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UNIVERSITY OF RUHUNA

FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME
FIRST BPHARM PART II EXAMINATION – AUGUST 2014
PH 1213: PHARMACEUTICAL CHEMISTRY II

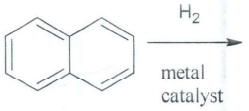
TIME: 03 HOURS

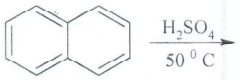
INSTRUCTIONS

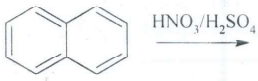
- Answer **all six (06)** questions.
- Do not use any correction fluid.
- Use illustrations where necessary.

01. Answer all parts

1.1 Draw the structural formulae for the possible products of the following reactions.

1.1.1 

1.1.2 

1.1.3 

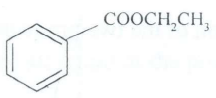
1.1.4 

oxidizing

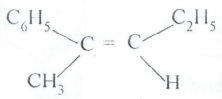
[30 marks]

1.2 Giving necessary **reducing** reagents and reaction conditions, draw the possible structures for the products.

1.2.1 

1.2.2 

1.2.3 CH_3-CH_2-CHO

1.2.4 

[40 marks]

1.3 Give a suitable mechanism for the following Claisen-Schimdt reaction.

$$C_6H_5CHO + CH_3COCH_3 \xrightarrow{OH^-}$$

[30 marks]

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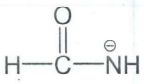
02. Answer all parts

2.1

2.1.1 Of the following molecules /ions which are more stable?

(A) 

(B) 

(C) 

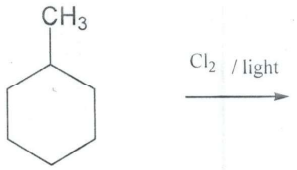
(D) 

[10 marks]

2.1.2 Giving necessary structures explain your answer above in 2.1.1.

[15 marks]

2.2 Consider the two reactions given below:

(E) 

(F) 

2.2.1 Of the above two reactions, which one is faster?

[08 marks]

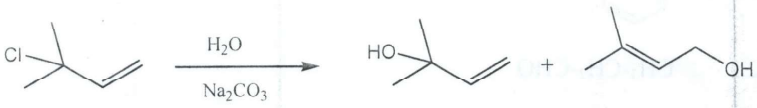
2.2.2 Draw the structure of the product(s) formed in the fast reaction according to your answe above.

[12 marks]

2.2.3 Giving appropriate mechanism, explain why the above mentioned reaction is faster.

[10 marks]

2.3 Giving necessary structures, explain the formation of the two products in the reaction below:



[25 marks]

2.4

2.4.1 What it meant by resonance energy of benzene?

[08 marks]

2.4.2 Using approprate structures, explain why cycloheptatrienyl cation is more stable than cycloheptatriene.

[12 marks]

(12)

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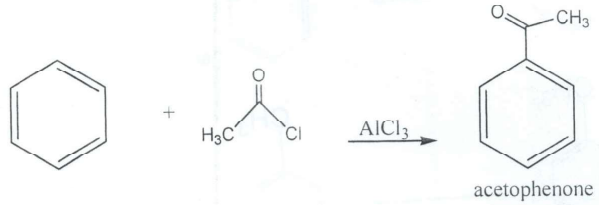
03. Answer all parts

3.1

3.1.1 Explain briefly why aromatic compounds generally undergo electrophilic substitution reactions.

[10 marks]

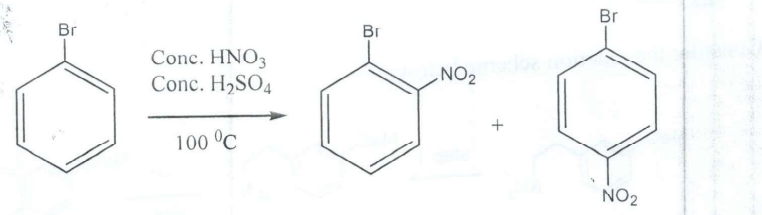
3.1.2 Write down the complete mechanism for the following conversion.



acetophenone

[15 marks]

3.2 Consider the following reaction of nitration of bromobenzene;



bromobenzene 2-nitrobromobenzene 4-nitrobromobenzene

Using electronic effects explain why:

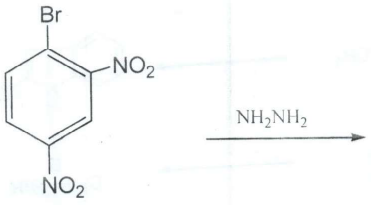
3.2.1 bromobenzene needs strong conditions for the nitration.

