Intermediate Module 301
Types and Manufacture of Pigments

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This Intermediate Level Module starts by describing and classifying various pigments and extenders used in the Coatings Industry, both by type and by physical form. The importance of pigment particle shape is presented and examples given of pigments and extenders, which fall into these various categories.

The module goes on to describe the various parts in the pigment manufacturing process, including pigment after treatments. Pigment grinding, classification, filtering, drying and calcining are covered, along with pigment flushing and micronising.

Next, the chemical composition and properties of a number of commonly available white pigments and extenders, are described in some detail, followed by similar sections devoted to the chemical structure and physical properties of some widely used coloured inorganic and organic pigments.

Finally, the main properties of some widely used metallic pigments are summarised.

Introduction to Module 301

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Structure of the Module

The module consists of a theory block of 6 sections, 1 CMA and 1 ASG

The total study time will be approx. 7 hrs with additional time being required for the CMA and the ASG. Experience indicates that on average, the total time to complete this module will be of the order of 4 – 6 weeks.

Marks for the module are split as follows, CMA (20%), ASG (35%) and End Test (45%).

For full certification, the CMA and the ASG must be completed satisfactorily.

An overall mark of 50% or more is necessary for successful completion of the module, with students achieving at least 40% of the marks available in each element.

It is advisable to wait until you have completed three modules before sitting the end tests, as this will involve only one visit to the examination room

Module Prerequisites

It will be a distinct advantage if students tackling this Module have already studied some science subjects to GCSE or relevant GNVQ level and have completed other modules at Foundation level.

A student should be currently employed within the Coatings Industry or be with a supplier to this Industry.

Past relevant experience of employment within the industry would be a distinct advantage.

SAQs – Self Assessment Questions

Although these do not carry any marks for completion, nevertheless they are important to the student, as they show that the Section has been clearly understood.

The answers to SAQs may be found in Appendix 1.

ASG – Assignment Exercise

There is one ASG in Module 301. This is concerned with the resistance to "bleeding" of organic pigments. The exercise should take about 1 hour and may be found in Appendix 2.

CMA – Computer Marked Assessments

Full details of how to complete this important part of the Module is on the website. A reminder as to how to fill in a CMA is given in the general introduction to the module.

Module Objectives

When you have finished this module, you should be able to do the following:

Section 1 - Pigment particle shape

1.1 Distinguish between granular, acicular and laminar pigment shapes by means of simple line drawings and in each case name two pigments.

Section 2 - Pigment production processes

Describe the following pigment production processes:

2.1 Grinding
2.2 Classification
2.3 Filtration
2.4 Drying
2.5 Calcination
2.6 Flushing
2.7 Micronising

Section 3 - Chemical composition and properties of white pigments and Extenders

Describe the origin, chemical composition and principal properties of:

3.1 Titanium dioxide
3.2 Barytes and blanc fixe
3.3 Calcium carbonate
3.4 Silica and silicates
3.5 China clay
3.6 Zinc oxide

Section 4 - Coloured inorganic pigments

Describe the origin, chemical composition and principal properties of:

4.1 Iron oxides
4.2 Ferro chromes
4.3 Chrome oxide
4.4 Ultramarine blue
4.5 Mixed oxides

Section 5 - Organic pigments

Describe the chemical composition and principal properties of:

5.1 Quinacridones
5.2 Dioxazines
5.3 Phthalocyanines
5.4 Azo pigments

Section 6 – Metallic pigments

6.1 Describe the various types of metallic pigment