, Pennicillin G is a lactam and Spandex is a polycarbonate.
c) Rosane is a monoterpenoid, Meldrum's acid is a lactone, Pennicillin G is a polyamide, and Spandex is a polyamide.
d) All of the molecules above fit in the same class and are active hydrogen compounds.
e) None of the answers above.

14) What is the product of heating glutaric acid?

a)

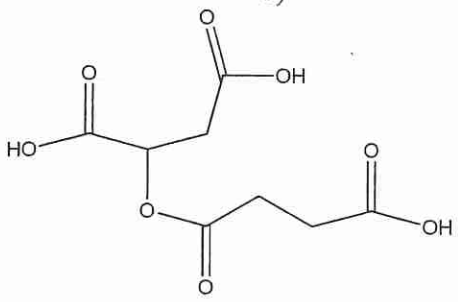


b)



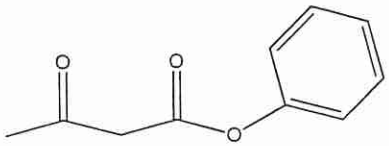
c)

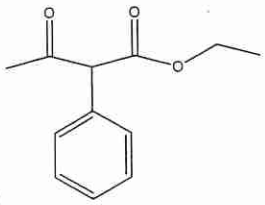
d)

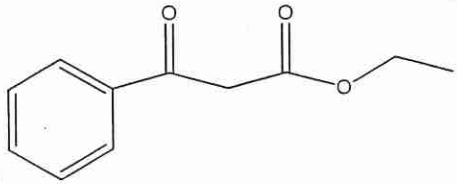


e) None of the molecules above.

15) Which structure below is the product of the mixed Claisen condensation between ethyl phenylacetate and ethyl benzoate?

a) 

b) 

c) 

d) Trick question. Multiple products would be formed because they both have alpha protons.

e) None of the structures above are the product of this mixed Claisen.

16) Which reactions below would give you m-bromoiodobenzene from benzene?

a) 1) HNO_3/H_2SO_4 2) $Br_2/FeBr_3$ 3) Fe/HCl 4) KI

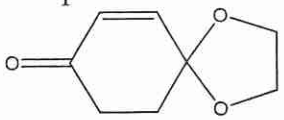
b) 1) HNO_3/H_2SO_4 2) Fe/HCl 3) $Br_2/FeBr_3$ 4) KI

c) 1) $Br_2/FeBr_3$ 2) HNO_3/H_2SO_4 3) Fe/HCl 4) HONO, H^+ 5) KI

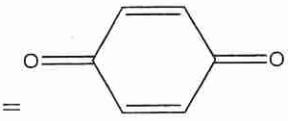
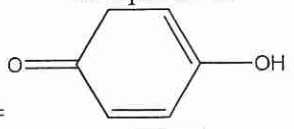
d) 1) HNO_3/H_2SO_4 2) $Br_2/FeBr_3$ 3) Fe/HCl 4) HONO, H^+, 5)KI

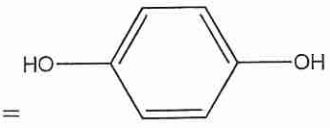
e) None of the conditions above will give m-bromoiodobenzene.

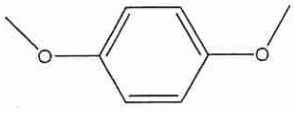
17) Compound A undergoes hydrolysis of its acetal function in dilute sulfuric acid to yield 1,2-ethanediol and compound B. Compound B exhibits a carbonyl stretching band in the infrared at 1690 cm-1 and has two singlets in its proton NMR spectrum, at δ 2.9 and δ 6.7, in the ratio of 2:1. On standing in water or ethanol, compound B is converted cleanly to an isomeric substance, Compound C. Compound C has no peaks around 1690 cm-1. What are compound B and Compound C?