3.2.2 only 2-nitrobromobenzene and 4-nitrobromobenzene are formed.

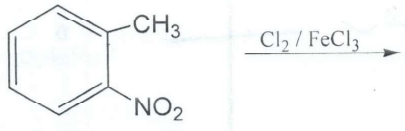
[25 marks]

3.3 Draw the structure of the product(s) formed in the following reactions:

3.3.1



3.3.2



[20 marks]

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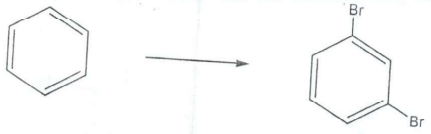
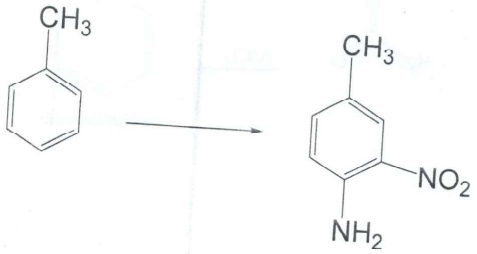
3.4 Indicating reagents, reactions conditions and intermediates, show how you would carry out following conversions.

3.4.1 

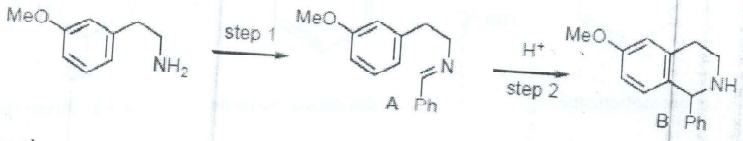
3.4.2 

3.4.3 

[30 marks]

04. Answer **all** parts

4.1 Consider the reaction scheme below:



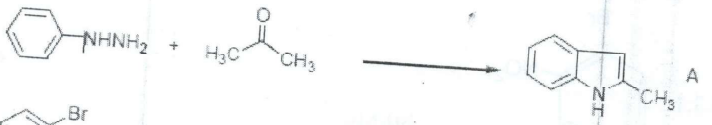
4.1.1 Give the reactant and reagent needed in step 1.

4.1.2 Show the mechanism for step 2.

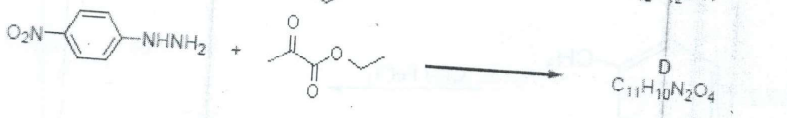
4.1.3 In step 2 an alternative product to **B** may be formed in theory. Draw this product and explain why it is not formed in practice.

[30 marks]

4.2 In the Fischer indole synthesis acetone and phenylhydrazine ($PhNHNH_2$) react to give 2-methylindole (**A**). Using this example predict the structures of the products **B**, and **D**.

4.2.1 

4.2.2 

4.2.3 

[20 marks]

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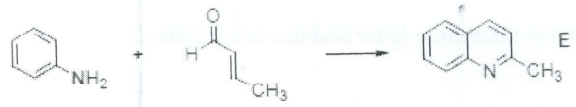
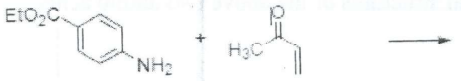
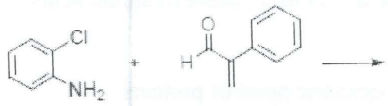
4.3 Given that in the Doebner-von Miller quinoline synthesis *trans*-but-2-enal and aniline react to give 2-methylquinoline (**E**), predict the products **F** and **G**.

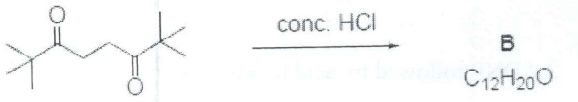
4.3.1 

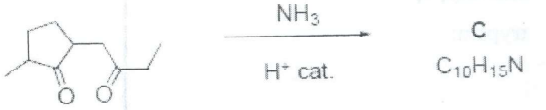
4.3.2 

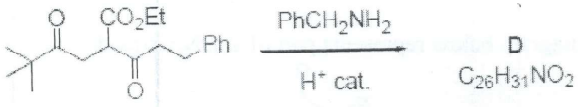
4.3.3 

[20 marks]

4.4 Give the structure of the unknown products **B**, **C**, and **D** of the following reactions:

4.4.1 

4.4.2 

4.4.3 

[30 marks]

05. Answer <u>all</u> parts

5.1

5.1.1 Giving structures, explain the threo and erythro forms of sugars.

[04marks]

5.1.2 What is meant by mutarotation pertaining to sugars?

[04marks]

5.1.3 Write down a chemical reaction which can be used to protect the anomeric OH of glucose.

[04marks]

5.1.4 Sorbitol has a high commercial value in food industry as well as in manufacturing of toothpaste. Give a chemical method to prepare sorbitol from glucose.

