NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF TEXTILE TECHNOLOGY
END OF SEMESTER EXAMINATIONS : MAY 2005
TEXTILE DYEING II : TXT 2216

TIME : THREE (3) HOURS

INSTRUCTION TO CANDIDATES:

Answer ***ANY FIVE*** questions. Each question carries 20 Marks.
Show mechanism, chemical steps or synthesis by means of curved arrows.
Draw structure(s), if necessary to explain your reasoning.

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1. (a) Write the reaction mechanism for the reaction of nitration of benzene.
(5 Marks)

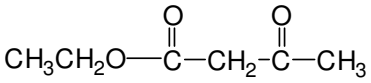
   (b) Why is resorcinol, in preference to phenol used as a coupling component in the manufacture of azo dyes? Use chemical equations to explain your reasoning.
(15 Marks)

2. (a) Comment on why naphthalene derivatives are more useful coupling components in azo dye chemistry than benzene derivatives.
(10 Marks)

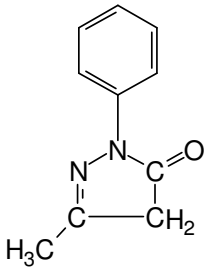
   (b) You are provided with the following reagents:

   Nitrating agent (NO_2^+), Fe/HCl, $NaNO_2$/HCl, Na_2SO_3 , NaOH, dil HCl,
   You can use any other reagents which are not listed.

   You are also given benzene and ethyl acetoacetate



   Synthesise: 3-methyl-1-phenyl-5-pyrazolone and its enol form.



(10 Marks)

3. (a) With the aid of appropriate diagrams outline the industrial manufacture of Tobias acid.

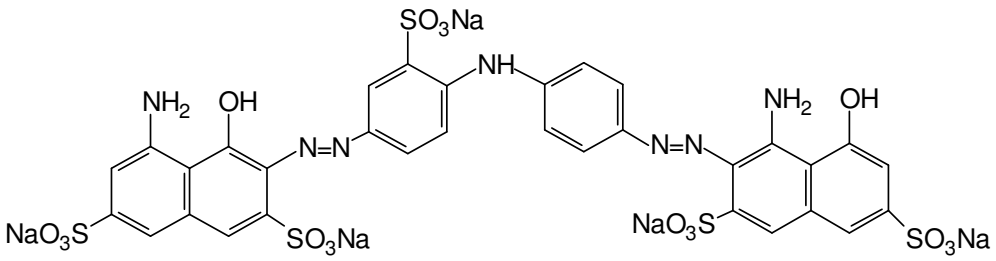
(8 Marks)

(b) In Winther's formula, what do the following symbols stand for?

A, E, M, D and Z

(5 Marks)

(c) Identify Winther's formula for the following dye and write the structure of each component.



(3 Marks)

(d) What is the difference between unit process and unit operation. Give one example of each.

(4 Marks)

4. (a) Generally the diazonium component is coupled with aminonaphthols in acidic conditions and then in alkaline conditions. Explain your reasoning with the aid of chemical equations.

(6 Marks)

(b) "In azoic dyes, the diazonium salt is coupled with anilide derivatives of β-naphthol. This coupled component is found to be more suitable for dyeing than β–naphthol". Explain.

(6 Marks)

(c) In the diazotization process, why is excess hydrochloric acid added?
Why is the reaction generally carried out at low temperature?
Use chemical equations for your answer.

(8 Marks)

5. (a) (i) Amino-J acid is an important azo dye intermediate. It was formerly made from
2- naphthyl amine. But now this acid is made from β-naphthol.
Synthesise Amino-J acid from β-naphthol,

You may require the following reagents:
Oleum, $(NH_4)SO_3$, steam or any other reagents you may require.

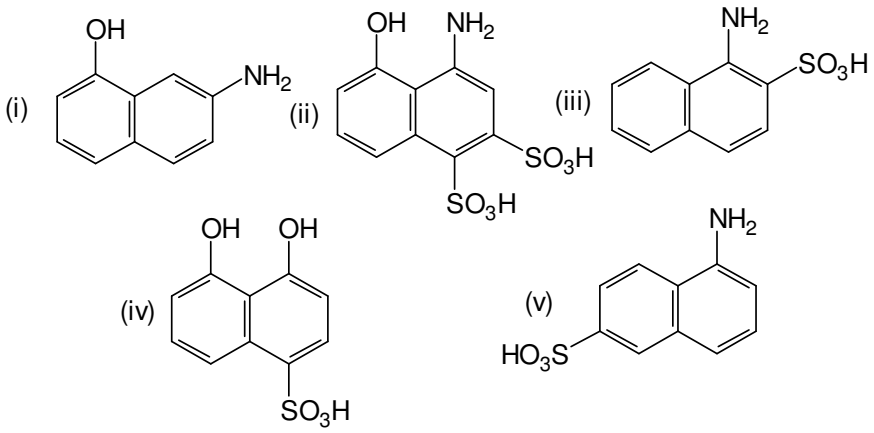
(10 Marks)

(ii) Why is β-naphthol and not 2-naphthyl amine used to manufacture

Amino - J acid?

(2 Marks)

(b) State the conditions and indicate the positions by an arrow where the following intermediates will couple during dye manufacturing.



(8 Marks)

6. (a) Write reaction mechanism for the synthesis of anthraquinone from phthalic anhydride and benzene. Use reagents of your choice.

(8 Marks)

(b) Direct Blue 71 (chlorantine Fast Blue GL2) has Winther's formula as follows:

$$A \longrightarrow M \longrightarrow M' \longrightarrow E$$

You are given 1-naphthyl amine, cleve's acid (1-amino naphthalene-7-sulphonic acid), 3-amino-1,5-naphthalene disulphonic acid, J acid, acidic and alkaline solutions.

Draw the structure of Direct Blue 71.

(8 Marks)

(c) State the Armstrong and Wynne rule for sulphonation.

(4 Marks)

**********END OF EXAMINATION PAPER**********