

## الإجابة النموذجية لامتحان مادة كيمياء الأصباغ والنسيج

٤١٠ ك  
(نصف ورقة امتحانية)

المستوى: الرابع

الشعبة: كيمياء وكيمياء تطبيقية

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الممتحن: د. هاني إبراهيم محمد إبراهيم

قسم: الكيمياء

كلية: العلوم



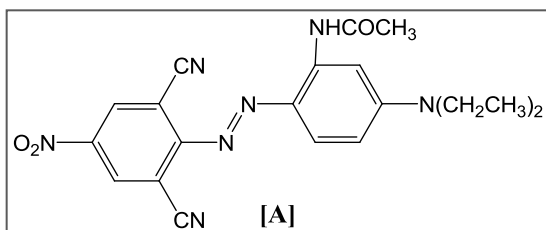
Chemistry of Dyes & Textiles [410 Ch]

Answer the following questions: [24 marks]

[1] (a) Disperse Blue 165 [A] is an excellent dye that can be used for dyeing polyester fabrics: [5 marks]

For **this dye**, assign the following:

- All chromophoric groups
- All auxochromic groups
- The longest conjugated system

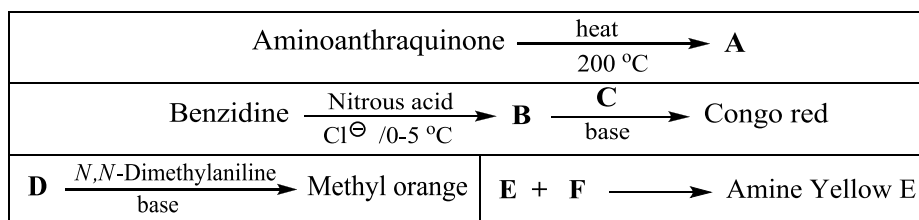


(b) By dropping your answer on **fluorescein**, show all structure-color relationships for such dye at different values of pH. [3 marks]

(c) Give a brief account on **two only** of the following: [4 marks]

- Reactive dyes
- Vat dyes
- Mordant dyes

[2] (a) Deduce the chemical structures of A to F: [6 marks]



(b) Use chemical equations to describe the preparation of: [Choose **three only**; 6 marks]

- Alizarin from naphthalene
- Eosin via two methods
- Indigo dye "start with anthranilic acid"
- Gambin Y and picric acid

**Best wishes**

**Dr/ H. I. Mohamed**

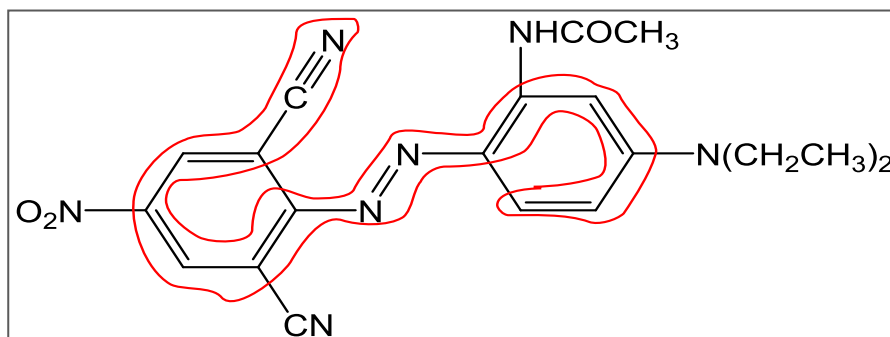
### Model Answer

[1] (a) i) The chromophoric groups are:

C=C, N=N, C=O, NO<sub>2</sub> and C≡N groups

ii) The auxochromic groups are: NHCOCH<sub>3</sub> and N(CH<sub>2</sub>CH<sub>3</sub>)<sub>2</sub> groups

iii) The longest conjugated system:



(b)

pH level	Color	Chemical structure
< 7	Colorless	
= 7	Colorless	
> 7 & < 12	Fluorescent green	

> 12	Colorless	
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**(c) i) Reactive dyes:**

Reactive dyes are a class of highly colored organic substances, primarily used for tinting textiles that attach themselves to their substrates by a chemical reaction that forms a covalent bond between the molecule of dye and that of the fiber. The dyestuff thus becomes a part of the fiber and is much less likely to be removed by washing than are dyestuffs that adhere by adsorption.

