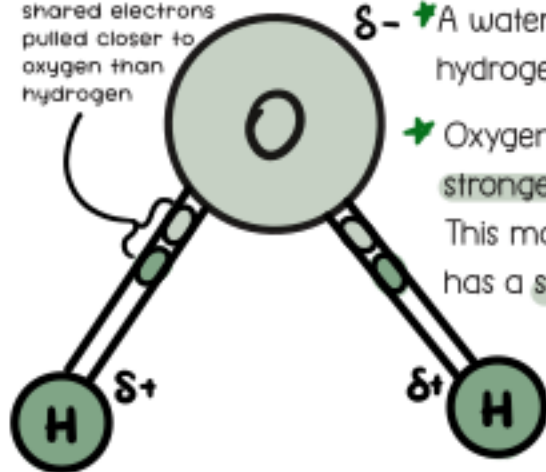




Bio unit 01

water molecules

shared electrons pulled closer to oxygen than hydrogen



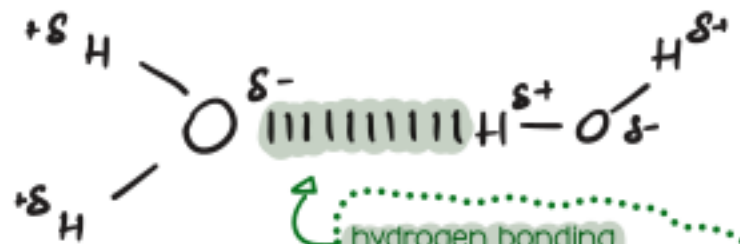
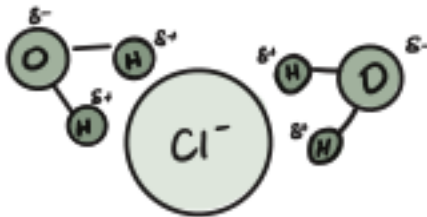
- ★ A water molecule consists of one oxygen atom covalently bonded to two hydrogen atoms.
- ★ Oxygen has more protons in its nucleus than hydrogen hence it has a stronger attraction towards the shared electrons compared to hydrogen. This makes oxygen more electronegative than hydrogen therefore oxygen has a stronger pull on the shared electrons
- ★ As a result, the oxygen atom becomes slightly negative (δ^-) and the hydrogen atoms become slightly positive (δ^+). This creates a permanent dipole, making water a polar molecule.

Importance of water

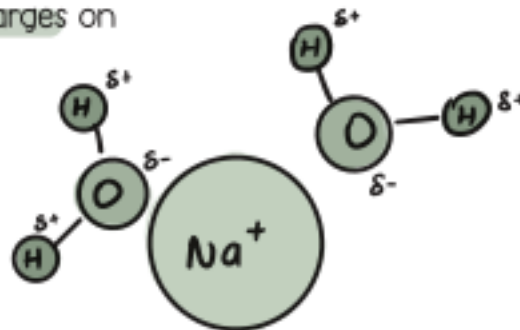
↳ due to water molecules' polarity and its ability to form hydrogen bonds leads to water having unique properties

1. Water acts as a solvent

- ★ When an ionic substance dissolves the δ^- oxygen atoms in water molecules are attracted to the positive ions while the δ^+ hydrogen atoms are attracted to negative ions. Water molecules surround each ion due to electrostatic attraction between the ions and the partial charges on the water molecules



hydrogen bonding
Weak electrostatic intermolecular force of attraction between slightly positive hydrogen and slightly negative oxygen and other polar molecules nearby



2. High specific heat capacity allows water to be a suitable habitat; helps to maintain optimal temperature within cells and bodies. This is due to presence of many hydrogen bonds requiring a large amount of energy to raise the temperature.

3. High latent heat of vaporisation acts as a coolant (through sweating or transpiration). The presence of many hydrogen bonds requiring large amount of energy to turn liquid water into a gas.

4. Cohesion and adhesion

cohesion is the tendency of water molecules to stick together through hydrogen bonds

adhesion tendency of water molecules to stick to other materials.

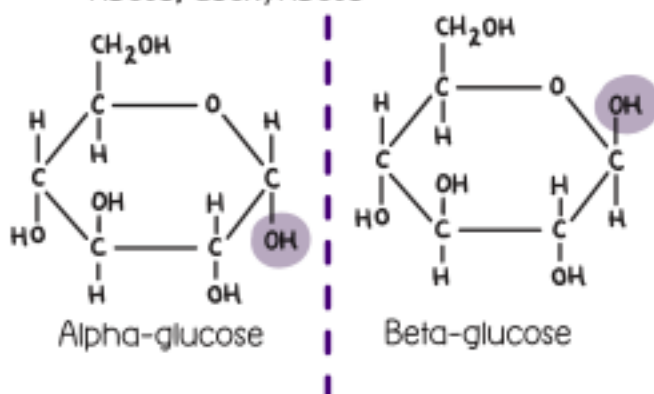
strong cohesion and adhesion helps water to flow through organisms, carrying substances along with it (for example during transpiration)

Carbohydrates

↳ composed of carbon, hydrogen and oxygen

Monosaccharides

- single sugar monomer
- general formula = $C_nH_{2n}O_n$
- hexose sugars (6 carbon atoms) = glucose, fructose, galactose
- pentose sugars (5 carbon atoms) = ribose, deoxyribose



