

**THE SOCIETY OF DYERS AND COLOURISTS
PERKIN HOUSE, 82 GRATTAN ROAD
BRADFORD BD1 2JB**

EXAMINATION FOR THE ASSOCIATESHIP (ASDC) 2006

PAPER 1

**Theories of Colour
Colour Assessment and Measurement
Relation of Colour to Constitution**

10.30am – 1.45pm Monday 8 May 2006

(Note: Candidate must not commence writing until 10.45am but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets, the maximum marks for each question are 20.)

Candidates are required to answer FIVE questions, begin each question on a separate sheet

1. (a) Describe the scientific principles on which instrumental recipe prediction systems are based. [12]
(b) Outline the major features of an instrumental recipe prediction system. [8]

2. (a) Describe the major components of a modern reflectance spectrophotometer suitable for the colour measurement of fabric samples. [8]
(b) Outline the advantages and disadvantages of using a reflectance spectrophotometer for measuring the colour of surfaces. [8]
(c) State the instrumental and other factors that should be recorded to enable the colour measurement to be reproduced at another site with a similar design of reflectance spectrophotometer. [4]

3. (a) Discuss the advantages and disadvantages for pass/fail colour assessments of materials, of using an instrumental method with a colour-difference formulae compared to visual assessment by an experienced colourist. [10]
(b) Describe how the generalised colour-difference equations, such as CMC and CIE DE2000, differ from the CIELAB colour-difference equation. [10]

4. (a) Give an account of the essential features of the CIE XYZ system of colour specification. [10]
- (b) Explain why there are two types of Standard Observer in the CIE system of colour specification [4]
- (c) Define what is meant by *dominant wavelength*, *excitation purity* and *complementary dominant wavelength*. Illustrate your answer with a drawing of the CIE chromaticity diagram. [6]
5. (a) Describe the NCS colour order system and the method of use of an NCS colour atlas for determining a colour specification for a fabric sample. [12]
- (b) State the advantages and disadvantages of a colour order system based method of colour specification, such as NCS, over other methods of specifying colour. [8]
6. (a) Sketch a typical spectral reflectance curve for the surface of a dyed or pigmented material with each of the following colours:
 (i) bright yellow;
 (ii) pink;
 (iii) brown;
 (iv) dark grey;
 (v) medium blue. [10]
- (b) Suggest a possible set of CIE $L^*a^*b^*$ values for each of these surfaces. [5]
- (c) State the hues that would normally be obtained for additive mixtures and for subtractive mixtures of:
 (i) red plus green;
 (ii) red plus yellow plus blue;
 (iii) blue plus yellow. [5]

7. The CIE $L^*a^*b^*$ coordinates for five coloured surfaces are given in the table below:

Surface	L^*	a^*	b^*
A (standard)	60.2	2.3	10.7
B (batch)	57.8	2.5	11.7
C (standard)	42.3	-20.5	-2.6
D (batch)	43.4	-18.1	-5.0
E	86.9	1.9	17.2

- (a) Describe, in visual terms, the colour of surfaces A, C and E. [8]
- (b) Calculate C^* and h° for surfaces A, C and E. [6]
- (c) Calculate the colour difference (ΔE^*) between surfaces A and B, and between surfaces C and D. Express the colour differences in visual terms. [6]

8. (a) Define the terms *absorbance* and *molar extinction coefficient*. [3]
- (b) Describe Lambert's Law and Beer's Law. The answer should include the mathematical relationships and a definition of any terms used. [8]
- (c) Explain why, in practice, the results from measurements of the absorbance of dye solutions may show deviations from these laws. [9]
9. (a) Explain what is meant by the terms *metamerism* and *colour constancy*, carefully distinguishing between the two. [8]
- (b) Discuss a practical situation where metamerism is important. [4]
- (c) Describe a method for the quantitative assessment of metamerism. [8]
10. Write an essay on ONE of the following topics:
- (a) Theories of Colour Vision. [20]
- (b) Colour Communication. [20]
- (c) Colour Appearance Models. [20]

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EXAMINATION FOR THE ASSOCIATESHIP (ASDC) 2006

PAPER 2

**Chemistry (Structural and Physical) of Dyes, Pigments and Auxiliary Chemical
Used in Technological Processes.**

9.15am – 12.30pm Tuesday 9 May 2006

(Note: Candidate must not commence writing until 2.00pm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets, the maximum marks for each question are 20.)

