

## Examination for the Associateship (ASDC) 2010

### Paper 1: Theories of colour; colour assessment and measurement; relation of colour to constitution

hh:mm–hh:mm Monday 10th May 2010

(NOTE: Candidates must not commence writing until hh:mm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets; the maximum mark for each question is 20.)

(Candidates are required to answer **FIVE** questions only. Begin each question on a **separate** sheet.)

Candidates may use calculators. Graph paper will be provided. CIE chromaticity diagram graph paper will be provided.

1. Outline the principles underlying instrumental colour-match prediction systems. [13]  
  
Describe how such systems can be used to produce recipes with desirable qualities such as a low degree of metamerism and a low cost. [7]
2. Describe the main components of a modern reflectance spectrophotometer suitable for the colour measurement of fabric samples. [10]  
  
Describe the steps that you would take to ensure that reliable results were obtained for one specific application of your choice. [5]  
  
Discuss the particular features required for such an instrument to provide satisfactory results for fluorescent materials. [5]
3. Give an account of the development of colour-difference formulae since 1976. [12]  
  
Discuss the advantages and disadvantages of colour-difference formulae in pass/fail assessments. [8]
4. Two colours, A and B, have the following tristimulus values under illuminant D65 (Table 4-1).

Table 4-1 CIE tristimulus values for surfaces A and B

	Tristimulus values		
	X	Y	Z
Colour A	50	55	10
Colour B	12	20	15

Give an approximate description of the surface colours A and B. [4]

Calculate the chromaticity coordinates of colours A and B. [4]

Define what is meant by dominant wavelength, excitation purity and complementary dominant wavelength. [6]

Evaluate the dominant wavelength and excitation purity of surface colours A and B by plotting them on the CIE Chromaticity diagram. [6]

5. (a) Define the following terms in relation to colour: [8]

- (i) hue;
- (ii) strength or depth;
- (iii) brightness or dullness.

(b) Describe the build-up of dyes on a textile substrate. Assuming that the textile substrate is white discuss the build-up of dyes applied at increasing concentrations. Use  $L^*C^*$  and  $a^*b^*$  diagrams to illustrate your answer. [12]

6. (a) Sketch possible spectral reflectance curves for the following coloured surfaces: [10]

- (i) red-orange;
- (ii) dark green;
- (iii) medium yellow;
- (iv) brown;
- (v) dark blue.

(b) Suggest possible sets of CIE  $L^*$ ,  $a^*$  and  $b^*$  values for each of these surfaces. [5]

(c) State which hues you would expect for both additive and subtractive mixtures of: [5]

- (i) yellow plus blue;
- (ii) Red plus yellow plus blue;
- (iii) Red plus yellow.

7. (a) The CIE  $L^*a^*b^*$  (1976) coordinates for four coloured surfaces are given in table 7-1 below:

Table 7-1  $L^*$ ,  $a^*$ ,  $b^*$  values for samples A, B, C and D.

Surface	$L^*$	$a^*$	$b^*$
A (standard)	61.5	34.5	62.8
B (batch)	61.0	35.0	62.0
C (standard)	31.7	26.5	-7.6
D (batch)	34.0	25.9	-8.0

Describe the colour of samples A and C. [6]

Calculate  $C_{ab}^*$  for and  $h_{ab}^o$  for samples A and C. [4]

Calculate the colour difference ( $\Delta E_{ab}^*$ ) between samples A and B. [4]

Calculate the colour difference ( $\Delta E_{94}^*$ ) between samples A and B. [6]

8. Define the terms *absorbance* and *molar extinction coefficient*. [4]
- Calculate the absorbance of materials that transmit (a) 50%, (b) 20% of the incident monochromatic radiation. [4]
- Describe Beer–Lambert Law. Your answer should include any relevant mathematical relationships and a definition of all terms used. [8]
- Briefly explain the difference between simple- and complex-subtractive mixing. [4]
9. Explain what is meant by the terms *metamerism* and *colour constancy*, carefully distinguishing between the two. [7]
- Discuss practical situations in which **each** is important. [7]
- Outline the problems involved in quantifying *metamerism*. [6]
10. Describe **two** of the following (each has ten marks): [20]
- the CIE whiteness formula;
  - theories of human colour vision;
  - the relationship between the chemical structure of a dye and its colour.