Fiber reactive dyes are the most permanent of all dye types. Unlike other dyes, it actually forms a covalent bond with the cellulose or protein molecule. Once the bond is formed, what you have is one molecule, as the dye molecule has become an actual part of the cellulose fiber molecule. No wonder you can safely wash a garment that has been dyed in bright fiber reactive colors with white clothing, a hundred times, without endangering the whites in the least - even if it is all different bright colors, or even solid black. In contrast to all others, the reactive dyes bind chemically to the textile fibers, significantly improving the product's color stability and wash ability.

**ii) Vat dyes:**

Vat dyes characteristically require a reducing agent to solubilize them. The most common reducing agent is sodium dithionite ( $\text{Na}_2\text{S}_2\text{O}_4$ ), which converts the dye to its "leuco" form that is soluble. Once attached to the fabric, the leuco dye is then oxidized to the insoluble state, which is intensely colored. Chemical reactions such as oxidation, reduction, pH control are often

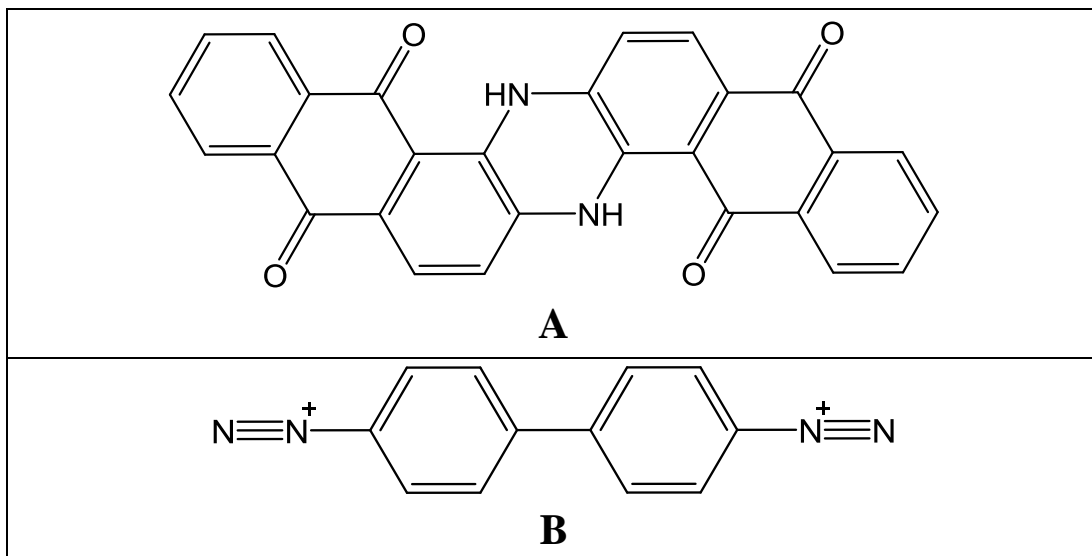
necessary; even the dissolution process necessitates measuring out appropriate quantities of caustic soda and sodium hydrosulphite in order to achieve reduction. The dye is soluble only in its reduced (oxygen-free) form. The fiber is immersed repeatedly in this oxygen-free dyebath, and then exposed to the air, whereupon the water-soluble reduced form changes color as oxygen turns it to the water-insoluble form. For these reasons, vat dyes are less suitable than reactive dyes for amateur use.

