OCR (B) Biology A-level

2.1.2 - Water and its importance in plants and animals

Flashcards

Why are water molecules polar?

Why are water molecules polar?

O is more electronegative than H, so attracts electron density in the covalent bond more strongly. Forms O δ- (slightly negative) and H δ+ (slightly positive). Thus water can act as polar solvent.

Results in intermolecular hydrogen bonding between lone pair of electrons on O of one molecule and H δ+ on neighbouring molecule.

What is water important in intra and extracellular body fluids?

Why is water important in intra and extracellular body fluids?

Water is a component of:

- Blood plasma (for the transport of substances)
- Cytoplasm
- Tissue fluid (bathes cells)
- Lymph
- Urine for excretion
- Serum

What is serum?

What is serum?

Blood with the clotting factors removed.

It contains antibodies, electrolytes, hormones, antigens etc.

Describe the roles of water in plants.

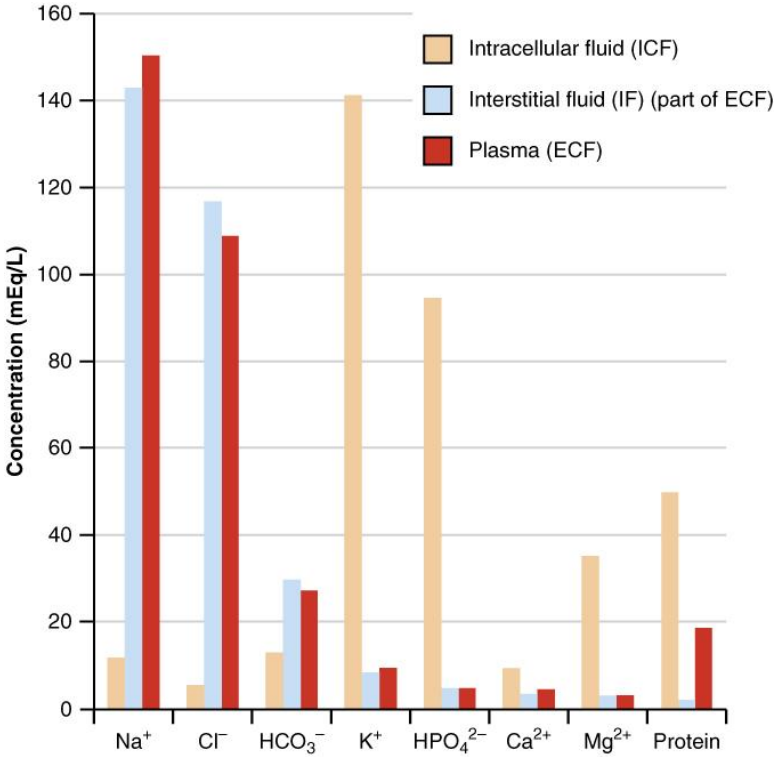
Describe the roles of water in plants.

- Component of cell sap in the vacuole, maintains turgor pressure.
- Transpiration stream relies on cohesion-tension to transport water from roots to leaves for photosynthesis.

How does the composition of body fluids illustrate the role of water as a solvent?

How does the composition of body fluids illustrate the role of water as a solvent?

Solutes and electrolytes can be transported in body fluids because water is a polar universal solvent.



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How can sugars and proteins be detected and measured in samples?

How can sugars and proteins be detected and measured in samples?

- Use **biosensors**. A bioreceptor detects the presence of a chemical. A transducer converts the response into a detectable electrical signal.
- Use a **test strip** coated in a reagent that changes colour if reducing sugar is present.
- Use Benedict's test (sugar)/ Biuret test (protein) with **colorimetry**.

Outline the Benedict's test for reducing sugars.

Outline the Benedict's test for reducing sugars.

1. Add an equal volume of Benedict's reagent to the sample to be test.
2. Heat the mixture in a water bath at 100°C for 5 minutes.
3. Positive result: colour change from blue to green to yellow to orange to brick-red. Precipitate forms.

Outline the Benedict's test for non-reducing sugars.

Outline the Benedict's test for non-reducing sugars.

