

Synthetic Fibres and Plastics

UNIT II: CHEMICALS AND MATERIALS

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Natural Fibres

- ▶ *A fibre is a thin thread of a natural or artificial substance, especially one that is used to make cloth or rope.*
- ▶ *Fibres can be classified into 2 main categories: natural and synthetic.*
- ▶ *Natural fibres are obtained from natural sources such as animals and plants*

Natural Fibres



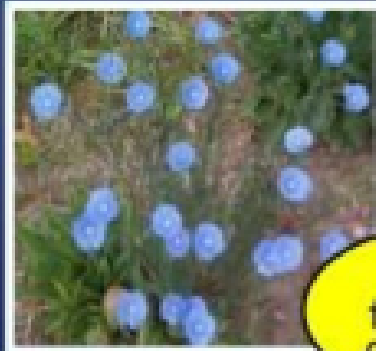
Cotton
from a
plant



Silk from
the silk
worm



Wool
from
sheep



Linen
from the
flax plant

Hair fibres
from rabbits
& goats



Plant Fibres

- ▶ *Cotton: Cotton fibre is obtained from the cotton plant. It is one of the traditional fibres used in the textile industry*
- ▶ *Linen: Linen fabric is obtained from the flax plant. The properties of linen fabric are very much similar to cotton fabric.*
- ▶ *Jute: It is obtained from the jute plant. On account of its high strength, it is perfect for use in packaging material.*

Animal Fibres

- ▶ *Silk: Silk is obtained from silk worms. The most popular kind of silk is obtained from the **mulberry silk worm**.*
- ▶ *Wool: Wool is commonly obtained from **sheep**. Wool fabric is soft to the touch and provides warmth to the weather, due to which it is the preferred choice for winter apparel.*



In 2 days, a **silkworm** spins thread that is about 1,000 to 3,000 feet long.



- ▶ *Yak fibre: The yak is an animal that is largely found in the Himalayas in India and Tibet. The hair of the yak is very useful in the production of warm clothes, mats and sacks.*



Synthetic Fibres

- ▶ *Synthetic fibres are man-made fibres.*
- ▶ *Synthetic fibres are made from different chemicals, hence each kind of synthetic fibres have their own properties.*
- ▶ *Synthetic fibres are more in length and are long lasting.*
- ▶ *The only limitation in synthetic fibres is that they are poor absorbents of moisture and they catch fire easily*

Synthetic Fibres

- *Many items of clothing contain materials such as polyester, polyamide, terylene, rayon etc.*
- *The items previously mentioned are all man-made fibres, and are called synthetic fibres.*