Disaccharides

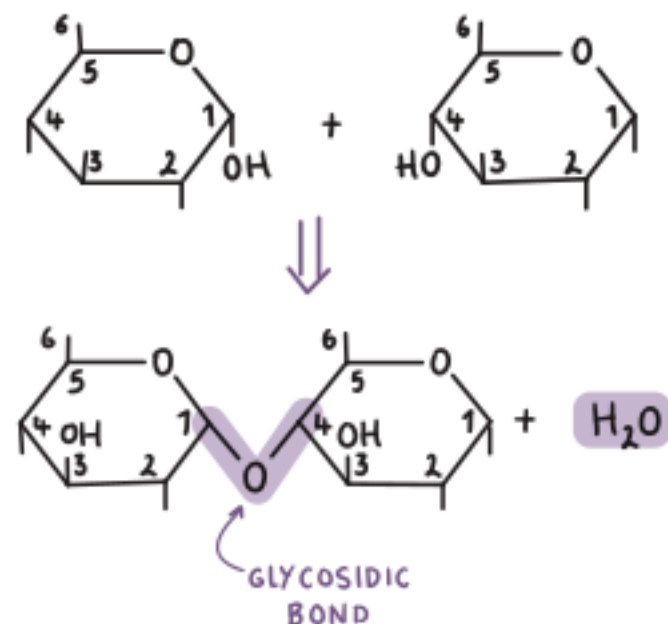
- formed when two monosaccharides join together via a condensation reaction forming a glycosidic bond
- examples

↳ maltose (product of digestion of starch) = α -glucose + α -glucose

↳ sucrose (transport sugar in plants) = α -glucose + fructose

↳ lactose (sugar in milk) = α -glucose + galactose

Condensation reaction



Condensation reaction reaction in which two molecules join by the removal of a water molecule

Hydrolysis reaction breaking down of a larger molecule into smaller molecules by adding a water molecule

Condensation	Hydrolysis
Synthesis of a large molecule by the joining of simpler molecules and removal of water	Breaking down of large molecules by adding water
Reactant = smaller molecules	Reactants = larger molecule
product = larger molecules	Products = smaller molecules
Bonds are formed	Bonds are broken

Monosaccharides	Disaccharides
Both are soluble Made up of carbon, hydrogen and oxygen	
Single unit	Two units
there is a carbon: hydrogen: oxygen ratio	No ratio
No glycosidic bonds	Have glycosidic bonds

Polysaccharides

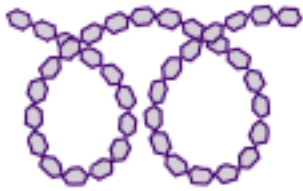
Large carbohydrates that are made up of simple units of monosaccharides joined by glycosidic bonds.

1. Starch

A polymer of alpha glucose that is used as energy storage in plants

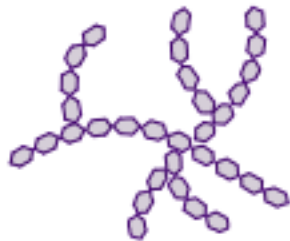
Consists of two types of polysaccharides = amylose and amylopectin

AMYLOSE



An unbranched chain of alpha glucose monomers.
Joined by 1,4-glycosidic bonds that coils into a compact helix (due to hydrogen bonds)

AMYLOPECTIN



Branched chain containing both 1,4 and 1,6 glycosidic bonds
The branched chains increases surface area which allows enzymes such as amylase to quickly hydrolyse the molecule and release glucose when required by the plant for respiration

2. glycogen



Polymer of alpha glucose that is used as an energy storage in animals

Linked by 1,4 and 1,6 glycosidic bonds

Similar to amylopectin but more branched

Extensive branching creates very compact molecule with many terminal ends

Branched chains provides increased surface area allowing glucose molecules to be easily hydrolysed for respiration

Features of a storage polysaccharide

Compact large numbers of glucose molecules (and therefore more energy content) can be stored in a less space inside the cell

Branched many glucose terminals enabling many glucose molecules to be broken down at the same time (hydrolysed)