## Examination for the Associateship (ASDC) 2010

### Paper 2: Chemistry (structural and physical) of dyes, pigments and auxiliary chemicals used in technological processes

hh:mm–hh:mm Tuesday 11th May 2010

(NOTE: Candidates must not commence writing until hh:mm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets; the maximum mark for each question is 20.)

(Candidates are required to answer **FIVE** questions only. Begin each question on a **separate** sheet.)

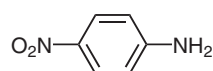
1. Discuss the role of sulphur in the structure of colorants. [20]

2. Describe the various chemical groups used to confer aqueous solubility on dyes of different application classes. [12]

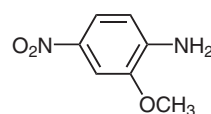
Explain briefly how the degree of solubility of these dyes can be controlled. [4]

Describe the chemical groups which confer on disperse dyes the micro-solubility which is required for their effective application. [4]

3.



**A**

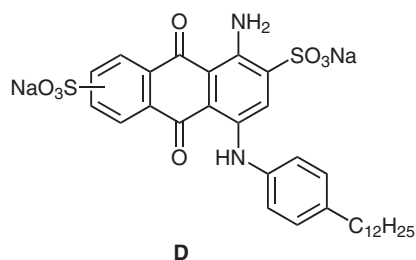


**B**

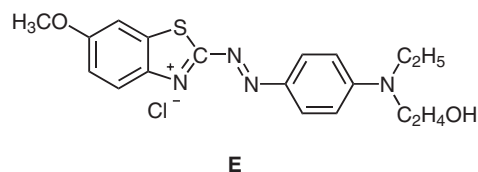
Show how products **A** and **B** can be used to produce a monoazo dye **C**, indicating the reagents and general reaction conditions required. [14]

Suggest how **C** could be converted into a disazo dye. [6]

4. The blue dyes **D** and **E** are to be used for the dyeing of fabric **F**.



**D**



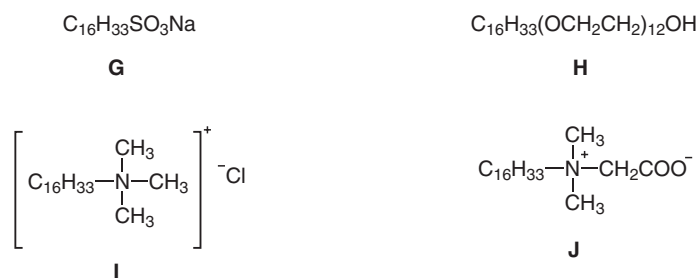
**E**

Identify the chemical and dye application types of **D** and **E**. [6]

Indicate the probable nature of fabric **F**. [2]

Explain what would be the major problem in applying these dyes together and suggest possible solutions for their successful application, paying particular attention to the auxiliaries needed. [12]

5. Compare the properties of products **G**, **H**, **I** and **J**. [10]



Describe typical uses of these products in textile wet processing and comment on their environmental acceptability. [10]

6. Give an account of the chemistry of reactive dyes with particular reference to the various types of reactive groups. [20]

7. Explain the following:  
(a) the differences between dyes and pigments. [6]

(b) why disperse dyes are considered to be dyes rather than pigments despite being substantially insoluble in water. [6]

Describe, with chemical equations, how pigments (as azoic combinations) are synthesised on cotton. [8]

8. Explain, with examples, the structural features of fluorescent brightening agents that are particularly appropriate for use on the following fibres:  
(a) cellulose acetate or polyester [5]  
(b) cellulose [5]  
(c) nylon or wool [5]  
(d) acrylic [5]

9. Write an essay on the chemistry and use of enzymes in textile processing. [20]

10. *Either:*  
Describe the structural features of yellow and red azo pigments. [14]

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

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

## Examination for the Associateship (ASDC) 2010

### Paper 3: Chemistry (structural and physical) of polymers

hh:mm–hh:mm Monday 17th May 2010

(NOTE: Candidates must not commence writing until hh:mm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets; the maximum mark for each question is 20.)

