APPENDIX I

ANSWERS TO SELF ASSESSMENT EXERCISE

MODULE 1: COLOUR, PIGMENTS AND DYES

UNIT 1 COLOUR AND ITS FEATURES

Self assessment exercise 1

(i) Origin of colours

Answer: Aristotle discovered that by mixing two colours, the third is produced. He did this with a yellow and blue piece of glass, which when brought together produced green. He also discovered that light travels in waves. Plato and Pythagoras also studied light. In the 10th century, Al-Haytham researched into colour and his findings inspired Newton. During the Middle Ages, Paracelsus reintroduced the knowledge and philosophy of colour using the power of the colour rays for healing along with music and herbs. Unfortunately, he was hounded throughout Europe and ridiculed for his work. Most of his manuscripts were burnt, but now he is thought of, by many, to be one of the greatest doctors and healers of his time. A man, it would seem, very much ahead of his time. Not only do we now use Colour Therapy once again, but, his other ideas, using herbs and music in healing, can also be seen reflected in many of the complementary therapies now quite in commonplace.A pioneer in the field of colour, Isaac Newton, in 1672 published his first, controversial paper on colour, and forty years later, his work 'Opticks'. Newton passed a beam of sunlight through a prism, when the light came out of the prism it was not white but was of seven different colours: Red, Orange, Yellow, Green, Blue, Indigo and Violet. The spreading into rays of these colours was called ‘dispersion’ by Newton and he called the different coloured rays the ‘spectrum’. He discovered that when the light rays were passed again through a prism, the rays turned back into white light. If one ray was passed through the prism it would come out the same colour as it went in. Newton concluded that white light was made up of seven different coloured rays.

(ii) The content of visible spectrum are as follows

Answer:

(i) Violet
(ii) Indigo
(iii) Blue
(iv) Green
(v) Yellow

(vi) Orange
(vii) Red

Self assessment exercise 2

(i) Why objects possess a particular colour

Answer: The colour of anything we observe depends upon a few factors. Firstly - *Everything* is made up of electrons and atoms. Different materials, objects and items have a different make up of atoms and electrons. Any object, by its nature, will, when exposed to light, do one of the following: reflect or scatter light (reflection and scattering), absorb light (absorption), do nothing (transmission) and refract light (refraction).

(ii) Mention the relationship between colours and the eyes

Answer: The eye picks up colour and light by the rods and cones. It is the *Cones* that detect colour. Each cone contains one of three pigments sensitive to either red green or blue. There are about 120 million rods and about 6 to 7 million cones in the human eye. Rods are more sensitive than the cones but they are not sensitive to colour, they perceive images as black, white and different shades of grey. More than one thousand times as sensitive, the rods respond better to blue but very little to red light. Each pigment absorbs a particular wavelength of colour. There are short wavelength cones that absorb blue light, middle wavelength cones that absorb green light, and long wavelength cones that absorb red light. When we observe a colour that has a wavelength between that of the primary colours red, green and blue, combinations of the cones are stimulated. An example could be that yellow light stimulates cones that are sensitive to red and green light. The result is that we can detect light of all colours in the visible spectrum.

(iii) What is colour perception?

Answer: We see colour with the sensors in the retina of the eye called rods and cones. The rods are sensitive to low light and the cones, which require a greater intensity of light, are sensitive to colour. The message is passed to the optic nerve and then on to the brain.

UNIT 2 TYPES OF COLOURS

SELF ASSESSMENT EXERCISE 1

i. What is colour?

Answer: A colour is a sensation produce in the eye by the breaking down of white light. When substances absorbed rays of Wight lightand reflect the rays of a single colour.

ii. Differentiate between additive and subtractive primary colours

Answer: Additive colours are colours that are associated with emitted light directly from a source before an object reflects the light. These colours are red, green and

blue.**While Subtractive** colours are colours that are associated with reflected light. In this case the subtractive colours are blue, red and yellow. These are the colours we are probably most familiar with as primary colours in school.