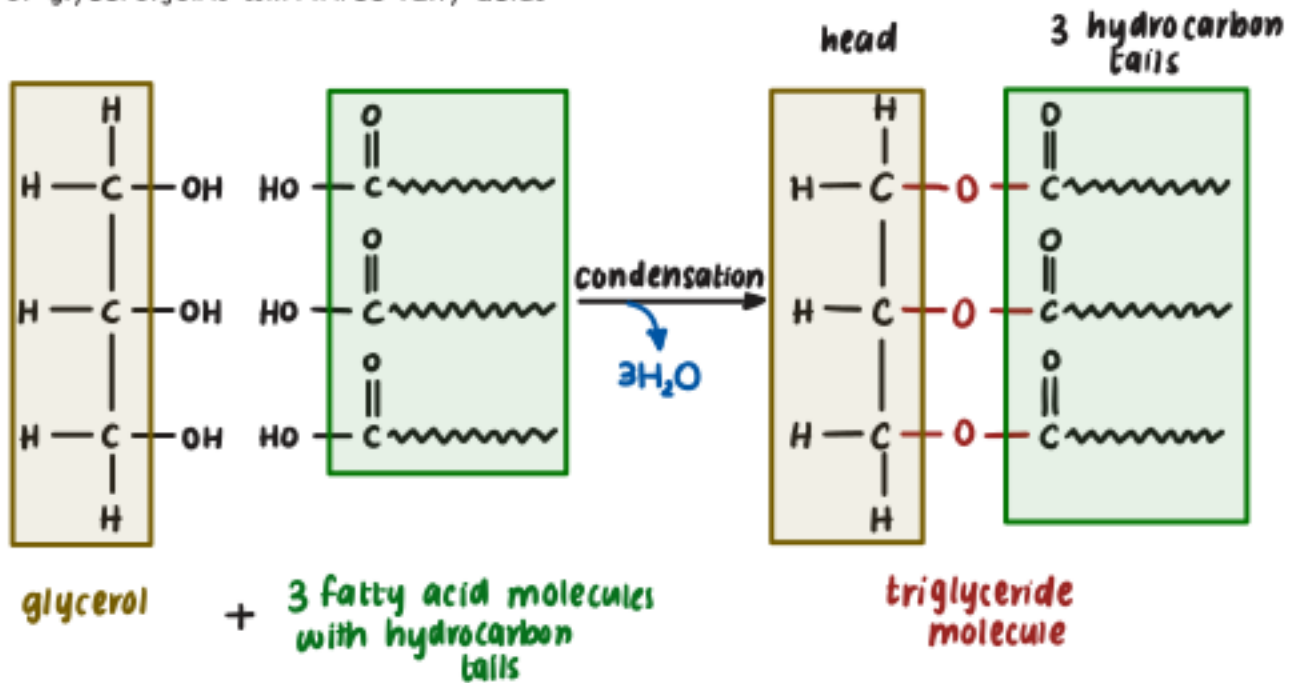
Insoluble doesn't dissolve in water and therefore doesn't affect the osmotic pressure inside the cell

Lipids

Composed of carbon, hydrogen and oxygen. However, lipids contain much lower proportion of oxygen than carbohydrates.

Triglycerides

Synthesized in a condensation reaction (also known as esterification) where one molecule of glycerol joins with three fatty acids



For each fatty acid that joins to one of the hydroxyl (-OH) groups on the glycerol, an ester bond is formed, and one molecule of water is released.

Therefore, the formation of one complete triglyceride molecule produces a total of three ester bonds and releases three molecules of water

Fatty acid tails depend on:

number of carbons which determines the length of the chain

types of bonds between the carbon atoms can be either single (saturated) or double (unsaturated)

Unsaturated fatty acid

Saturated fatty acid

Made of carbon, hydrogen and oxygen linked by covalent bonds

Glycerol head and 3 fatty acid tails

One or more carbon -to-carbon double bond

Single carbon-to-carbon bond

High C:H ratio
Low H:C ratio

Low C:H ratio
High H:C ratio

Branched and distant because of kinks at the position of double bonds

Straight and tightly packed

the distant fatty acids cannot form strong intermolecular forces which result in lower melting points

High melting point because of strong intermolecular forces of attraction

proteins

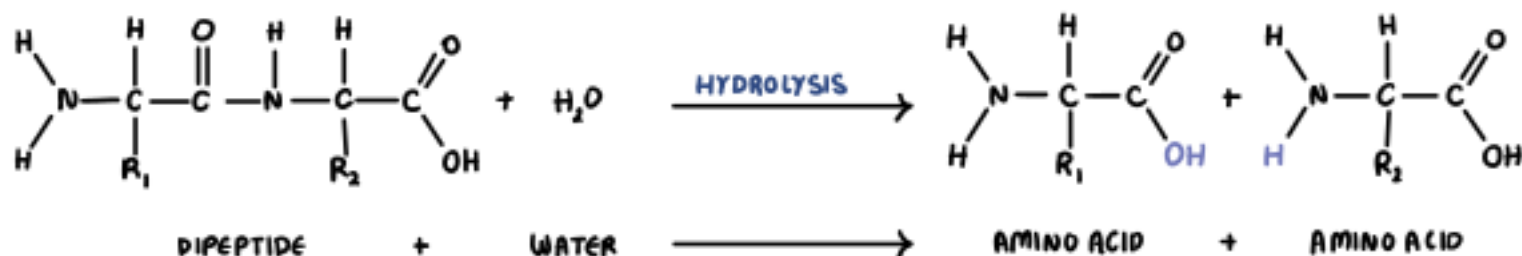
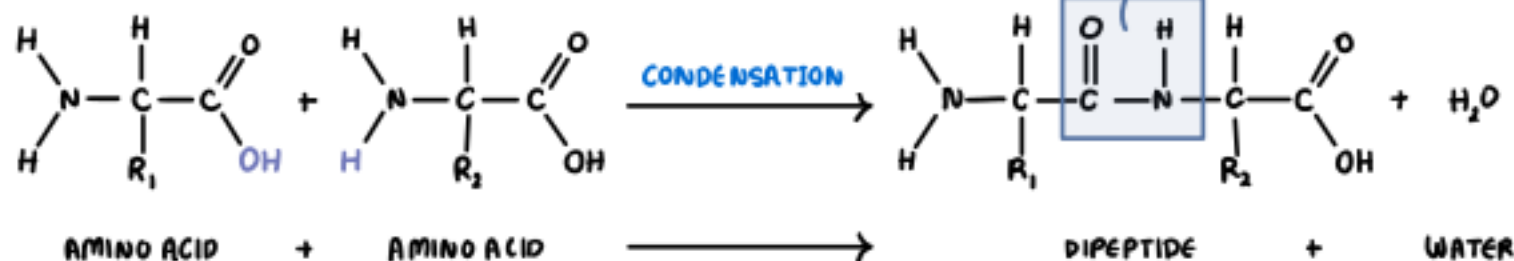
↳ composed of carbon, hydrogen, nitrogen and sulfur

