



FACULTY OF SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

NATIONAL DIPLOMA IN ANALYTICAL CHEMISTRY (4 years)

MODULE CET1BO3
 ORGANIC CHEMISTRY 2

CAMPUS DFC

NOVEMBER EXAMINATION

DATE: 17/11/2014

SESSION: 08:30 – 11:30

EXAMINER

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INTERNAL MODERATOR

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DURATION: 3 HOURS

MARKS: 140

NUMBER OF PAGES: 6

INSTRUCTIONS: ANSWER ALL QUESTIONS.

REQUIREMENT: ANSWER SCRIPT.

SECTION 1

ANSWER THIS SECTION IN YOUR ANSWER SCRIPT BY WRITING THE QUESTION NUMBER AND THE LETTER OF YOUR CHOICE. FOR EXAMPLE: 2. B

1. Sec-butyl is the name for which of the following alkyl groups?
 - A. $(\text{CH}_3)_2\text{CHCH}_2-$
 - B. $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)-$
 - C. $\text{CH}_3(\text{CH}_2)_2\text{CH}_2-$
 - D. $(\text{CH}_3)_3\text{C}-$
2. Which of the following contains only nucleophiles?
 - A. FeBr_3 ; Br^- ; I^- ; OH^-
 - B. H_2O ; BF_3 ; NO_2^+ ; H^+
 - C. HS^- ; H_2O ; NH_3 ; OH^-
 - D. AlCl_3 ; H_2O_2 ; Hg ; NH_3
3. The best reagent to use to produce propene from chloropropane is
 - A. sodium hydroxide
 - B. sodium ethoxide
 - C. sodium *t*-butoxide
 - D. any of the above
4. Which of the following compounds represents a geminal dihalide?
 - A. 1-chloro-1-iodobutane
 - B. 1-bromobutanol
 - C. 1,2-dibromobutane
 - D. chlorobutane and butane chloride
5. The reaction between propene and HBr is an example of
 - A. nucleophilic substitution
 - B. nucleophilic addition
 - C. electrophilic substitution
 - D. electrophilic addition
6. The following set of reagents leads to a Markovnikov reaction.
 - A. HBr
 - B. $\text{HCl}/\text{H}_2\text{O}_2$
 - C. $\text{Hg}(\text{OAc})_2/\text{THF}/\text{H}_2\text{O}$
 - D. All of the above
7. Dehydrohalogenation of vicinal dihalides may produce
 - A. alkenes
 - B. alkynes
 - C. either of the above
 - D. none of the above
8. Which of the following is **NOT** true of benzene?
 - A. Benzene tends to undergo substitution rather than addition reactions.
 - B. Benzene is more stable than the hypothetical compound 1,3,5-cyclohexatriene.
 - C. The C-C bonds of benzene are alternatively short and long.
 - D. Only one *o*-chlorobenzene exists.

9. Which reagent(s) would you use to prepare benzoic acid from ethylbenzene?
- A. $\text{HNO}_3/\text{H}_2\text{SO}_4$
 - B. (1) $\text{KMnO}_4/\text{OH}^-/\Delta$ (2) H_3O^+
 - C. $\text{SO}_3/\text{H}_2\text{SO}_4$
 - D. O_2
10. When preparing a Grignard reagent, the following may not be present:
- A. $-\text{OH}$
 - B. $-\text{NH}_2$
 - C. $-\text{C}\equiv\text{N}$
 - D. All of the above
11. The reaction between lithium di-sec-butylcuprate and isopentylbromide yields
- A. 2,5-dimethylheptane
 - B. 3,5-dimethylheptane
 - C. 2,6-dimethylheptane
 - D. 3,4-dimethylheptane
12. Which of the following reagents can be used as a laboratory test to distinguish between $\text{CH}_3\text{CH}_2\text{CHO}$ and CH_3COCH_3 ?
- A. Br_2/CCl_4
 - B. $\text{Ag}(\text{NH}_3)_2^+/\text{H}_2\text{O}$
 - C. LiAlH_4
 - D. $\text{Zn}/\text{Hg}/\text{HCl}$
13. The explosive impurities in ethers that contain an oxygen-oxygen bond are called
- A. peroxides
 - B. epoxides
 - C. oxides
 - D. oxyethers
14. Which of the following is a derivative of a carboxylic acid?
- A. Esters
 - B. Anhydrides
 - C. Amides
 - D. All of the above
15. Lithium aluminium hydride cannot be used to reduce a carboxylic acid to an aldehyde because
- A. it is an oxidizing agent
 - B. an alcohol will rather be formed
 - C. a ketone will be formed
 - D. carboxylic acids cannot be reduced
- [15 x 2 = 30]**
-

SECTION 2**QUESTION 1**

Complete the following sentences by writing only the number and the missing word(s), formula(e) or equation(s) in your answer script.

The reactivity of an organic compound depends on (1)____. The general reactions that organic compounds undergo can be classified as (2)____, (3)____ or (4)____.

A carbocation can be stabilized in three ways, namely (5)____, (6)____ and (7)____.

A cyanohydrin is a compound containing both a (8)____ and a (9)____ group.

An example of a polar protic solvent is (10)____. Such solvents are best for reactions following an (11)____ mechanism since the solvent stabilizes the (12)____ well.