(Candidates are required to answer **FIVE** questions only. Begin each question on a **separate** sheet.)

Candidates may use calculators.

1. Give the chemical structures of **two** free-radical initiators and show schematically how they decompose to yield free radicals. [8]

Describe, with appropriate equations, the three fundamental steps in the free-radical polymerisation of a vinyl monomer. [12]

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

What are the limitations to their use in this application? [2]

An amorphous non-polar polymer has a solubility parameter of 9.4 Hildebrands. Using the table below, list which 2-liquid mixtures are likely to act as solvents for the polymer and calculate the optimum composition for one of them. [10]

Non-polar liquid	Solubility parameter (Hildebrands)
A	7.3
B	9.1
C	10.9
D	15.5

3. Write an essay on the environmental impact of synthetic polymers and on ways in which their impact may be minimised. [20]

4. Discuss the actions of acids and alkalies on cotton and wool and show how the different processing methods for these two fibres reflect their behaviour to these reagents. [20]
5. Give the chemical repeat units of:  
(a) nylon 6.6;  
(b) nylon 6. [4]
- Describe the differences in polymerisation mechanisms for these two polymers. [12]
- Nylon 6 has been marketed as 'deep dyeing' nylon. Explain, on the basis of the two mechanisms of polymerisation, why nylon 6 has a greater uptake of acid dye than does nylon 6.6 under similar dyebath conditions. [4]
6. Fibres are frequently described as 'two-phase' polymers; explain what is meant by this term. [4]
- Describe in detail the importance of each phase in the processing and dyeing of synthetic fibres. [12]
- Give an example of a fibre that is **not** a 'two-phase' polymer and explain how this affects its handling during dyeing. [4]
7. Give an account of the production of alginate fibres. [12]
- Describe **two** applications of alginate fibres. [8]
8. Write an essay on the chemistry of permanent press/durable press/crease-resistant treatments for cotton fabrics. [20]
9. Give an account of the chemistry involved in the synthesis of cellulose ethers. [12]
- Describe **two** applications of cellulose ethers. [8]
10. Describe the synthesis, properties and uses of a man-made polymer of your choice that has not been chemically specified in any of the above questions. [20]



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and colourists

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## Examination for the Associateship (ASDC) 2010

### Paper 4: Industrial organisation and management

hh:mm–hh:mm Tuesday 18th May 2010

(NOTE: Candidates must not commence writing until hh:mm but are free to study the question paper in advance. The marks for each question, or part question, are indicated in brackets; the maximum mark for each question is 20.)

(Candidates are required to answer **FIVE** questions only. Begin each question on a **separate** sheet.)

1. (a) Explain what is meant by **two** of the following terms (each has five marks): [10]
  - business strategy;
  - budgeting;
  - marginal costing;
  - variance analysis.

(b) Choose **one** of the above and give an account of how it could be applied in a textile manufacturing company. [10]
2. Compare the '4Ps of marketing' and explain how they may be used in the marketing of a textile finishing company. [20]
3. Write an essay on total quality management (TQM). [20]
4. Compare and contrast the content and function of a job description and job specification for a dyehouse manager. [20]
5. Critically discuss on **one** of the following statements: [20]

"The recent recession has had major implications on the dyeing and finishing industry in Europe but less of an effect on the Far East";

"Budgeting and forecasting are essentially the same process".

6. Write an essay on the function of the human resources manager in a textile manufacturing company. *[20]*
7. Argue the case for, and against, research and development in the dye manufacturing industry. *[20]*
8. Write brief notes on the use of **two** of the following in the textile industry (each carries 10 marks): *[20]*
  - the internet
  - management information systems
  - training
  - strategic planning
9. Write an essay on the importance of industrial relations in today's textile industry *[20]*
10. Write an account of environmental factors affecting the textile industry *[20]*