* amino acids are monomers and can join together via peptide bonds to form polypeptide chains



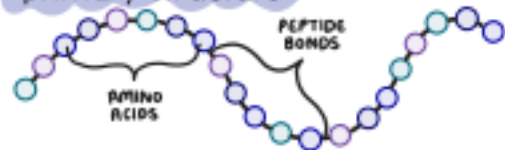
general structure of amino acids

- a central carbon
- an amino group (NH_2)
- a carboxyl group (-COOH)
- a hydrogen atom
- an R group



Levels of protein structure

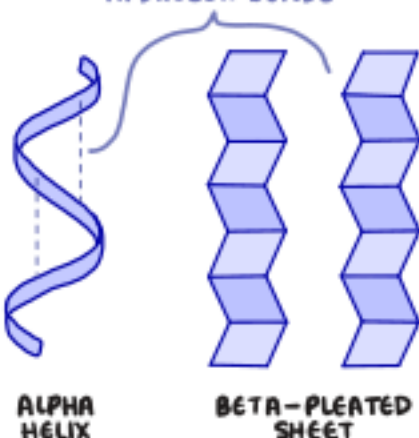
1. primary structure



- ↳ a sequence of amino acids joined by peptide bonds
- ↳ determines its folding in the secondary and the tertiary structures and this folding determines the shape of protein which determines the function of the protein

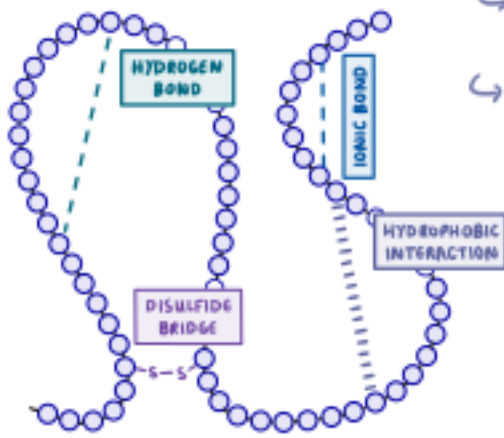
2. Secondary structure

HYDROGEN BONDS



- ↳ folding of the polypeptide chain due to hydrogen bonds between the amino group of one amino acid and the carboxyl group of another amino acid.
- ↳ Causes the polypeptide chain to coil into either an alpha-helix or a beta-pleated sheet structure

3. Tertiary structure

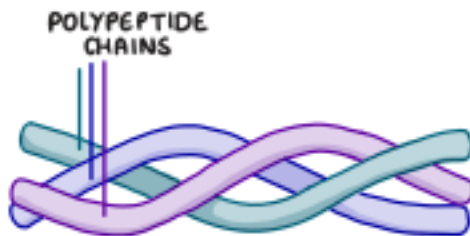


↳ forms when the polypeptide chain folds and twists further to create a complex 3D structure.

↳ Bonds such as:

- ✱ hydrogen bonds (weak but common, between polar R groups)
- ✱ ionic bonds (between oppositely charged R groups, stronger)
- ✱ disulfide bonds (strong covalent bonds between sulfur containing R groups)
- ✱ Hydrophobic and hydrophilic interactions - These are weak interactions between polar and non-polar R groups.

4. Quaternary structure



Involves two or more polypeptide chains forming a functional protein held by the same types of bonds as tertiary structure

types of protein

Globular protein

fibrous protein

Globular protein

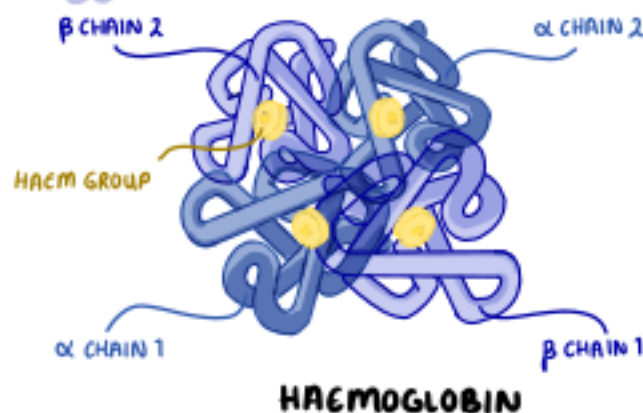


round, compact proteins made up of multiple polypeptide chains usually tertiary or quaternary structure

chains are coiled up so that hydrophilic parts of chains are on the outside of the molecule and hydrophobic parts of chains face inwards, making the protein soluble.