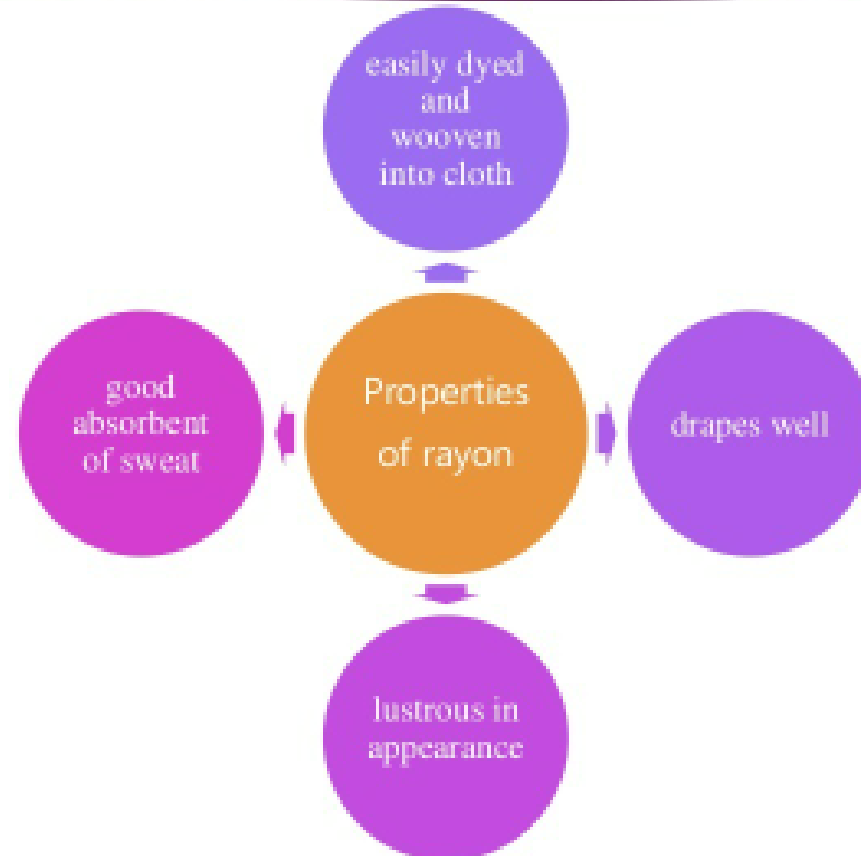
Synthetic Fibres

- ▶ *A synthetic fibre is a chain of small chemical units joined together.*
- ▶ *Each small unit is called a **monomer**.*
- ▶ *Large chain formed by many monomers is called a **Polymer**.*
- ▶ *The process of combining small monomers to form a large polymer is called **Polymerisation**.*

Rayon

- ▶ *Rayon is prepared from cellulose.*
- ▶ *Though cellulose is a natural polymer it needs extensive chemical treatment to form rayon.*
- ▶ *It is also called **artificial silk**,*
- ▶ *It absorbs moisture and is comfortable to wear.*
- ▶ *It can be easily dyed in vivid colors.*

Properties of rayon



An infographic with a central pink circle containing the text "Uses of rayon". Surrounding this central circle are seven smaller pink circles, each containing a different use of rayon. The background features a dark purple horizontal band at the top and a vertical pink bar on the right side.

Uses of rayon

Dress material because it is soft, silky and moisture absorbent

Mixed with fibre glass for making helmets

Used to make Jackets and tracksuits.

Curtains because it drapes well

Surgical Dressings.