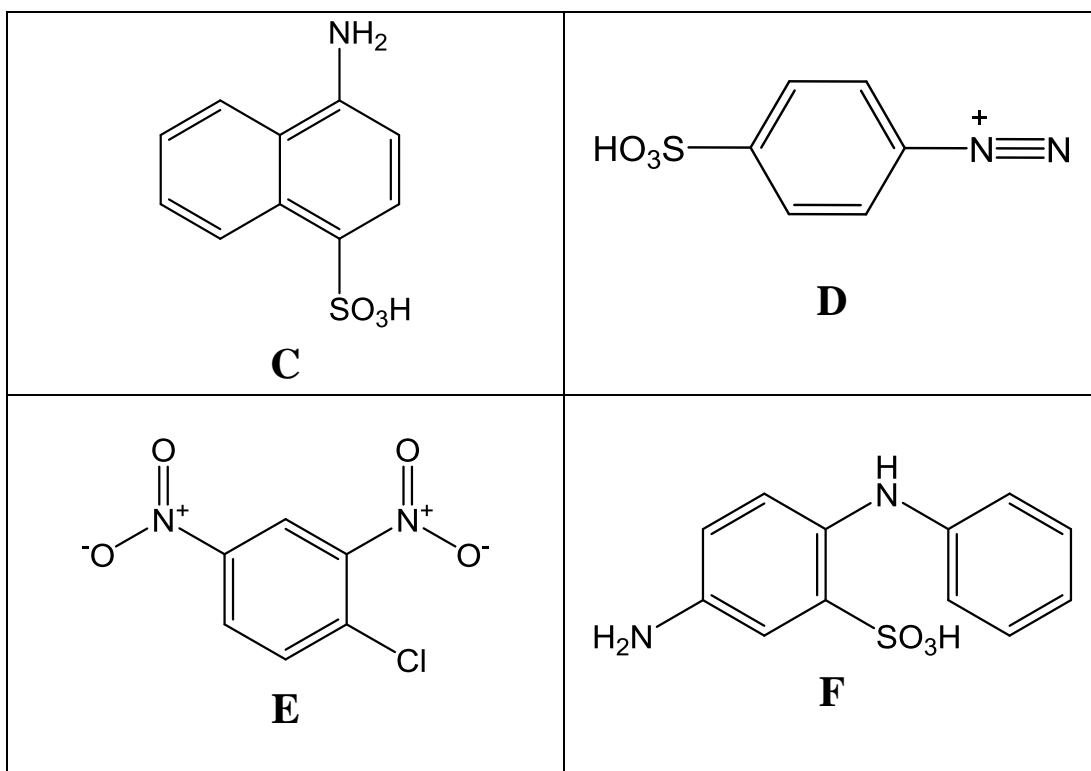
iii) **Mordant dyes:**

Dyes, which have no affinity towards textile fibers are attached with the fiber with the help of mordants, are known as mordant dyes. Most commonly used mordants are inorganic salts e.g. chromium.

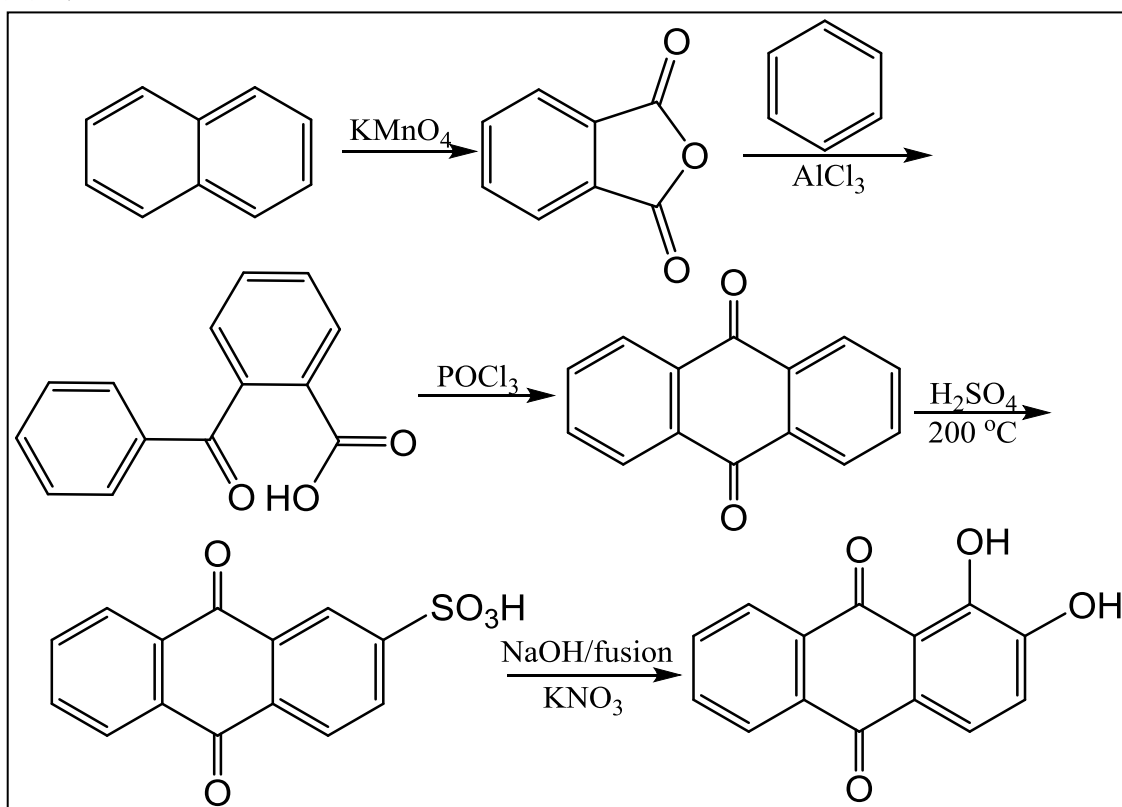
These dyes have some mordant attracting groups, which have some influence on the metal ions. A metal ion takes the place of hydrogen in the –OH or –COOH group in azo dyes. The mordants have affinity for both fiber and dye so; dyes can be applied by using suitable mordant, as dyes have mordant attracting groups. Fibers most readily dyed with mordant dyes are wool, methacrylic and nylon fibers.