usually have a metabolic functions

EXAMPLE:- HAEMOGLOBIN



a globular protein with a quaternary structure consisting of four polypeptide chains: two alpha-globin and two beta-globin subunits
 each subunit contains one haem group (prosthetic group) which has an iron ion at its centre.
 iron ion reversibly binds to one molecule of oxygen.
 spherical shape and positioning of hydrophilic R-groups on its surface making the haemoglobin soluble in the aqueous environment of the red blood cell cytoplasm.

fibrous protein



made up of long, straight, parallel, polypeptide chains that are tightly coiled round each other to form a rope shape.

usually primary or secondary structure
 no tertiary structure
 insoluble
 have structural functions
 have a repetitive amino acid sequence

EXAMPLE:- COLLAGEN



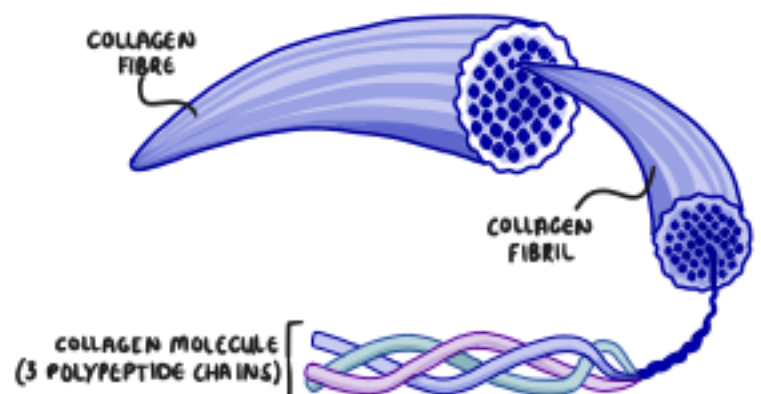
fibrous protein that has a tensile strength
 three polypeptide chains
 primary structure of these chains is a short repeating sequence of an amino acid called glycine with two other amino acids- often proline and hydroxyproline
 three polypeptide chains wound together into a triple

Collagen molecules (made up of three chains) lie parallel to one another where they form covalent bonds ('cross links') between the molecules.

These cross links hold many collagen molecules together to form fibrils.

The ends of the collagen molecules are staggered to prevent any weak spots.

Many fibrils lie alongside each other to form strong bundles known as fibres.

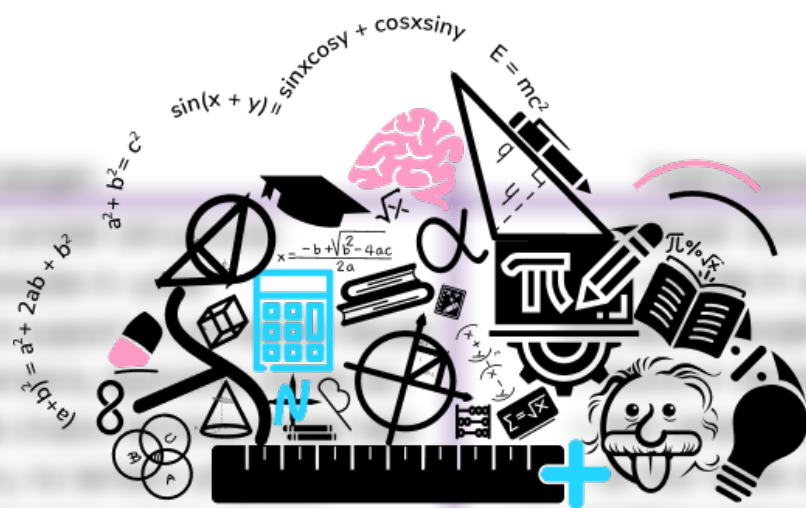


Adaptations

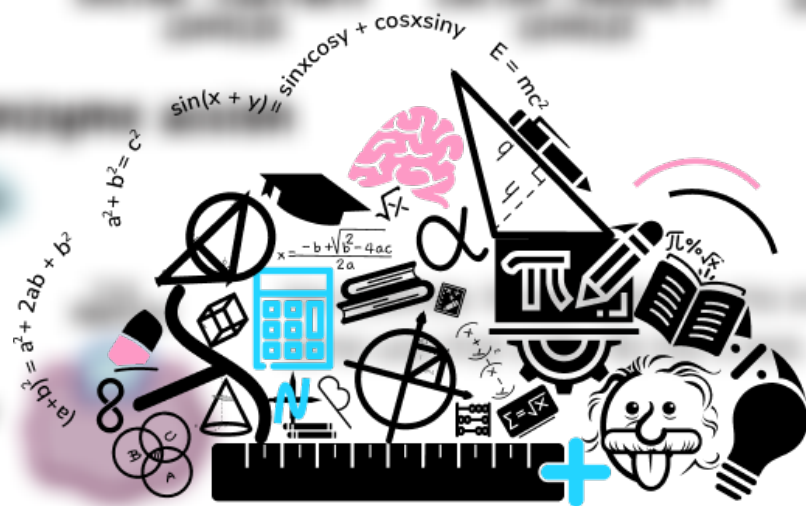
every third amino acid is glycine = glycine is the smallest amino acid allowing three chains to pack tightly into a stable triple helix

high tensile strength = hydrogen bonds in between the three polypeptide chains, staggered ends and covalent cross-links