SELF ASSESSMENT EXERCISE 2

Distinguish between secondary and tertiary colours

Answer: If two of the primary colours are mixed together, a **secondary colour** is created, while Tertiary colours are combinations of primary and secondary colours.

MODULE 2CLASSIFICATION OF DYES AND FIBRES

Unit 1 CLASSIFICATION OF DYES

Self assessment exercise 1

i. List carefully the different means of classification of dyes

Answer:

(i) Organic/Inorganic
(ii) Natural/Synthetic
(iii) By area and method of application
(iv) Chemical classification- Based on the nature of their respective chromophores.
(v) By nature of the Electronic Excitation (i.e. energy transfer colourants, absorption colourants and fluorescent colourants).
(vi) According to the dyeing methods

ii. Mention the functional groups present in the azo, thiazole, and the phthalocyanine types of dyes.

Answer: Azo -N=N-
thiazole>C=N-and -S-0=
phthalocyanine>C=N

SELF ASSESSMENT EXERCISE 2

i. Mention four types of industrial classification of dyes and their applications

Answer: Acid dyes: Are applied to fibers such as silk, wool, nylon and modified acrylic fibers using neutral to acid dye baths.

Basic dyes: Applied to acrylic fibers, but find some use for wool and silk.

Direct or substantive dyeing: Are used on cotton, paper, leather, wool, silk and nylon. They are also used as pH indicators and as biological stains.

Mordant dyes: used for wool, useful for black and navy shades, applied as an after-treatment.

Vat dyes: has an affinity for the textile fibre.

Reactive dyes: Are by far the best choice for dyeing cotton and other cellulose fibers at home or in the art studio.

ii. Enumerate the classification of die base on used

Answer: Leather Dyes
Oxidation Dyes
Optical Brighteners
Solvent Dyes
Fluorescent Dyes
Fuel Dyes
Smoke Dyes
Sublimation Dyes
Inkjet Dyes
Leuco Dyes

UNIT 2 CLASSIFICATION OF FIBRES
SELF ASSESSMENT EXERCISE

i. List carefully the different types of natural fibres you have studied.

Answer:

1. Vegetable Fibres
2. Wood Fibres
3. Animal Fibres
4. Mineral fibres

ii. Distinguish a soft fibre from a hard one.

Answer:

Soft fibre	**Hard fibre**
come from the bast portion of the plant	comprised not only of the phloem but also partly of the hardened wood core of the plant, the Xylem
removed from the stems	generally come from the leaves of monocot (single seed-leaf) species

Unit 3 NATURAL DYES AND DYEING PROCESS

SELF ASSESSMENT EXERCISE 1

i. What is a natural dye?

Answer: Natural dyes are a class of colourants extracted from vegetative matter and animal residues.

ii. Describe four categories of natural dyes with respect to source and colour they produced.

Answer: Any four of the categories of dies in section 3.4.1

SELF ASSESSMENT EXERCISE 2

i. What is a mordant? Mention two types

Answer: Mordants are needed to set the colour when using natural dyes. Different mordants will give different results.

Types of mordant are Alum, Copper, Chrome, Iron, Glaubersalt, Spectralite, Tara Powder, Tartaric Acid, Tin, Calcium Carbonate

ii. *How would you dye a fabric?*

Answer: Refer to section 3.6

MODULE 3 SYNTHETIC DYES AND FIBRES

UNIT 1 SYNTHETIC FIBRES

SELF ASSESSMENT EXERCISE 1

Mention two kinds of synthetic fibres

Answer: Acid Dyes, Azoic (or Naphthol) Dyes, Basic Dyes, Chrome (or Mordant) Dyes, Mordant**,** Developed (or Diazo) Dyes**,** Direct Dyes**,** Disperse (or Acetate) Dyes**,** Reactive (or Fiber-reactive) Dyes, Sulphur Dyes, and Vat Dyes.

UNIT 2POLYMER FIBRES

SELF ASSESSMENT EXERCISE 1

i. Define the word Polymer fibre

Answer: These are a subset of man-made fibres, which are based on synthetic chemicals (often from petrochemical sources) rather than arising from natural materials by a purely physical process.