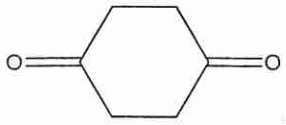
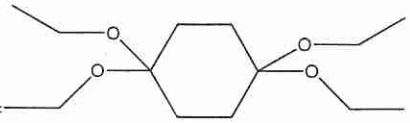


Compound A

a) B =  , C = 

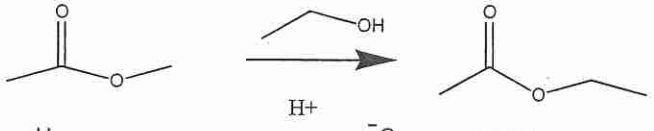
b) B =  , C = 

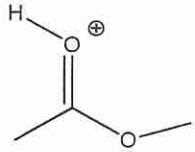
c) B =  , C = 

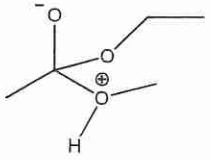
d) B =  , C = 

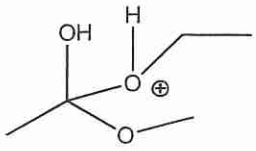
e) None of the answers above.

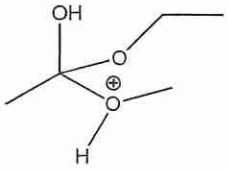
18) Given below is the trans-esterification reaction. Which drawing below is NOT an intermediate in this reaction?



a) 

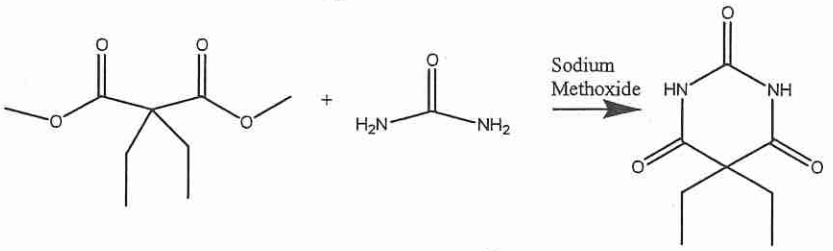
b) 

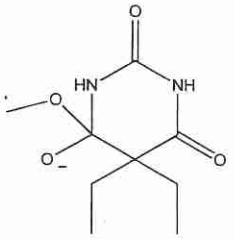
c) 

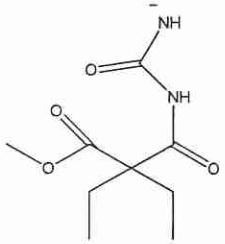
d) 

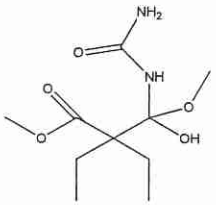
e) They are all intermediates for this reaction.

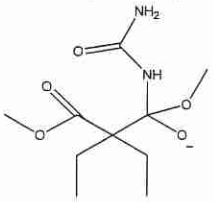
19) Given below is the reaction to form a barbiturate. Which drawing is NOT an intermediate in this reaction?



a) 

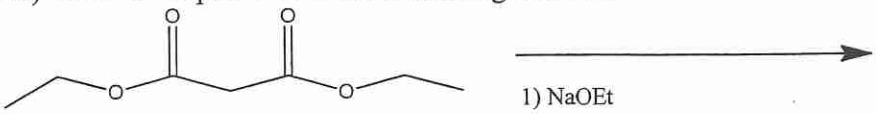
b) 

c) 

d) 

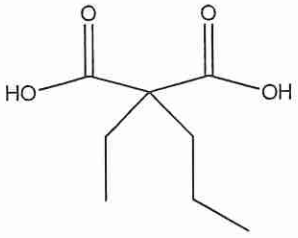
e) They are all intermediates in this reaction.

20) What is the product for the following reaction?

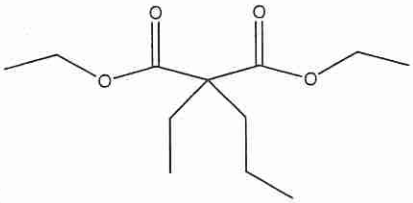


1) NaOEt
2) Ethyl bromide
3) Potassium tert-butoxide
4) Propyl bromide
5) Dilute NaOH
6) Dilute H+
7) Heat, $-CO_2$

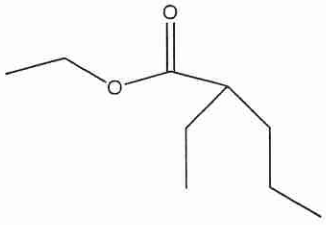
a)



