

# ORGANIC CHEMISTRY

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# ESTERIFICATION

- ACID + ALCOHOL  $\rightarrow$  ESTER + WATER
- CONDENSATION RXN
- CONDITIONS: CONCENTRATED SULPHURIC ACID [ CATALYST & DEHYDRATING AGENT]
- NAMING ESTER: 1<sup>ST</sup> NAME FROM ALCOHOL  
2<sup>ND</sup> NAME FROM ACID
- DRAWING ESTER: 1<sup>ST</sup> PART: ACID  
2<sup>ND</sup> PART: ALCOHOL

# PHYSICAL PROPERTIES OF ESTERS

- Covalent non-polar molecules held together by weak Van der Waals forces.
- Short chain acids ( C1- C4) produce esters which are oily pleasant smelling liquids. [ fruits, flowers from which perfumes & flavourings are made)
- Long chain acids ( C11 and >) produce esters referred to as fats and oils which are greasy, scentless solids & liquids.

# HYDROLYSIS OF ESTERS

- Two types:

1. Acid hydrolysis
2. Alkaline hydrolysis

# ACID HYDROLYSIS


- Dilute acid is used to speed up the rxn.
- Ester heated under REFLUX with dilute acid.
- Rxn is reversible.
  
- What happens:
  1. Ester + water [in presence of dil. acid] give acid & alcohol.

# ALKALINE HYDROLYSIS

- Ester heated under reflux with dilute alkali
- Rxn is not reversible
- Products can separate easily.
  
- Rxn takes place in 2 stages:
  1. Formation of acid and alcohol
  2. The acid formed forms salt and water [in xs alkali]

# Saponification

- What is it?
- Process by which soaps are made by the hydrolysis of natural esters.
- Conditions: conc. Sodium hydroxide solution.
- LET'S GO TO THE BOARD!!!!!!!!!!!!!!

A stylized, monochromatic illustration of a plant with a central stem, several large, pointed leaves, and a cluster of small, round buds or flowers on the left side. The illustration is rendered in a dark brown color against a lighter brown background.

Organic Chemistry  
**POLYMERS**



# Polymer

Many + Parts

This name hints at how polymers are made



# PLASTICS

Latin: *Plasticus*, that which can be molded

This name honors plastics useful property of being easily molded

# Definition of a POLYMER

- Polymers are macromolecules formed by linking together thousands of small molecules called MONOMERS

# Polymers are classified according to how they are made

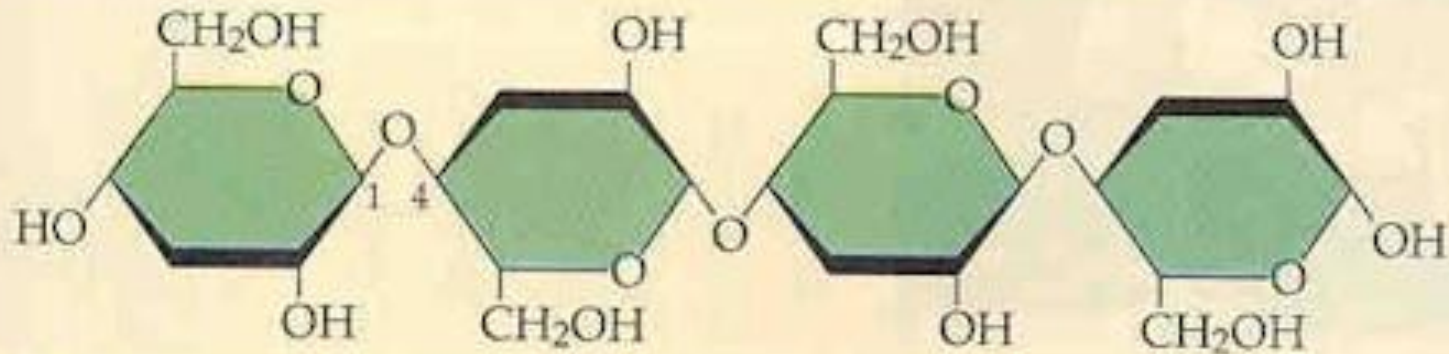
- 1. Addition polymers made by ADDITION POLYMERISATION
- Condensation polymers made by CONDENSATION POLYMERISATION
  
- THEY CAN ALSO OCCURE NATURALLY LIKE COTTON!!