[04marks]

5.1.5 "Although cellulose belongs to the family of carbohydrates, it is a very hard material present in plants". Explain this statement.

[04marks]

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5.2

5.2.1 Name two α-amino acids having more than one amino group.

[02marks]

5.2.2 Give their three-letter and one-letter codes.

[04marks]

5.2.3 Draw the chemical structures of the above two amino acids.

[06marks]

5.2.4 Explain briefly the amphoteric nature of amino acids.

[04marks]

5.2.5 Define the term isoelectric point of proteins.

[04marks]

5.3 The octapeptide **P** with the amino acid sequence of Ala-Lys-Phe-Glu-Gly-Tyr-Arg-Leu was subjected to the following treatments. Derive the product(s) obtained after each treatment with:

5.3.1 *2,4* DNP followed by acid hydrolysis;

5.3.2 chymotrypsin;

5.3.3 carboxypeptidase;

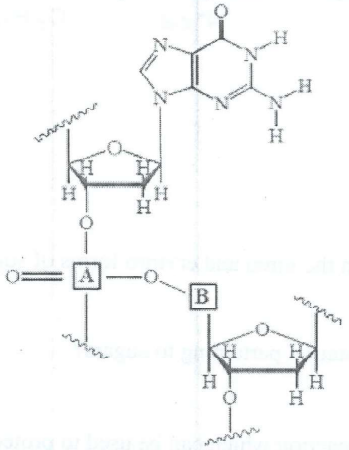
5.3.4 trypsin;

[20 marks]

5.4 Draw the structures of the organic products formed when dAMP is hydrolyzed with acid.

[10 marks]

5.5 The diagram below represents part of a DNA strand



5.5.1 Identify the atoms represented by **A** and **B**

5.5.2 Indicate the anomeric carbon atom(s)

5.5.3 Indicate the N-glycosidic and the phophodiester bonds

5.5.4 Number the both purine ring and the sugar unit

5.5.5 Draw structure and name the base that is complementary to the base shown.

[30 marks]

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06. Answer all parts

6.1 Explain the following observations:

6.1.1 *p*-Nitrophenol (*pKa*=7.15) is a stronger acid than *m*-nitrophenol (*pKa*=8.28).

6.1.2 cyclopetadiene (*pKa*= 15) is more acidic than cyclopentene (*pKa*= 40).

6.1.3 Pyridine (*pKa*=5.2) is a weaker base than piperidine (*pKa*=11.2).

[15 marks]

6.2 Complete each of the following acid-base reactions and indicate whether the equilibrium is favored to the right or left.

6.2.1 $CH_3SH + NaOH \rightleftharpoons$

6.2.2 $CH_3CH_2ONa + CH{\equiv}CH \rightleftharpoons$

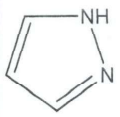
6.2.3 $CH_3OH + KOtBu \rightleftharpoons$

6.2.4 $HF + NH_3 \rightleftharpoons$

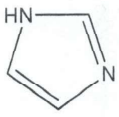
[15 marks]

6.3

6.3.1 Explain why imidazole is a stronger base than pyrazole



pyrazole



imidazole

6.3.2 The two nitrogen of atoms of imidazole are quite different. Which nitrogen is protonated in acidic medium?

[20 marks]

6.4 Identify physical and chemical factors affecting the biodegradation of polymers.

[10 marks]

6.5 Identify the primary mechanisms, by which active agents can be released from a polymer drug delivery system.

[10 marks]

6.6 Draw a rough sketch to show in a macroscopic scale the release of the active agent in the polymer matrix.

[10 marks]

6.7 Show the typical variation of (i) melting point(s) and (ii) solubility in water with the chain length of fatty acids in a plot.

[05 marks]

6.8 Show a typical variation of melting points with the number of double bonds present in fatty acids in a typical plot.

[05 marks]

6.9 Briefly discuss the significance of *omega fatty acids* in diets.

[10 marks]

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