**[2] (a)**

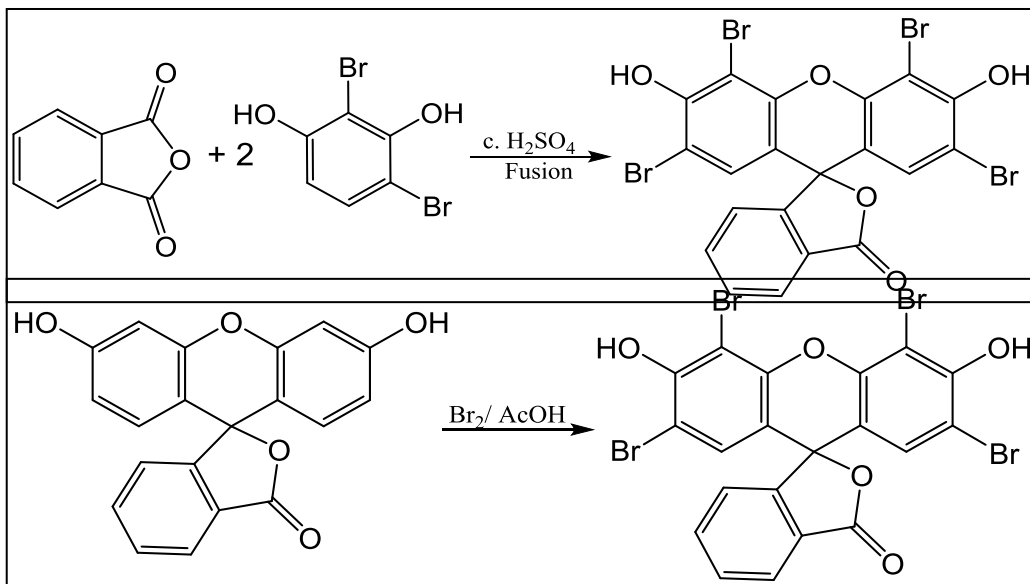




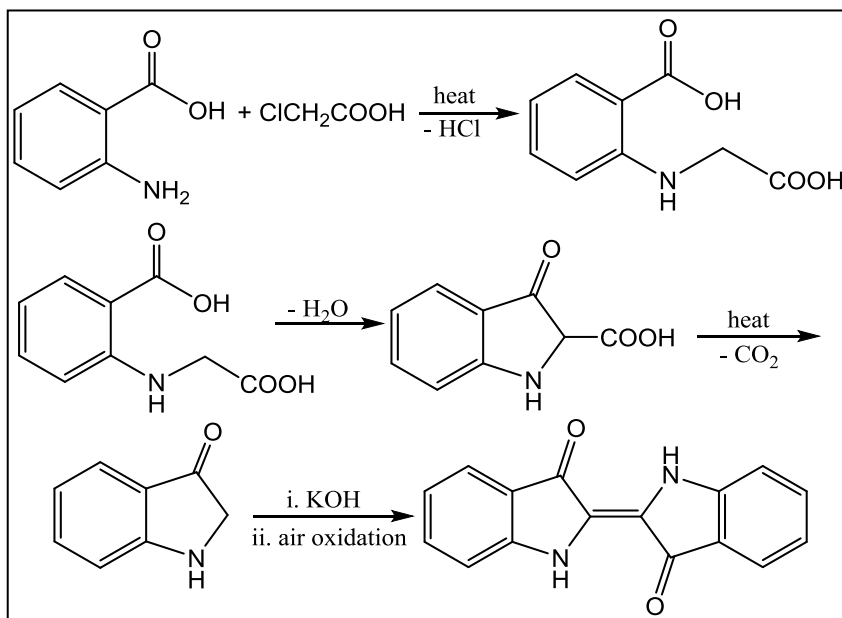
**(b) i) Alizarin:**



ii) **Eosin:**



iii) **Indigo dye:**



iv) **Gambin Y & Picric acid:**