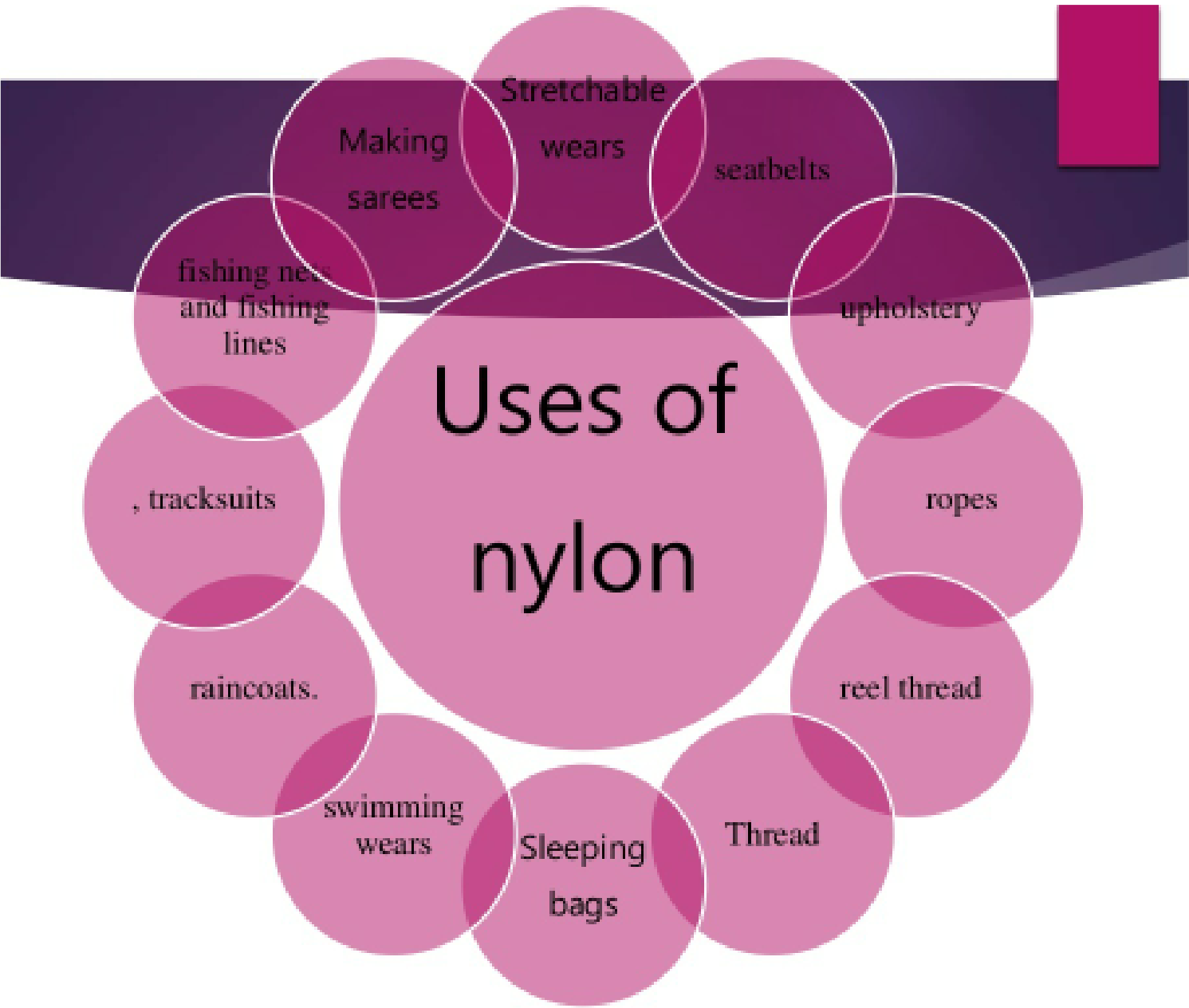
Upholstery for luxury cars and office and home furnishings

