

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF TEXTILE TECHNOLOGY

END OF SECOND SEMESTER EXAMINATIONS - AUGUST 2009

TXT 1214 - TEXTILE CHEMISTRY

TIME: 3HOURS

INSTRUCTIONS

Answer **TWO** questions from **Section A** and **ANY THREE** questions from **Section B**.
Each question carries **20 marks**.

Section A – (Physical Chemistry of Dyeing)

QUESTION 1

- (a) Explain why physical chemistry is essential in the understanding of dyeing and printing. (6)
- (b) Draw a diagram showing a model which is thought to take place at dye-fibre interface. (10)
- (c) State Gibbs adsorption equation. (4)

QUESTION 2

“The ability of a given dye to adsorb into a fibre from its solution can be studied by consideration of the dye’s affinity.” Define affinity.

In thermodynamic terms how would you express affinity? Explain the terms used. (20)

QUESTION 3

What do you understand by the term diffusion and what factors influence the rate of diffusion into a substrate. State and explain Fick’s Laws of diffusion. (20)

Section B (Dye intermediates and chemistry of dyes)

QUESTION 4

- (a) Explain the two methods of classifying dyes giving relevant examples to support your explanations. (4)
- (b) Explain four methods by which dyes attach to the fibre substrates. Support your answer by sighting relevant examples. (10)
- (c) What do you understand by the following terms: chromophore, auxochrome. Give examples of two dye structures to illustrate your understanding. (6)

QUESTION 5

- (a) Draw structures of the following dyes showing the different dye components: indigoid, triphenyl-methane, vat, direct and reactive. For each structure state the chromophore type. (10)
- (b) State conditions and indicate the positions by an arrow where the following intermediates will couple during dye manufacturing. (10)

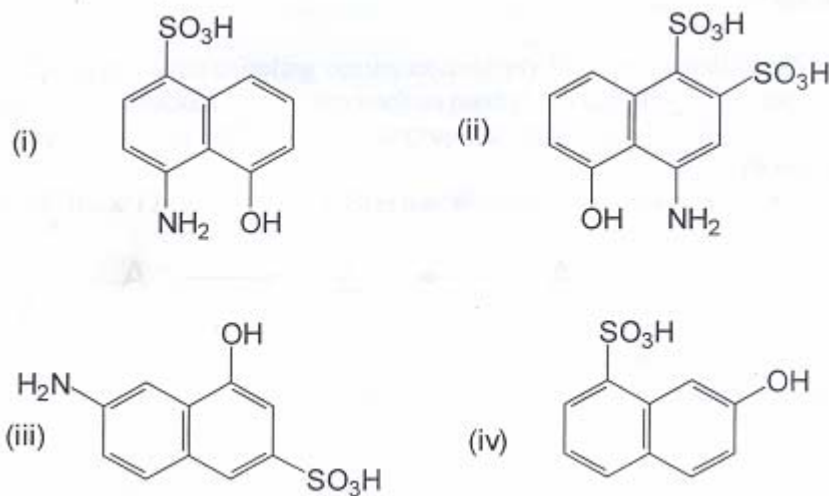


Figure 1

QUESTION 6

- (a) In Winther's formula, what do the following symbols: **A, E, M, D and Z** stand for? (5)
- (b) The structure of Diamond Black is as follows. Identify Winther's formula and write the structure of each component. (5)

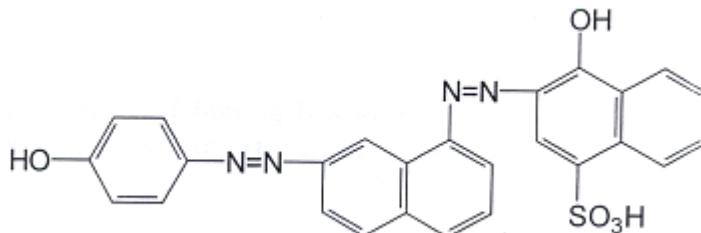


Figure 2

- (c) Outline the synthesis of 1-amino-8-hydroxy-naphthalene-3,6-disulphonic acid, from naphthalene, indicate the reagents and conditions required at each step in the sequence. What is the common name of this dye intermediate? (10)

QUESTION 7

- (a) Show the diazotization of aniline with sodium nitrite and hydrochloric acid. Give reasons for using excess acid in this reaction. (4)
- (b) With the aid of relevant structures outline the synthetic steps for producing an azoic dye, clearly indicating the conditions required during the synthesis. State the colour of the azoic dye you have produced and specify the dye using Winther's formula. (7)
- (b) For the dyes shown in Figure 3 (attached), identify:
- Chromophore type
 - Chemical and application class of dye
 - type of substrate that the dye is applicable to. (9)

END OF QUESTION PAPER