1. Reducing sugar test, negative result, reagent remains blue.
2. Hydrolyse non-reducing sugars (e.g. sucrose) into their monomers by adding 1cm^3 of HCl.
3. Heat in a boiling water bath for 5 minutes.
4. Neutralise the mixture using sodium hydrogen carbonate solution.
5. Proceed with the Benedict's test as usual.

What is the function of a Biuret test?

What is the function of a Biuret test?

Confirms **presence of peptide bond**(s).

Outline the Biuret test for proteins.

Outline the Biuret test for proteins.

1. Add an equal volume of **sodium hydroxide** to a sample at room temperature.

2. Add a few drops of **dilute copper (II) sulfate solution**. Swirl to mix. (steps 1 & 2 make the Biuret reagent)

3. **Positive result:** colour change from pale blue to purple .
   Negative result: solution remains blue.

Outline the process of colorimetry.

Outline the process of colorimetry.

1. Use a colorimeter with a complementary filter to measure the % absorbance or transmission of solutions of known concentration.
2. Plot a calibration curve: % absorbance or transmission (y-axis) against concentration (x-axis).
3. Measure the % absorbance or transmission of the unknown sample.
4. Use this value and the calibration curve to find the concentration of the unknown sample.

Define monomer and polymer. Give some examples.

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Monomer: smaller units that join together to form larger molecules

- monosaccharides (glucose, fructose, galactose, ribose)
- amino acids
- nucleotides

Polymer: molecules formed when many monomers join together

- polysaccharides
- proteins
- DNA/ RNA

What happens in condensation reactions?

What happens in condensation reactions?

A chemical bond forms between two molecules and a molecule of water is produced.

What happens in hydrolysis reactions?

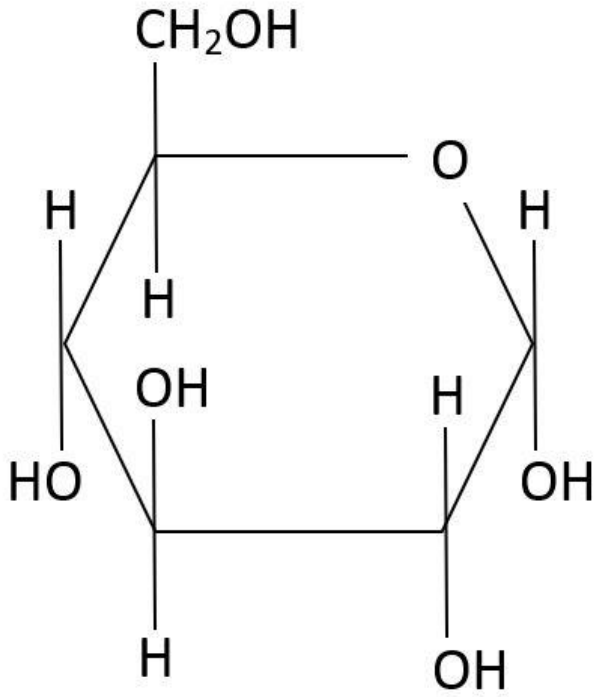
What happens in hydrolysis reactions?

A molecule of water is used to break a chemical bond between two molecules e.g. peptide bonds in proteins, ester bonds between fatty acids and glycerol in lipids.

Draw the structure of α-glucose.

Draw the structure of α-glucose.

- Simple monosaccharide
- 6C hexose ring structure
- Cis-isomer



Draw the structure of lactose.