# ***Cotton: a natural polymer***

***What is its building block (monomer)?***



Cotton fiber is mostly cellulose, and cellulose is made of chains of the sugar, glucose linked together a certain way.



(c) Cellulose: 1-4 linkage of  $\beta$  glucose

# POLYMERISATION

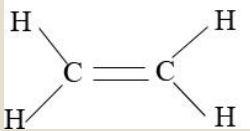
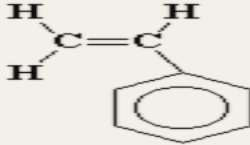
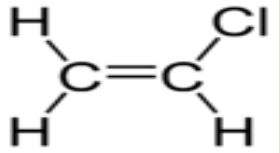
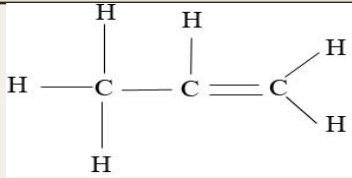
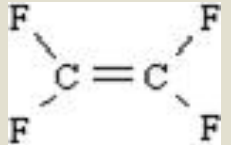
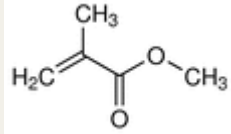
## Addition

- Made from unsaturated monomers
- One product formed
- No atoms/molecules lost in the process

## Condensation

- Made from monomers with a different composition to theirs
- Polymer formed, along with water/ small molecules
- Loss of small molecules-e.g. water

# Plastics made in ADDITION polymerisation

Name of polymer	Structure of monomer	Used to make
Polythene		Packaging, plastic bags, plastic film, plastic wrap
Polystyrene		Disposable plates, cups, food containers, packaging material, heat insulator in buildings
PVC/ polyvinylchloride		Rain coats, upholstery, suitcase coverings, plumbing fittings, water pipes, insulation of electric wires
Polypropene		Plastic containers- buckets, food containers, bowls, coolers, hinges for lids
Teflon		Non-stick coatings for irons and pots
Perspex		Glass substitute in aircrafts windows, reflectors on vehicles, sign boards