Reinforcing nylon tyres

Nylon

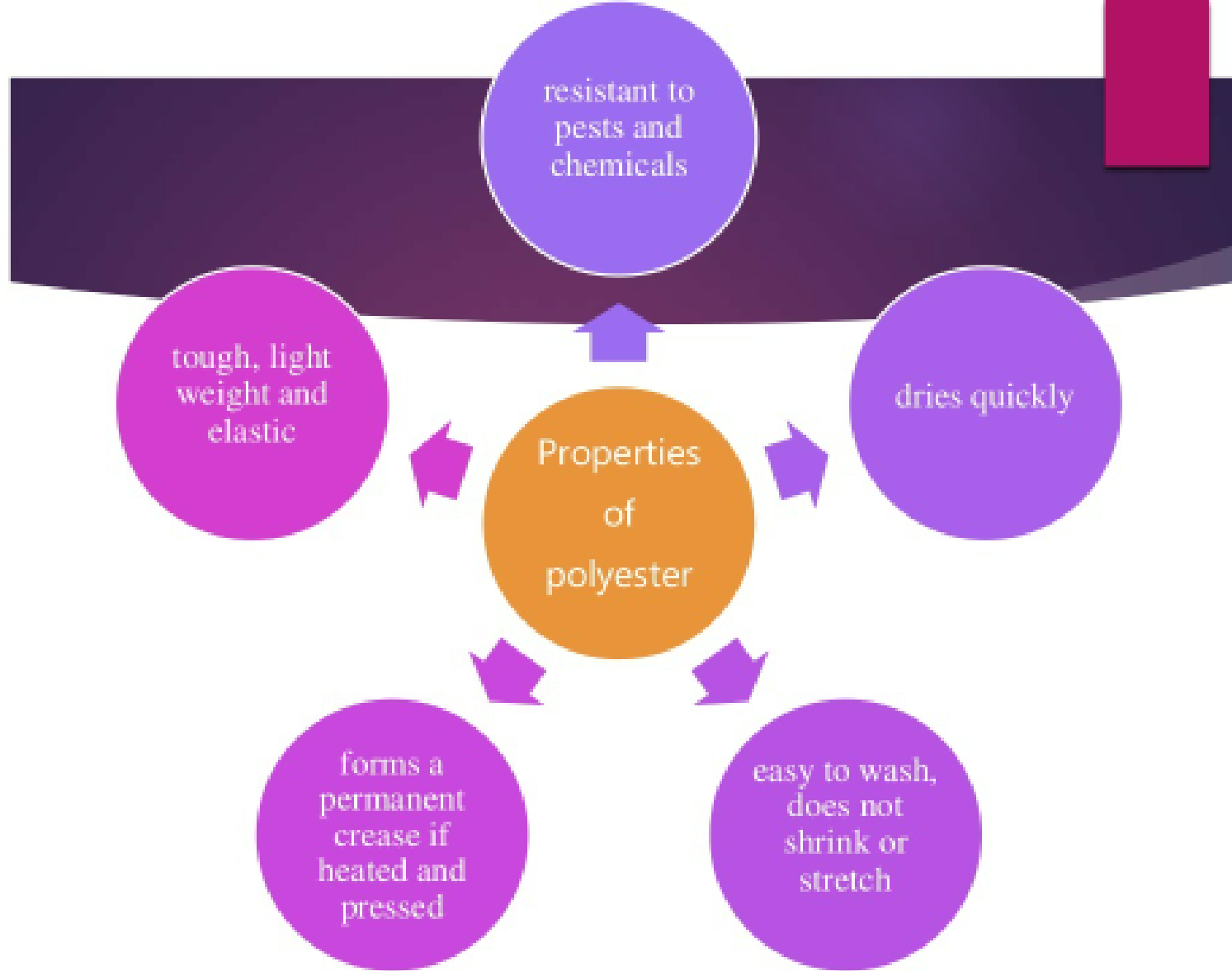
- ▶ *Chemically it is a 'polyamide', a polymer. It is the strongest synthetic plastic material which can be moulded to any shape.*
- ▶ *It is strong and easy to dye.*
- ▶ *Nylon fibres do not absorb water easily.*
- ▶ *It is elastic in nature and hence, highly durable.*