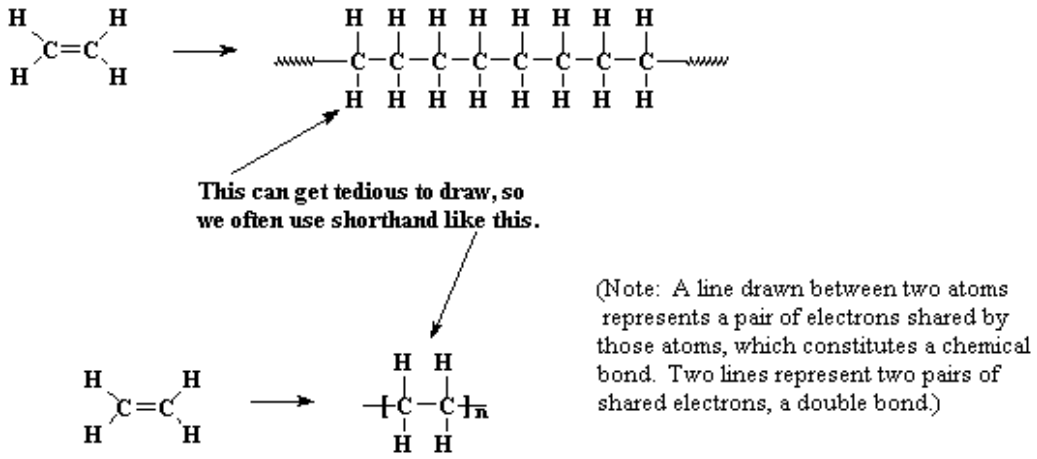
ii. Mention three kinds of synthetic polymers.

Answer: Olefins, **Acrylics, Polyesters, Polyamide (nylon)andFibre Blends**

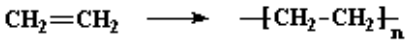
SELF ASSESSMENT EXERCISE 2

i. Propose a simple equation for the production low density polyethylene

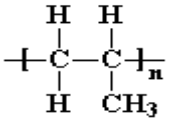
Answer:



And when we're feeling really lazy we just draw it like this:



ii. Differentiate between polyethylene and polypropylene.



polypropylene

Answer: Polyethylene [-CH_2-CH_2-]n while

UNIT 3 POLYMERS AND POLYAMIDE FIBRES

SELF ASSESSMENT EXERCISE

i. Differentiate between a nylon and a polyester

Answer: Nylon is a Polyamide while polyester is a Polyethylene. **Nylon** and **polyester** are both synthetic fabrics, but nylon production is more expensive, which results in a higher price for the consumer. Nylon also tends to be more durable and weather-resistant, which is why it is more likely to be used in outdoor apparel or gear. Both fabrics are flame retardant, but nylon is stronger, while polyester is more heat-resistant.

ii. What are the main chemical functional groups in both nylon and polyester?

Answer: Nylon is polyamides while polyester is poly (ethylene terephthalate) or PET

UNIT 4 POLYURETHANES, CELLULOSE AND POLYACRYLONITRILE

SELF ASSESSMENT EXERCISE 1

i. What are polyurethanes?

Answer: These are the single most versatile family of polymers there is. They can be elastomers, and they can be paints. They can be fibres, and they can be adhesives. Wonderful bizarre polyurethane is spandex. Of course, polyurethanes are called polyurethanes because in their backbones they have a *urethane* linkage.

ii. Mention two uses of the polyurethanes

Answer

1. They are often used to make block copolymers with soft rubbery polymers
2. They can be used as paints.
3. They can be used as adhesives.

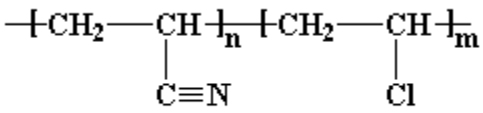
SELF ASSESSMENT EXERCISE 2

i. What are the chemical constituents of cellulose and polyarylonitrile

Answer: Cellulose is built out of a sugar monomer, it is called a polysaccharide while Polyarylonitrile are copolymers of acrylonitrile and methyl acrylate, or acrylonitrile and methyl methacrylate.

ii. copolymers of acrylonitrile and vinyl chloride are flame-retardant, and the fibres made from what?