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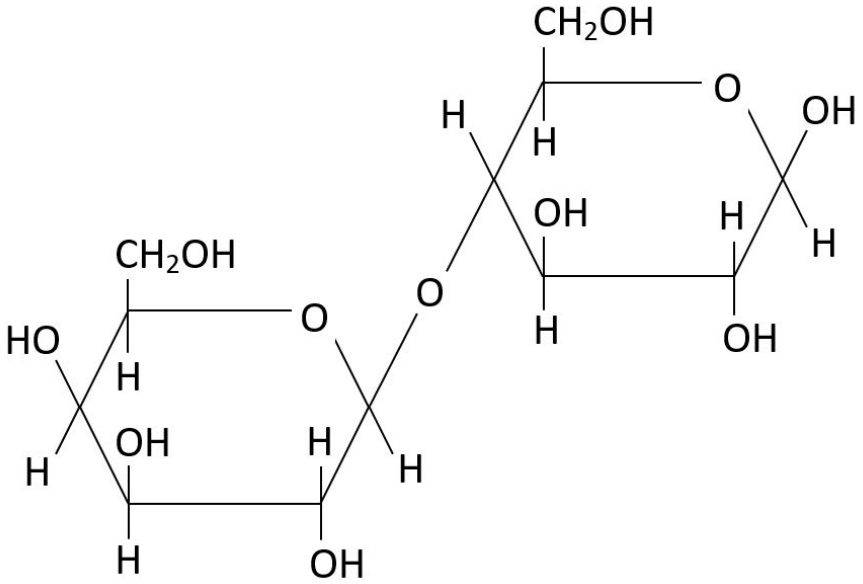
- Disaccharide formed by a condensation reaction between glucose and galactose
- α-1,4 glycosidic bond



What are organic molecules?

What are organic molecules?

Molecules containing the element carbon.

Also contain various other elements.

carbohydrates & lipids: C, H, O
proteins: C, H, O, N, S
nucleic acids: C, H, O, N, P

What type of bond forms when monosaccharides react?

What type of bond forms when monosaccharides react?

(1,4 or 1,6) glycosidic bond

What is formed when two monosaccharides react?

What is formed when two monosaccharides react?

One glycosidic bond and a **disaccharide** is formed.

What is formed when more than two monosaccharides react?

What is formed when more than two monosaccharides react?

Multiple glycosidic bonds and a **polysaccharide** is formed.

Describe the structure and functions of starch.

Describe the structure and functions of starch.

Storage polymer of α-glucose in plant cells

- insoluble = no osmotic effect on cells
- large = does not diffuse out of cells

Made from **amylose**:

- 1,4 glycosidic bonds
- helix with intermolecular H-bonds = compact

and **amylopectin**:

- 1,4 & 1,6 glycosidic bonds
- branched = many terminal ends for hydrolysis into glucose

What is the function of glycogen?

What is the function of glycogen?

Main storage polymer of α-glucose in animal cells (but also found in plant cells).

Describe the structure of glycogen.

Describe the structure glycogen.

- 1,4 and 1,6 glycosidic bonds
- Branched = many terminal ends for hydrolysis
- Insoluble = no osmotic effect and does not diffuse out of cells
- Compact

What effect does branching have on the solubility of polysaccharides?

What effect does branching have on the solubility of polysaccharides?

(given that the molecules are the same length) Branched compounds tend to be more soluble because there are fewer contact points between molecules, so intermolecular forces are weaker.

Describe how to test for and measure the presence of starch in a sample.

Describe how to test for and measure the presence of starch in a sample.

1. Add iodine solution.
2. Positive result: colour changes from yellow-brown to blue-black.
3. Use colorimetry to determine the % absorbance or transmission of the sample.
4. Use this result and a calibration curve to read off the concentration.

Define osmosis.

Define osmosis.

The **diffusion** of **water** across a **semi-permeable membrane** from an area of **higher water potential** to an area of **lower water potential** until a dynamic equilibrium is established.

What is water potential (ψ)?

What is water potential (ψ)?

- Pressure created by water molecules, measured in kPa
- Ψ of pure water at 25°C and 100 kPa is 0
- More solute/ electrolytes = more negative ψ

How does osmosis affect plant and animal cells?

How does osmosis affect plant and animal cells?

osmosis **INTO cell**:

- **plant**: protoplast swells = cell turgid
- **animal**: lysis

osmosis **OUT of cell**:

- **plant**: protoplast shrinks = cell flaccid
- **animal**: crenation

Outline the factors that affect the rate of osmosis.

Outline the factors that affect the rate of osmosis.

- higher temperature = higher kinetic energy = faster rate of movement
- surface area
- pressure
- concentration gradient