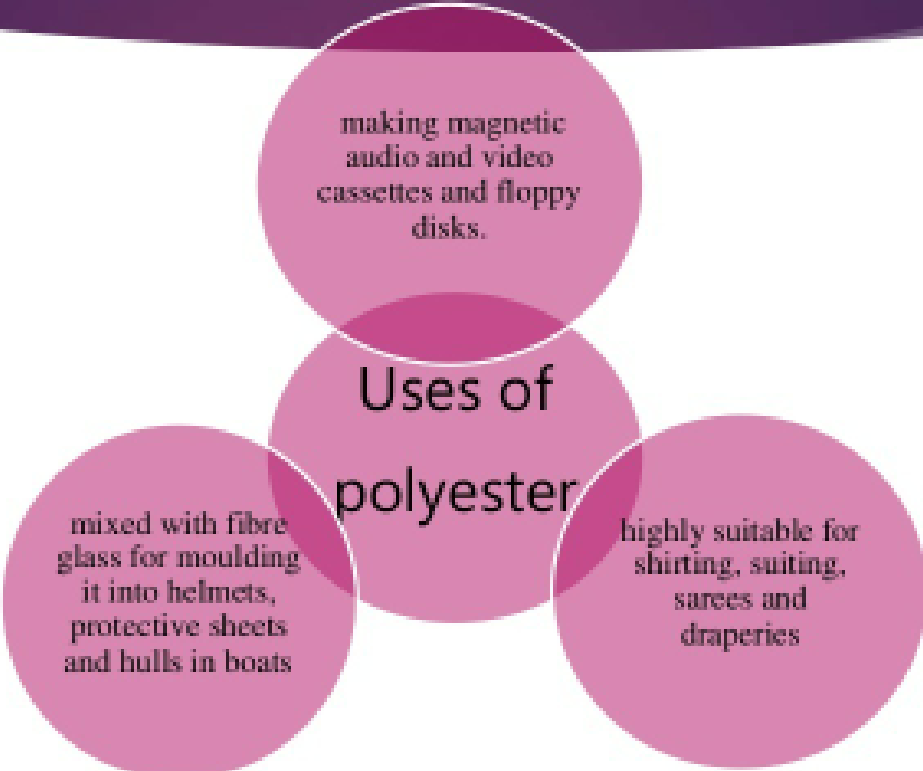
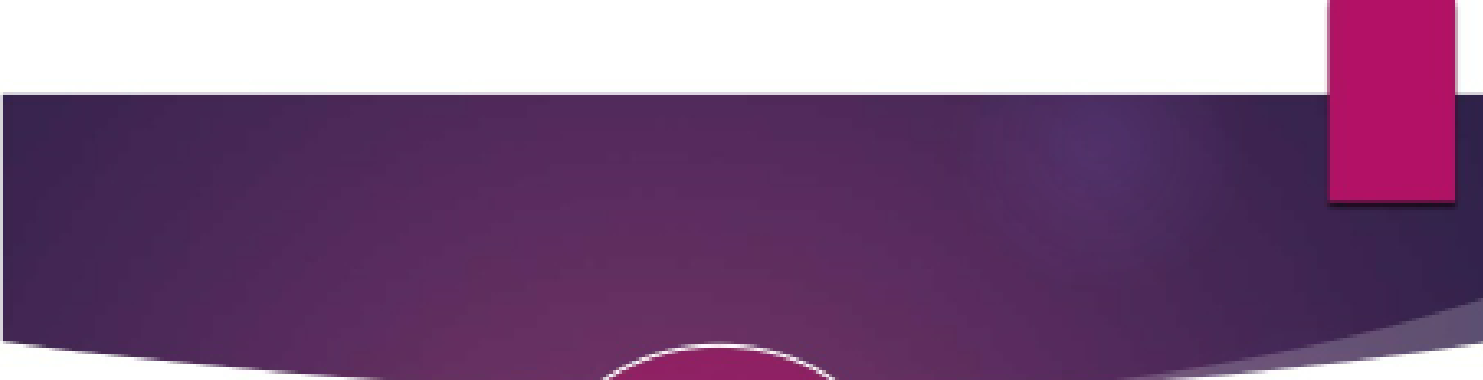




Polyester

- ▶ *Alcohol and organic acid react together to make compounds called esters which are polymers*
- ▶ *Polyesters come under the brand names of 'Terylene', 'Dacron', 'Terene' and 'Polyester'.*





making magnetic audio and video cassettes and floppy disks.

Uses of polyester

mixed with fibre glass for moulding it into helmets, protective sheets and hulls in boats

highly suitable for shirting, suiting, sarees and draperies

Acrylic

- ▶ *Acrylic is often used as a substitute for wool.*
- ▶ *Acrylic fibres are strong and wrinkle-resistant.*
- ▶ *It is easy to wash and dries quickly.*
- ▶ *It is resistant to moths, oils, chemicals and deterioration on exposure to sunlight.*





Acrylic knitting wool is good for baby wears because they are soft, warm and washable.

Uses of acrylic

A transparent type of acrylic is used to cover automobile lights, lenses surgical tools etc

Used for making artificial fur, blankets, carpets etc.

Blending Fibres

- ▶ *Terylene and cotton blend, known as terrycot is used for making dress materials.*
- ▶ *Terylene and wool blend is known as terrywool is used as a substitute for costly woollen clothes.*
- ▶ *Polyester and cotton blend is more crease-resistant.*
- ▶ *Acrylic and wool blend trousers are less expensive.*

Advantages of Synthetic fibres

- ▶ *Strong*
Synthetic fibres are strong so they can take up heavy things easily.
- ▶ *Retain their original shape*
Synthetic fibres retain their original shape so it's easy to wash and wear.
- ▶ *Elastic*
Can easily be stretched out.
- ▶ *Soft*
Synthetic fibres are generally soft so they are used in clothing materials.
- ▶ *Colour*
Varieties of colours are available as they are manufactured.
- ▶ *Cost*
Clothes made by synthetic fibres are generally cheaper than those made by natural fibres.