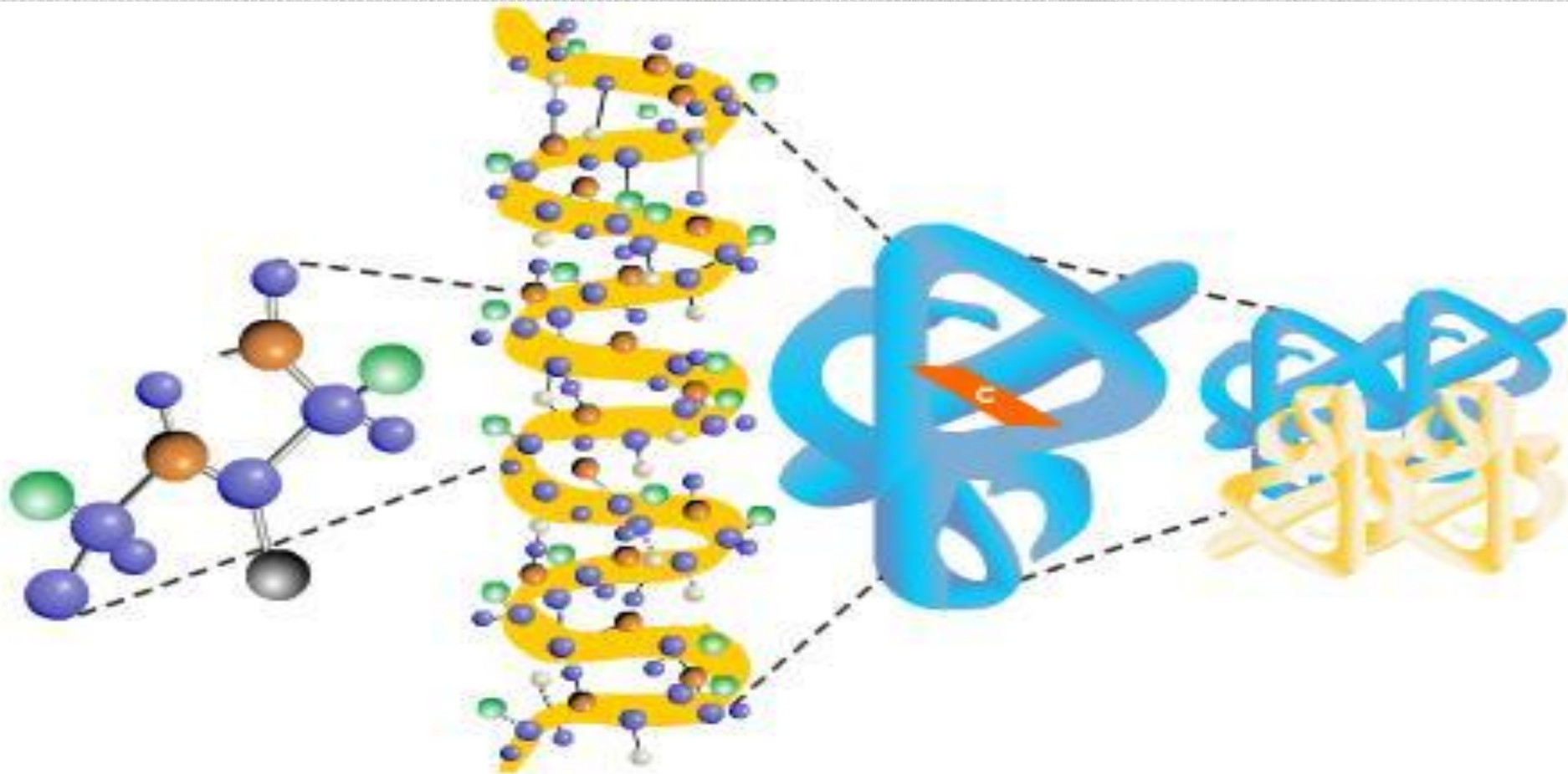


Polymerisation

# CONDENSATION



# Naturally Occurring: PROTEINS



(a) Primary structure



(b) Secondary structure

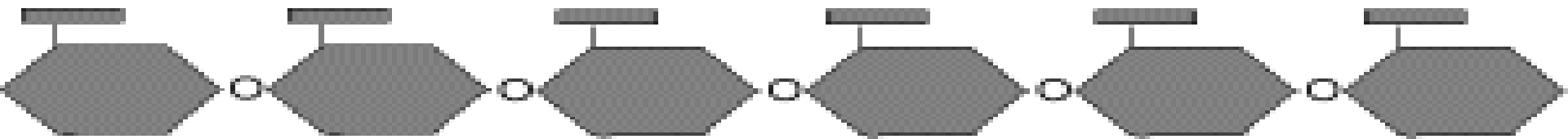


(c) Tertiary structure

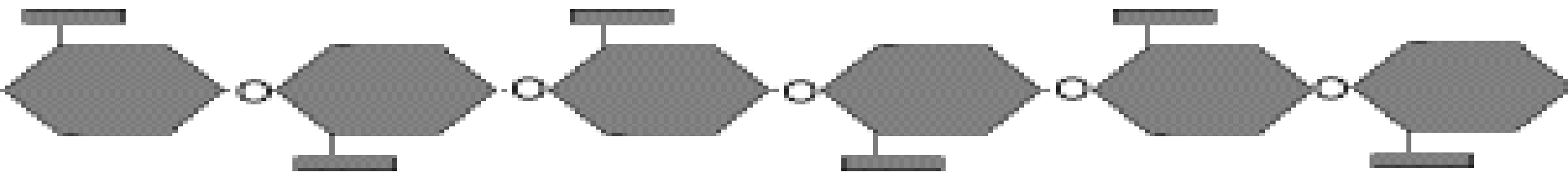


(d) Quaternary structure

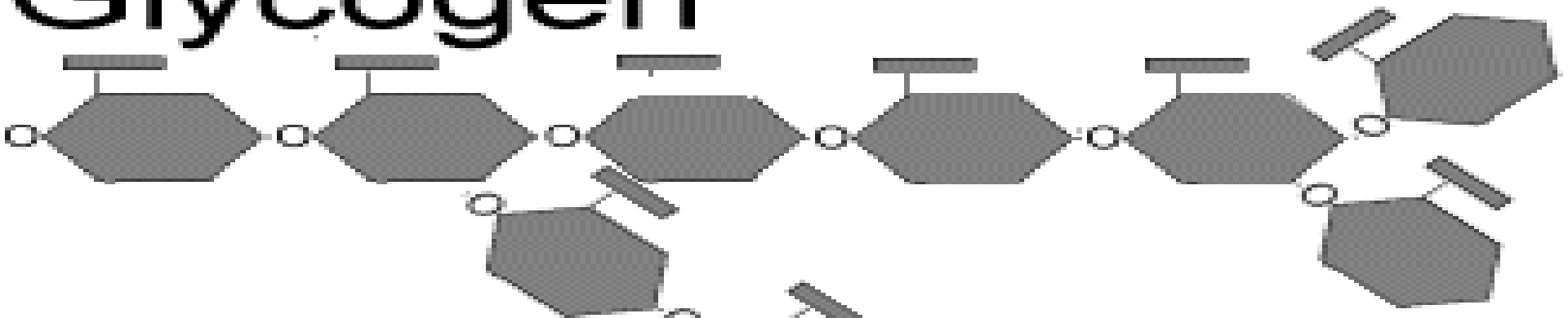
# Starch



# Cellulose



# Glycogen

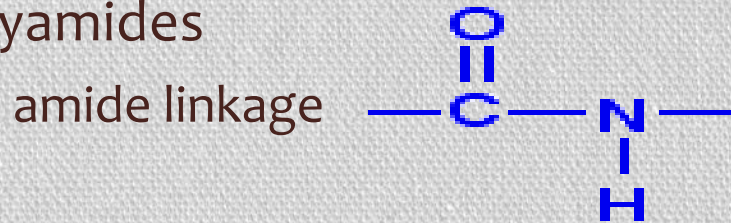


# Synthetic/ man-made condensation polymers:

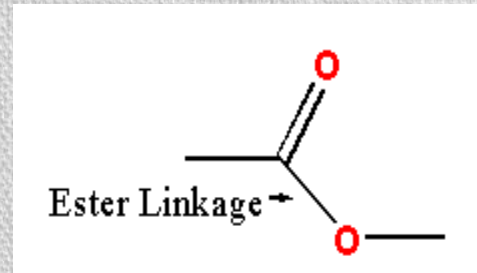
- Nylon
- Terylene

# Condensation Polymers are grouped based on the type of linkage between the monomer units

## 1. Polyamides



## 2. Polyesters



## 3. Polysaccharides ---O--- glycosidic linkage

# NYLON

A man-made  
polymer





**Nylon in Tires and Rope  
and Clothes**



PRETTY POLLY

10 denier stockings

*Nylons*

gloss  
stockings  
10 denier



# NY LON



Nylon is used in clothes, shoes, jackets, belts, and accessories. It's not surprising a magazine is named after this polymer. Where did nylon get its name?

Nylon was discovered in 1935. The name nylon is derived from two cities where it was discovered namely New York (NY) and London (LON).



Two ingredients are mixed and a solid begins to form at the junction between the two layers of liquid.



Hot nylon spaghetti can be extracted.



We say certain polymers are man-made, but the truth is they make themselves. Humans only have to get the ingredients near each other. The chemicals will assemble themselves.

# Uses of Condensation Polymers

Type of Polymer	Example	Uses
Synthetic polyamide	Nylon	Fibres for clothing, ropes, fishing lines, nets
Protein	Keratin	Growth & repair tissues, muscles, hair, nails, enzymes
Polyester	Terylene	Fibres for clothing, boat sails & fishing lines
Polysaccharide	Starch	Food reserves in plants, food source for animals