For an E2 reaction to be successful the leaving groups must be anti coplanar. This means (13)____, as illustrated in the following Newman projection (14)____. The reasons for this are (15)____ and (16)____.

Some alkenes can exist as two geometric isomers called (17)____ and (18)____, respectively. These isomers have the same order of attachment of their atoms, but different (19)____. The following examples illustrate this: (20)____ and (21)____.

The intermediates formed during a homolytic reaction are called (22)____. The reaction between (23)____ and (24)____ is an example of a homolytic reaction.

The preparation of the least substituted alkene as major product follows the (25)____ rule. This reaction can be done by heating a basic solution of a (26)____.

Due to (27)____ and (28)____, Friedel-Crafts alkylation is not the ideal way of preparing propylbenzene. The better way is to do a (29)____, followed by (30)____.

To be aromatic, a compound or ion must comply with all of the following rules: (31)____, (32)____ and (33)____. An example of an aromatic compound is (34)____. An example of an aromatic ion is (35)____.

In the preparation of an organometallic compound the best solvent to use is (36)____ since (37)____ and (38)____.

Aldehydes and ketones contain the same functional group. However, (39)____ are more reactive due to (40)____ and (41)____.

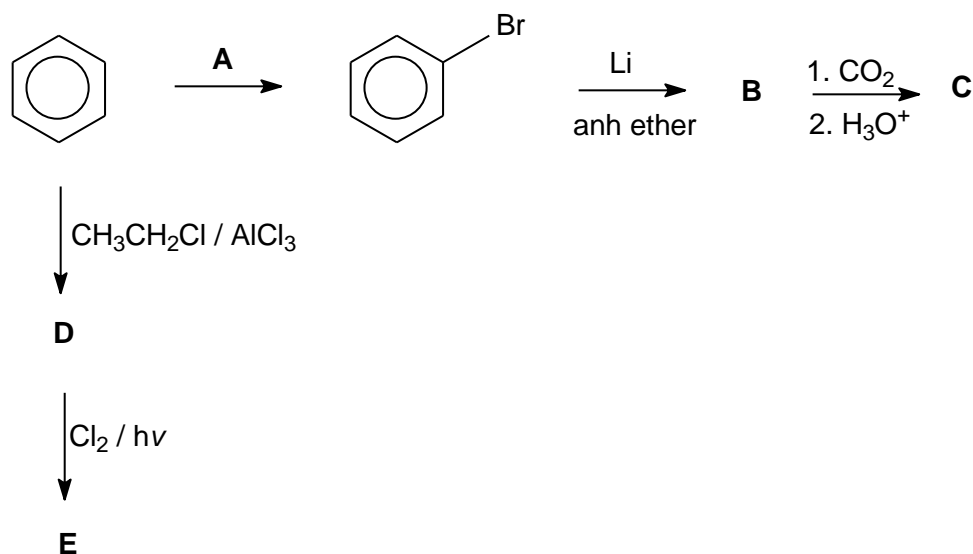
Carboxylic acids can be prepared from alkenes or alkynes using (42)____.

A specific derivative of a carboxylic acid may be prepared from another derivative provided that it is (43)____ reactive than the substrate. An example of such a reaction is (44)____.

[45]

QUESTION 2

- 2.1 Provide the missing reagents or major products (labeled **A** to **E**) for the following transformations. Write only the letter and the missing reagent/product in your answer script.



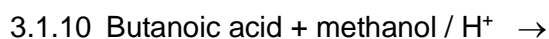
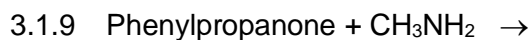
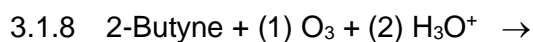
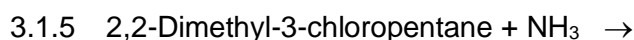
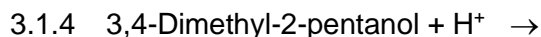
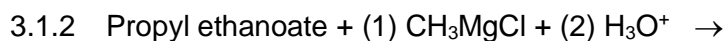
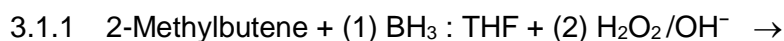
(5)

- 2.2 Classify the type of reaction that involves reagent **A**.

(2)

[7]**QUESTION 3**

- 3.1 Write equations representing each of the following reactions.



(20)

- 3.2 Use structural formulae to represent the mechanisms of the reactions that occur in Question 3.1.1, Question 3.1.4 **AND** Question 3.1.10, respectively.

(20)

[40]

QUESTION 4

- 4.1 Three unsaturated compounds (**A**, **B** and **C**) all have the formula C_6H_{10} . When **A** was oxidized with hot potassium permanganate and subsequently acidified, the only organic compound isolated was pentanoic acid. Similar oxidation of **B** yielded only propanoic acid, while similar treatment of **C** gave only an unsubstituted dioic acid. Determine the structures of **A**, **B** and **C**. (6)
- 4.2 Outline a synthetic scheme for the following transformations. More than one step may be required for each conversion. No mechanism is required.
- 4.2.1 Propyne \rightarrow 3-methylbutanal + ethanal (10)
- 4.2.2 Methanal \rightarrow hexane (7)

[23]

TOTAL MARKS = 145