

UNIVERSITY OF SWAZILAND
MAIN EXAMINATION 2017/2018

TITLE OF PAPER : Organic reactions & synthesis

COURSE NUMBER : CHE 332

TIME : Three Hours

INSTRUCTIONS : Answer any **Four Questions**.

This Paper contains five (5) pages.

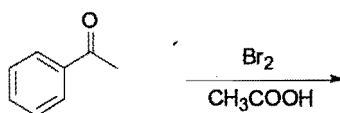
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Question 1

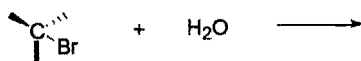
- (a) (i) Name the four kinds of organic reactions. [4]
(ii) Give an appropriate example for each named reaction. [4]
(iii) What is a reaction mechanism? [2]
(iv) Name two general types of reactions by which reactions occur, and give one real example for each type. [5]

(b) Write the structure of the major product expected from the following reactions.

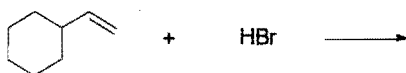
(i)



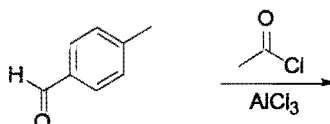
(ii)



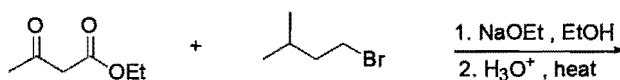
(iii)



(iv)



(v)

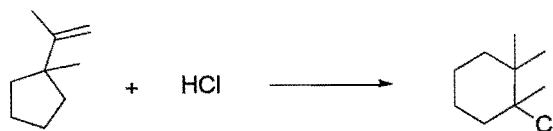


[10]

Question 2

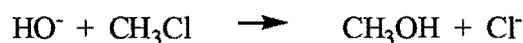
- (a) (i) Addition of HCl to 1-isopropenyl-1-methylcyclopentane yields 1-chloro-1,2,2-trimethylcyclohexane. Suggest a mechanism, showing the structures of the intermediate and using curved arrows to indicate electron flow.

[6]



- (ii) Draw an energy diagram for the reaction, labeling all points of interest and making sure that the relative energy levels on the diagram are consistent with the information given. [6]

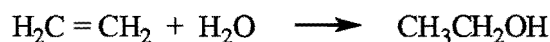
- (b) (i) The reaction of hydroxide ion with chloromethane to yield methanol and chloride ion is an example of a general reaction type called nucleophilic substitution reaction:



The value of ΔH° for the reaction is -75 kJ/mol , and the value of ΔS° is $+54 \text{ J/(K}\cdot\text{mol)}$. What is the value of ΔG° (in kJ/mol) at 298 K ? Is the reaction exothermic or endothermic? Is it exergonic or endergonic?

[6]

- (ii) The addition of water to ethylene to yield ethanol has the following thermodynamic parameters:



$$\Delta H^\circ = -44 \text{ kJ/mol}$$

$$S^\circ = -0.12 \text{ kJ/(K}\cdot\text{mol)}$$

$$K_{\text{eq}} = 24$$

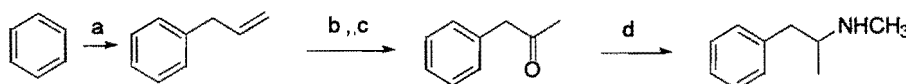
- (a) Is the reaction exothermic or endothermic?
 (b) Is the reaction favorable (spontaneous) or unfavorable (nonspontaneous) at room temperature (298 K)?

[7]

Question 3

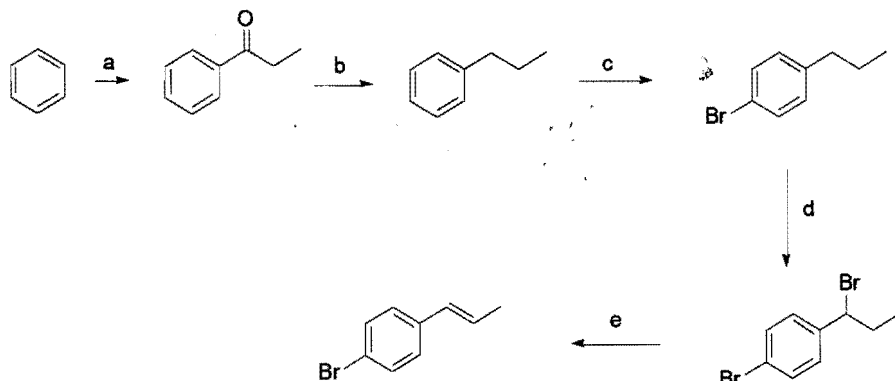
- (a) Fill in the reagents a – d in the following synthesis of racemic methamphetamine from benzene.

[12]



(b) Identify the reagents represented by the letters a-e in the following scheme.

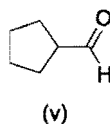
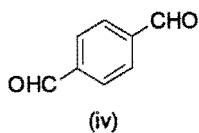
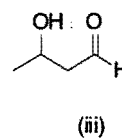
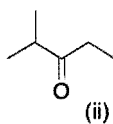
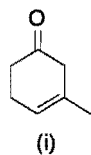
[13]



Question 4

(a) Give IUPAC names of the following compounds;

[15]



(b) Write an equation for the synthesis of ;

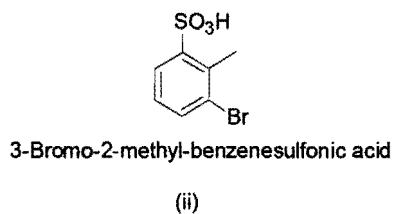
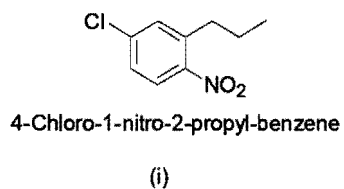
- 3-methylbutanal from an appropriate primary alcohol.
- Benzophenone from benzene and benzoyl chloride.

[10]

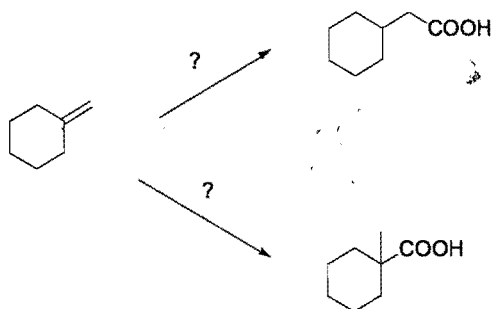
Question 5

(a) Outline a synthetic route from benzene to the following compounds;

[12]



(b) Describe a plan showing how you would synthesize the following compounds in the laboratory. [7]

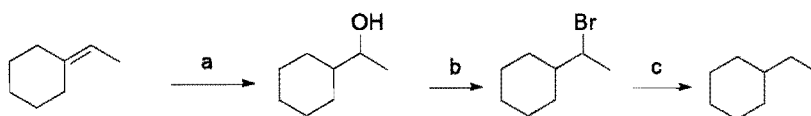


(c) Show how the malonic ester synthesis method is used to prepare the following carboxylic acids. [6]



Question 6

(a) Identify reagents a – c in the following scheme. [12]



(b) Outline a sequence of reactions to carry out the following conversion. [13]

