

**UNIVERSITY OF ESWATINI
MAIN EXAMINATION 2018/2019**

TITLE OF PAPER : Organic reactions & synthesis

COURSE NUMBER : CHE 332

TIME : Three Hours

INSTRUCTIONS : Answer any **Four Questions**.

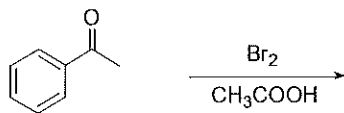
This Paper contains five (5) pages.

***You must not open this paper until the Chief
Invigilator so has granted permission to do.***

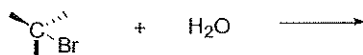
Question 1

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

(i)



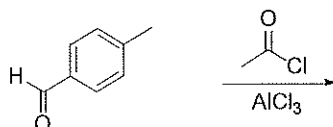
(ii)



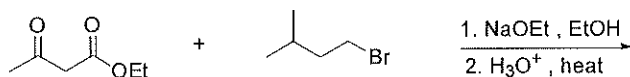
(iii)



(iv)



(v)



[10]

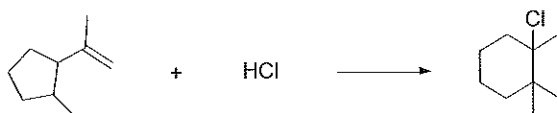
(b) Draw an energy diagram for each of the following.

- A one-step reaction that is fast and highly exergonic. [3]
- A two-step exergonic reaction whose second step has a higher-energy transition state than its first step. [6]
- The overall reaction of ethylene with HBr . [6]

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 intermediates 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]

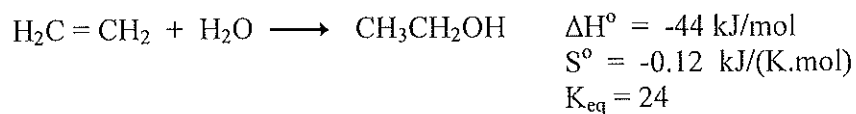
- (b) (i) The reaction of hydroxide ion with chloromethane to yield methanol and chloride ion is an example of a general reaction type called nucleophilic substitution reaction:



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]

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

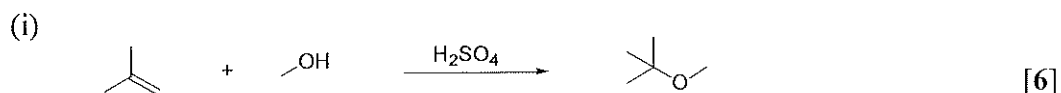


- (i) Is the reaction exothermic or endothermic?
 (ii) Is the reaction favorable (spontaneous) or unfavorable (nonspontaneous) at room temperature (298 K)?

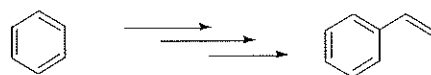
[7]

Question 3

- (a) Write the mechanism (using curved arrows) for each of the following reactions;



(b) Outline the sequence of reactions to carry out the following conversion.

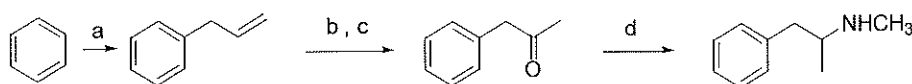


[12]

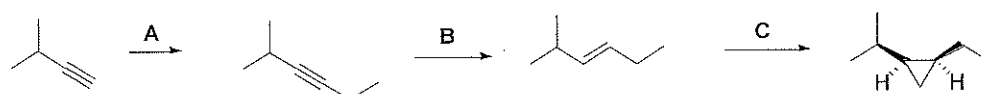
Question 4

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

[12]

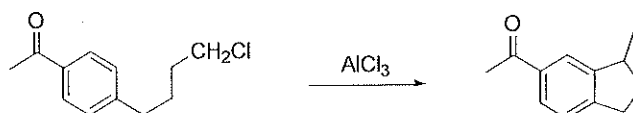


(b) Identify the reagents represented by the letters A-C in the following scheme.



[8]

(c) Propose a mechanism for the following reaction.

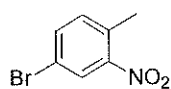


[5]

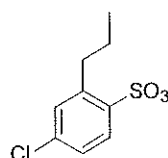
Question 5

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

[12]

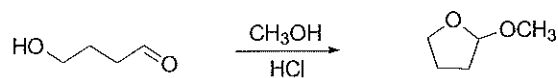


(i)



(ii)

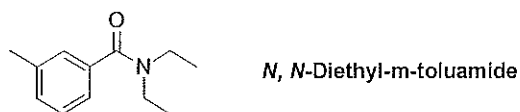
- (b) Discuss the Limitations of the Friedel-Crafts alkylation reaction. [8]
(c) Propose a mechanism for the following reaction.



[5]

Question 6

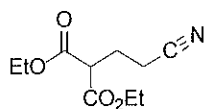
- (a) *N,N*-Diethyl-*m*-toluamide (DEET) is the active ingredient in many insect repellent preparations. How might you synthesize this substance from *m*-bromotoluene?



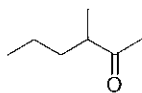
[10]

- (b) Use appropriate starting materials and reagents to synthesize the following compounds.
(Hint: Aldol reaction, Michael reaction and acetoacetic ester synthesis)

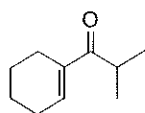
(i)



(ii)



(iii)



[15]