insolubility = due to the length and extensive bonding

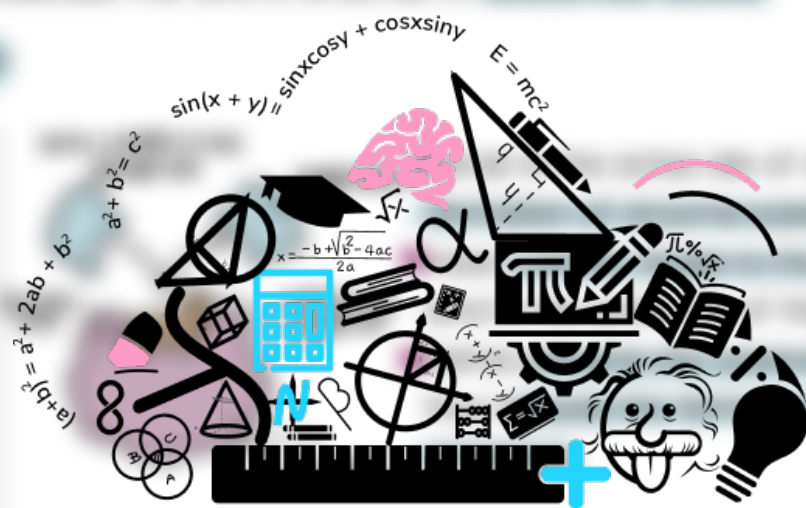


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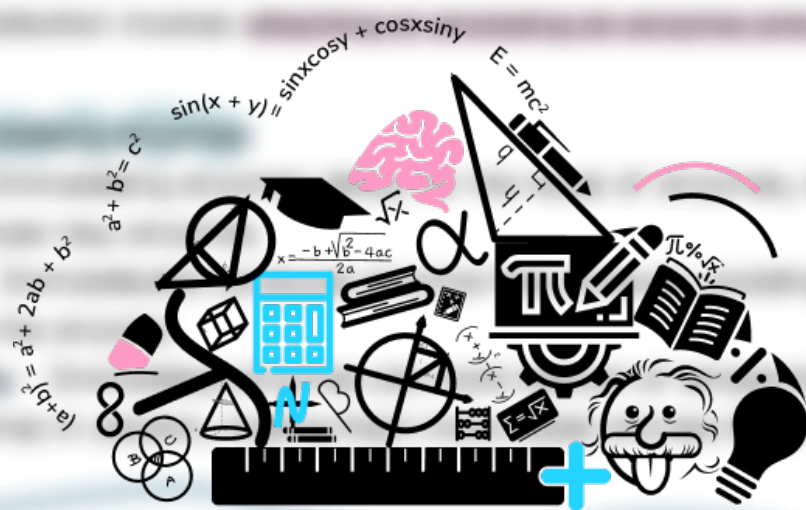


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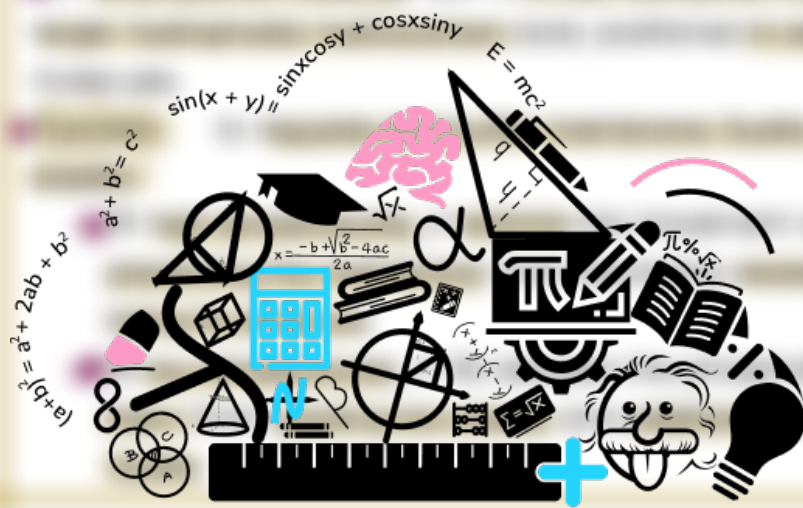
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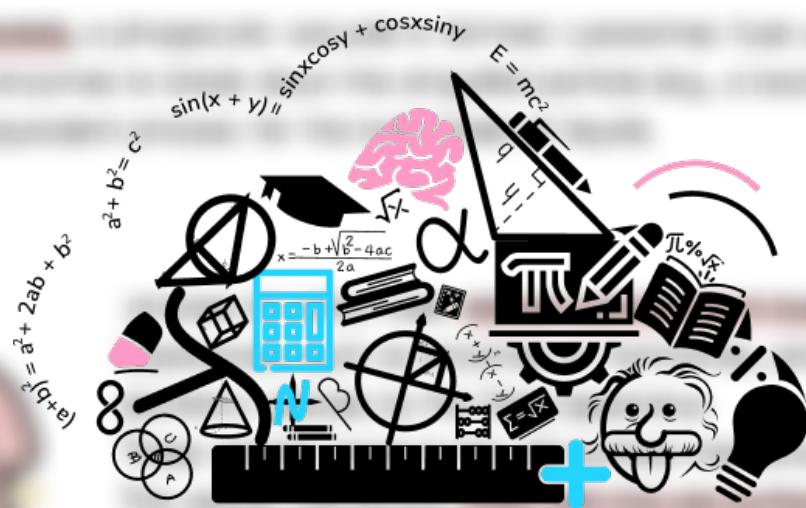
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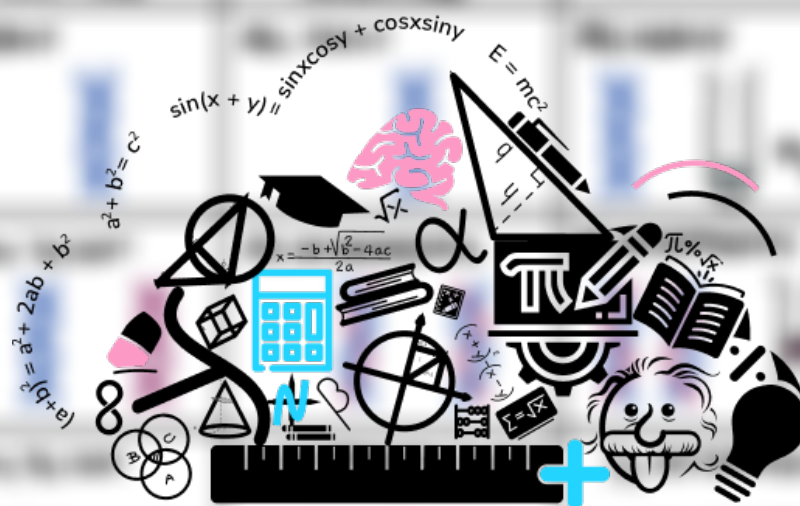