Candidates are required to answer FIVE questions, begin each question on a separate sheet

1. Explain what is meant by “emulsification” and “solubilisation” with respect to organic substances in aqueous media. [6]

Explain the concept and usefulness of the HLB scale. [6]

It is required to emulsify the organic substance **X** (which has HLB = 10) in water. The following three non-ionic surfactants are available:-
A (HLB = 4), **B** (HLB = 9.5), **C** (HLB = 13)
Indicate how these surfactants, either singly or in combination, would best be expected to effect the emulsification of **X**. [8]
2. State the optimum pH value and the active chemical species believed to be responsible for bleaching when (a) hydrogen peroxide, (b) sodium hypochlorite and (c) sodium chlorite are used for bleaching cotton. [12]

Discuss the environmental impact of these three agents. [8]
3. Describe the chemical structural features of typical non-ionic surfactants. [8]

Explain how the solubilising moiety (with respect to water) in these agents differs from those in other types of surfactant. [6]

Briefly describe the properties and uses of non-ionic surfactants. [6]
4. Describe the chemical structure and mode of reaction of reactive dyes specifically produced for the dyeing of wool. [10]

Describe the structure and function of the surfactant auxiliaries that are necessary in the application of these dyes. [6]

Outline a typical dyeing procedure. [4]

5. Explain in detail the processes of diazotisation and coupling. [11]

Show how these processes can be used to produce:-

- (i) monoazo colorants [3]
- (ii) disazo colorants [3]
- (iii) trisazo colorants [3]

6. Describe the structural features of **yellow** and **red** azo pigments. [14]

Explain what is meant by "blooming" with respect to the use of pigments in plastics and indicate how it can be minimised. [6]

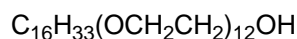
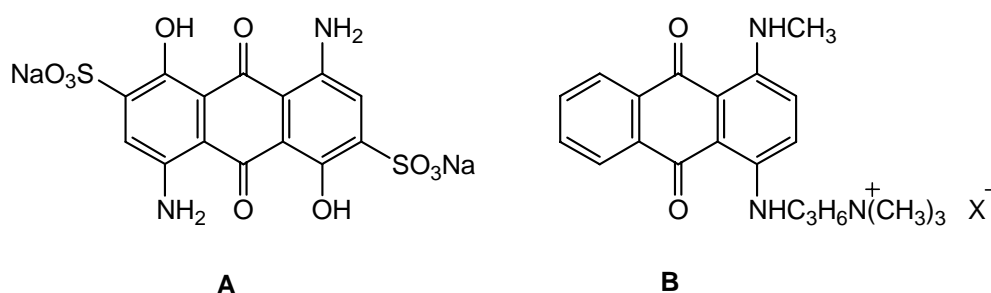
7. Compare and contrast the structural features and dyeing properties of acid and direct dyes. [20]

8. Describe and explain the chemical structures of disperse dyes. [14]

Explain the function of dispersing agents in the manufacture and application of these dyes. [6]

9. Describe how 1,3-diphenylpyrazolines can provide fluorescent brightening agents for polyester, nylon and acrylic fibres [20]

10. The dyes **A** and **B**, together with the auxiliary **C**, are used to dye fabric **D** in a one-bath process:-



C

- (i) Identify the dye application types of **A** and **B**. [6]
- (ii) Indicate the type and purpose of the auxiliary **C**. [4]
- (iii) Indicate the probable nature of fabric **D**. [2]
- (iv) Explain the problems inherent in a one-bath process of this type and outline a technically better process. [8]

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EXAMINATION FOR THE ASSOCIATESHIP (ASDC) 2006

PAPER 3

Chemistry (Structural and Physical) of Polymers.

1.45pm – 5.00pm Tuesday 16 May 2006

(Note: Candidate must not commence writing until 2.00pm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets, the maximum marks for each question are 20.)