Disadvantages of Synthetic Fibres

- ▶ *Does not absorb moistures*
Synthetic fibres do not absorb sweat, trapping heat in our body.
- ▶ *Rough feel*
Synthetic fibres may give rough feel, making it unsuitable for pyjamas, underwear, etc.
- ▶ *It is dangerous to wear near fire, as they catch fire easily.*
- ▶ *They cannot be easily ironed as they melt very easily.*

Plastics



Plastic Milk & Juice Bottles



Plastic Lumber
(decking, docks, etc.)



Play Sets



New Bottles

=



Plastic Detergent Bottles



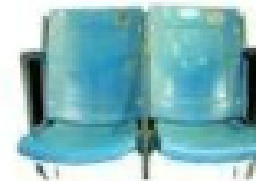
Buckets



Containers



Frisbees



Stadium Seats

Types of plastics

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graph TD; A[Types of plastics] --> B[Thermosetting Plastics]; A --> C[thermoplastics]
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The diagram features a central title box at the top with a light orange-to-white gradient. A purple line descends from the bottom of this box and splits into two horizontal lines, each leading to a child box. The left child box has a purple-to-white gradient and contains the text 'Thermosetting Plastics'. The right child box has a purple-to-white gradient and contains the text 'thermoplastics'. The background includes a dark purple shape on the left and a magenta shape on the right.

Thermosetting
Plastics

thermoplastics

Thermosetting plastics

- ▶ *Thermoset plastics are hard and rigid. Example is Bakelite and melamine.*
- ▶ *Thermoset can be moulded to set it in any shape but it cannot be remoulded.*
- ▶ *It is dark in color, hard and resistant to heat and electricity.*
- ▶ *It is being widely used for the handle of kettles and pans.*
- ▶ *Earlier black telephone sets, electric switches, electric lamp holders, pins and plugs were made from thermoset plastic.*

Examples of theroset plastics



Thermoset handles



A firemans uniform is coated with thermoset plastic to
made it fire resistant



Melamine wares



An electric pin (black)

Thermoplastics

- ▶ *Thermoplastics are soft and flexible.*
- ▶ *They are not elastic like rubber and steel springs.*
- ▶ *They melt on warming and regain their shape on cooling.*
- ▶ *Thermoplastics can be drawn into fine fibers, moulded to any desired shape or stretched or spread as sheets.*
- ▶ *Some of the better known thermoplastics are nylon (polyamide), polyesters, polyethylene, polyvinyl chloride (PVC), acrylic, polyurethane, polypropylene (PP), polytetra-fluoro-ethylene (PTFE) etc*

Thermoplastics examples



Plastic table and chairs



Plastic food containers



Plastic toys



Plastic spoons and forks



Plastic cups



Plastic daily use items

Properties of Plastics

- ▶ *Resist corrosion*
- ▶ *Resist high temperatures*
- ▶ *Insulate heat and electricity*
- ▶ *Elastic*
- ▶ *Thermoplastics can be recycled*
- ▶ *Not reactive to Chemicals and water*
- ▶ *Water resistant*
- ▶ *soft when hot*

Plastics and the environment

- ▶ *Recycling waste plastic is very important. It may kill many animals as well as polluting Earth.*
- ▶ *Plastics are not biodegradable.*
- ▶ *Few years ago, scientists have discovered photodegradable plastics that can be broken down by sunlight, but it takes very long time to rot.*
- ▶ *Recently, scientists developed biopolymers, biodegradable polymers. They rot very easily, for example plastics made from corn starch, dissolves rapidly in water.*