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Keywords and Study's contributions

1. Students will group in a random grouping, as shown on the paper.
2. The students will be divided in a random way for the two types of application, as the group strategy was introduced into the new 300 strategy they made.
3. The 300 was introduced into the strategy.
4. Step 111 was repeated for another round of application.
5. The distribution of paper strategy 300 was introduced to make the 300 was repeating. The second round was made in the new way. The representative strategy, made in 300 with one paper strategy and one paper strategy, was in the middle of the new way. The paper strategy was repeated up to the new way.



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Cloud

A vibrant collage of mathematical and scientific symbols and icons. It includes the Pythagorean theorem $a^2 + b^2 = c^2$, the sine addition formula $\sin(x + y) = \sin x \cos y + \cos x \sin y$, the energy-mass equivalence $E = mc^2$, the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, the discriminant Δ , the golden ratio ϕ , the Greek letter pi π , the Euler-Mascheroni constant γ , the Riemann zeta function $\zeta(s)$, the square root symbol $\sqrt{\quad}$, the summation symbol Σ , the Venn diagram, the lightbulb, the brain, the ruler, the calculator, the portrait of Albert Einstein, and the plus sign. The background is a soft, out-of-focus image of a person's face.

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Fluorescence is a **change in the absorption of light** in a DNA molecule.
Fluorescence is a **gene** that sometimes leads to a **change in the sequence** that the gene codes for.
Fluorescence occurs **spontaneously** during DNA replication.

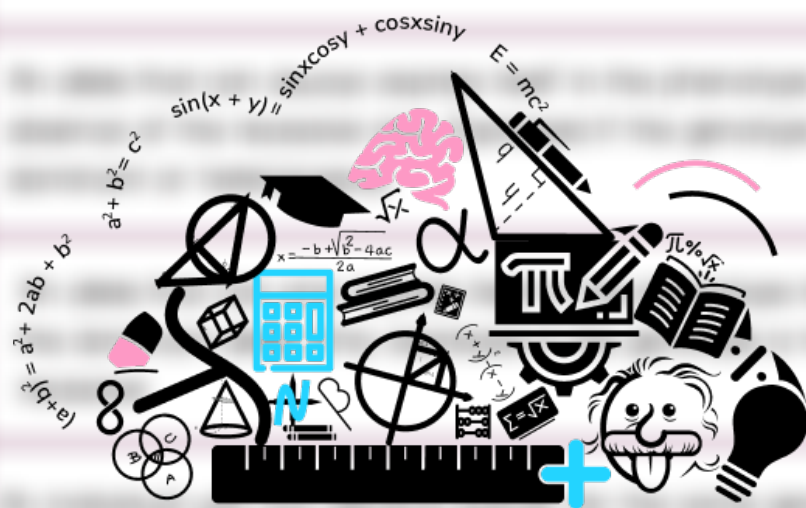


Threats to validity – any conditions that make your study's conclusions less convincing

Threats to the **internal validity** that can prevent you from seeing the **causal relationship** between the **independent variable** and the **dependent variable**

Design – the way you choose to conduct your study to **minimize the threats to validity** during the **research process** from **data collection**