Candidates are required to answer FIVE questions, begin each question on a separate sheet

1. Explain in detail the processes of:
- (i) ionic polymerisation [10]
 - (ii) co-ordination polymerisation [10]

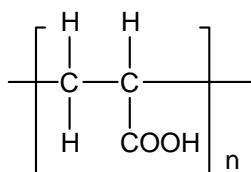
2. Explain the concept of solubility parameters with respect to the dissolution of polymers. [8]

An amorphous non-polar polymer has a solubility parameter of 9.1. Using the table below, comment on the probabilities of dissolving the polymer in:

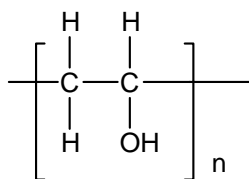
- (i) just one of the liquids [3]
- (ii) a mixture of A and B [3]
- (iii) a mixture of A and C [3]
- (iv) a mixture of A and D [3]

Non-polar liquids	Solubility parameter
A	7.3
B	9.4
C	10.9
D	15.5

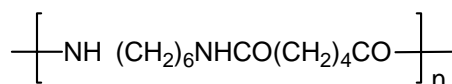
3. Identify the following polymers, explain how they are synthesised and briefly state some of their uses. [5 marks for each polymer]



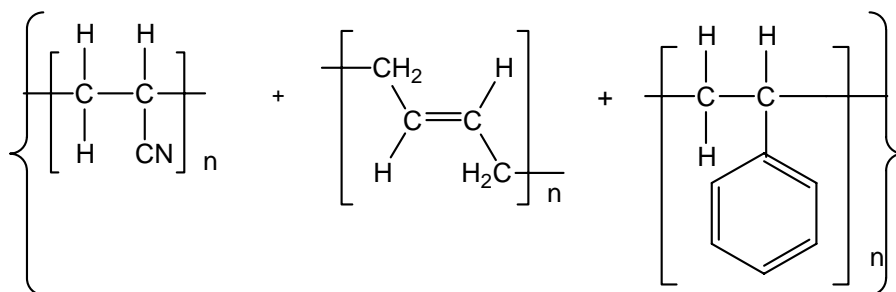
A



B



C



D

4. Describe in detail the synthesis of poly(tetrafluoroethylene). [12]

Describe its properties and uses. [8]

5. Describe the synthesis of poly(propylene) [7]

Explain the differences between atactic poly(propylene) and isotactic poly(propylene) with respect to their production and properties. [7]

A sample of poly(propylene) has a RMM of 200,000. In demonstrating the relative length of a molecule of this polymer by using paper clips to represent the repeat unit, calculate how many paper clips would be needed. [6]

6. Explain the main effects of crosslinking on an otherwise linear polymer. [5]

Explain why and how crosslinks are introduced in the production of:-

- (i) elastomers [5]
- (ii) polyester resins [5]
- (iii) urea-formaldehyde resins [5]

7. Describe the chemical structure of protein with respect to wool. [10]

Discuss the similarities and differences between the chemical structures of wool and synthetic polyamides. [10]

8. Discuss the environmental impact of synthetic polymers. [10]

Describe steps that can be taken to minimise this impact. [10]

9. Describe the synthesis and uses of:-
either (i) epoxy polymers
or (ii) silicone polymers [20]

10. Describe in detail the characteristics of step (condensation) polymerisation. [10]

Outline **TWO** examples of the synthesis of step (condensation) polymers.
[5 marks for each]

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EXAMINATION FOR THE ASSOCIATESHIP (ASDC) 2006

PAPER E

Industrial Organisation and Management

10.30am – 1.45pm Monday 15 May 2006

(Note: Candidate must not commence writing until 10.45am but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets, the maximum marks for each question are 20.)

Candidates are required to answer FIVE questions, begin each question on a separate sheet

1. Write a job description for the quality control manager of a company involved in coloration, with particular reference to his/her most important responsibilities. [20]
2. Discuss the recruitment and training of graduates in a company involved in coloration. [20]
3. Review the plans and actions that would be needed in order to reduce the production costs in a dyeing and finishing company. [20]
4. Write an essay on the importance of the relationship between maintaining a high standard of customer service and achieving competitive success. [20]
5. Discuss the most important aspects of financial management for the manager of a manufacturing company of your choice. [20]
6. Outline all the key factors that you would consider during the planning stage of a new dyeing and finishing plant on a greenfield site (unused). [20]
7. Write an essay on the role of marketing in a manufacturing company. [20]
8. Discuss the importance of information technology (IT) to the manufacturing industry of the 21st century. [20]
9. Write an essay on the importance of planned maintenance in the dyeing and finishing industry, including reference to the particular difficulties faced by a commission (horizontal) dyeing and finishing company. [20]
10. Write an essay on the present and future value of academic qualifications to the coloration industry. [20]