Answer:*modacrylic*fibres.



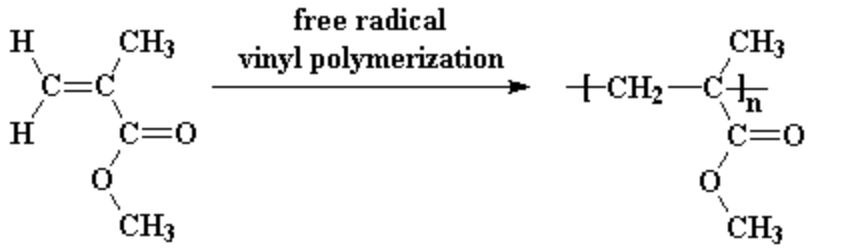
poly(acrylonitrile-*co*-vinyl chloride)

UNIT 5 ARAMIDS, POLY (METHYLMETHACRYLATE) AND POLYCARBONATE

SELF ASSESSMENT EXERCISE 2

i. Propose a short equation for the preparation of poly (methyl methacrylate)

Answer:



methyl methacrylate **poly(methyl methacrylate)**

ii. What are the striking features of a polycarbonate used in eyeglasses?

Answer:

1. It is a clear plastic
2. has a much higher *refractive index*
3. It bends light more than glass

MODULE 4 DYEING MECHANISMS

UNIT 1 TEXTILE DYEING PROCESS

1. *Describe the Batch Dyeing Process:*

Answer: Batch Dyeing Process is the most popular and common method used for dyeing of textile materials. Batch dyeing is also sometimes referred to as *Exhaust dyeing*. This is because in this process, the dye gets slowly transferred from a comparatively large volume dye bath to the substrate or material that is to be dyed. The time taken is also longer.

The dye is meant to 'exhaust' from dye bath to the substrate. In batch processes, textile substrates can be easily dyed at any stage of their assembly into the desired textile product. This includes fiber, yarn, fabric or garment. Some type of batch dyeing machines can function at temperatures only up to 1000^{o}C. For example cotton, rayon, nylon, wool etc. can be dyed at 1000^{o}C or lower temperatures, while polyester and some other synthetic fibers are dyed at 1000^{o}C or even higher temperatures. There are three general types of batch dyeing machines. The first is the one where there is circulation of fabric. Second, is the one where the dye bath gets circulated while the material that is being dyed remains stationary, and finally the third, where both the bath and material to be dyed gets circulated. Examples of dyeing machines that utilises batch dyeing process are Beck, Jet, Jigs, Beam Package dyeing machines etc.

UNIT 2 BEAM DYEING MACHINE, HANK DYEING MACHINE AND JIG DYEING MACHINE

SELF ASSESSMENT EXERCISE 1

i. Describe the features of a Beam Dyeing Machine

Answer: A beam dyeing machine is able to adjust water level in accordance to fabric volume, even dyeing and superior dyeing quality and Optimized circulation system along with high performance pumps.

ii. Mention two of its advantages

Answers:

1. In a beam dyeing machine fabric is put under controlled tension, also ensures total control of dimensions of the roll of fabric.
2. The fabric is held in a fixed position during the process of dyeing.

UNIT 3 JET DYEING MACHINE

SELF ASSESSMENT EXERCISE 1

1. *Define jet dyeing machine*

Answer:

A Jet dyeing machine the reel is completely eliminated. A closed tubular system exists where the fabric is placed. For transporting the fabric through the tube a jet of dye liquor is supplied through a venturi. The Jet creates turbulence. This helps in dye penetration along with preventing the fabric from touching the walls of the tube.

2. *Give the key features of soft flow dyeing machine*

Answer:

i. Significant savings in processing time.
ii. Savings in water that is around 50%.
iii. Excellent separation of different streams results in optimum heat recovery and a distinct possibility of further use or a dedicated treatment.