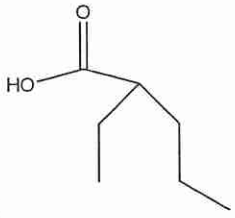
b)



c)



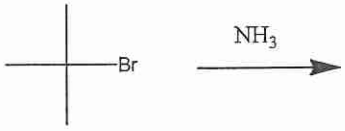
d)



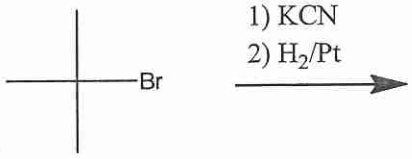
e) None of the products given would be formed in this reaction.

21) Which reaction sequence will produce tert-butylamine in good yield?

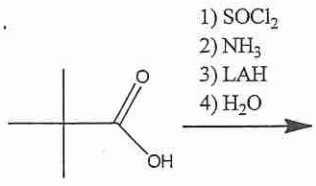
a)



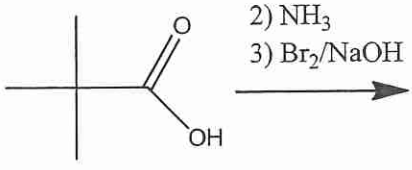
b)



c)

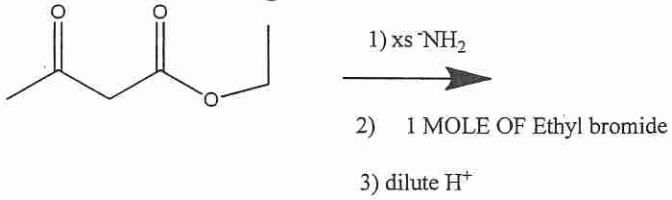


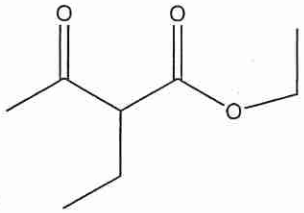
d)

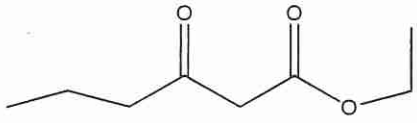


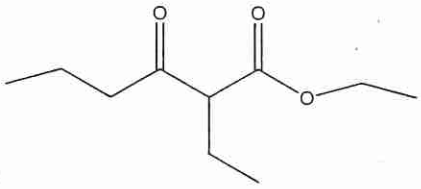
e) None of the reactions above will furnish tert-butylamine in high yield.

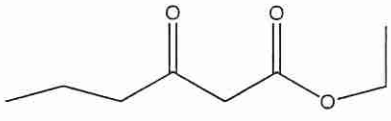
22) What is the product of the following reaction?



a) 

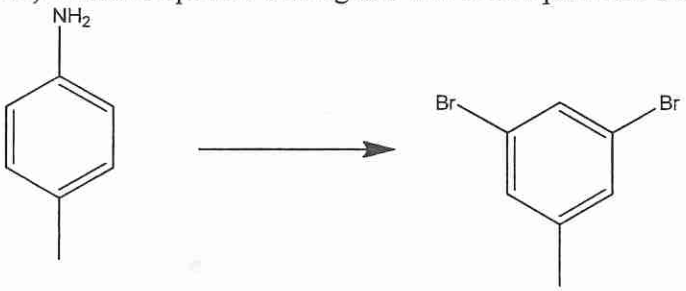
b) 

c) 

d) 

e) None of the answers above.

23) Which sequence of reagents will accomplish the transformation below?



a) 1) $NaNO_2$/HCl/0 °C 2) CuBr/Heat
b) 1) $NaNO_2$/HCl/0 °C 2) H_3PO_2 3) Br_2
c) 1) Br_2 2) LAH 3) H_2O
d) 1) Br_2 2) $NaNO_2$/HCl/0 °C 3) H_3PO_2
e) None of the sequences above will accomplish the transformation.

24) Give five ways to make butyric acid. You must start from 5 different functional groups.