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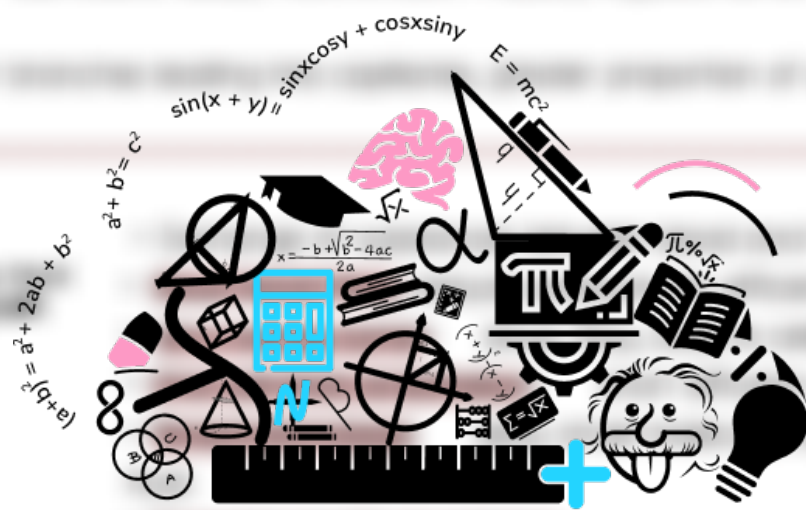


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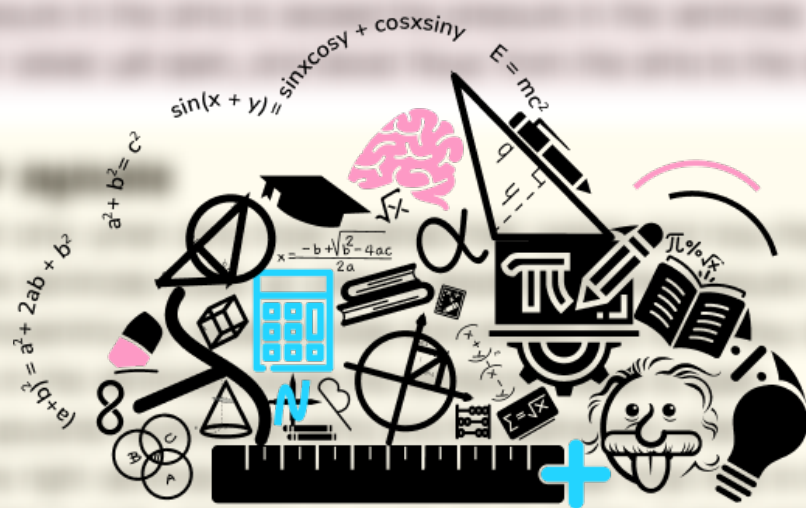
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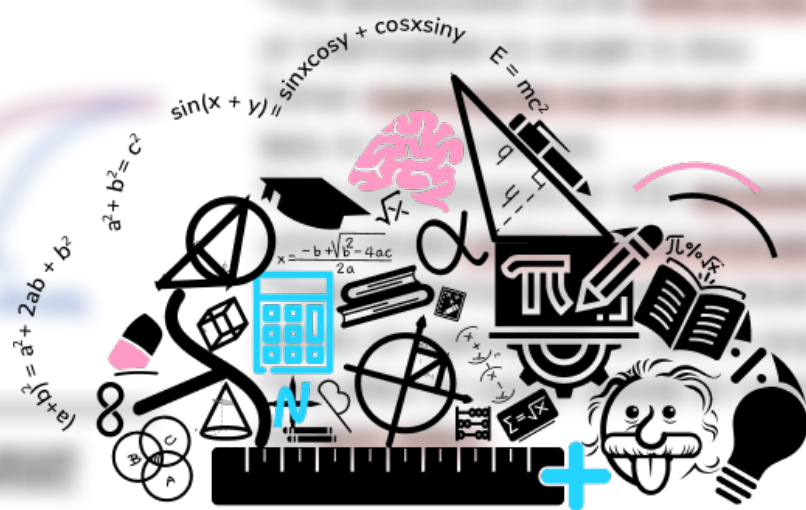
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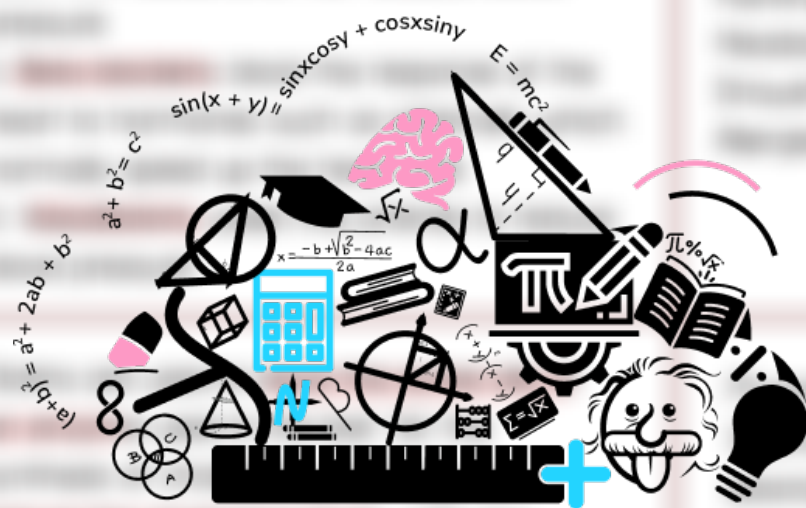
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- Exogenous** - A change in one variable is affected by a change in another. Exogenous variables are not directly related with the dependent variable.
- Endogenous** - A change in one variable is directly responsible for the change in another.
- lag** - the difference of something with respect to happen.
- Autoregressive** - measurable, statistical correlation.
- Autoregressive lag** - the lag of a variable with respect to previous one variable.

