**Topic 2.2: Water**

**Essential Idea: Water is the medium of life.**

**Statements & Objectives:**

**2.2.U1 Water molecules are polar and hydrogen bonds form between them.**

Describe the structure of an atom (in terms of protons, neutrons and electrons).

**(Describe**: Give a detailed account)

Contrast ion with atom.

**(Compare and Contrast:** Give an account of similarities and differences between two (or more) items or situations, referring to both(all) of them throughout.)

Define anion and cation.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Contrast covalent, ionic and hydrogen bonds.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

Write the molecular formula for water and draw the atomic structure of the molecule.

(**Draw**: Represent by means of pencil lines)

Describe the cause and effect of the polar nature of water.

**(Describe**: Give a detailed account)

Describe where and how water is able to form hydrogen bonds.​

**(Describe**: Give a detailed account)

**2.2.U2 Hydrogen bonding and dipolarity explain the cohesive, adhesive, thermal and solvent properties of water.**

Contrast adhesion with cohesion.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

Outline an example of the cohesive property of water being of benefit to life.

**(Outline**: Give a brief account or summary)

Outline an example of the adhesive property of water being of benefit to life.

**(Outline**: Give a brief account or summary)

Explain three thermal properties of water that are useful to living organisms.

(**Explain**: Give a detailed account including reasons or causes)

Outline a benefit to life of water's high specific heat capacity.

**(Outline**: Give a brief account or summary)

Outline a benefit to life of water's high latent heat of vaporization.

**(Outline**: Give a brief account or summary)

Outline a benefit to life of water's high boiling point.

**(Outline**: Give a brief account or summary)

Explain why is water such a good solvent.

(**Explain**: Give a detailed account including reasons or causes)

List the types of molecules that water will dissolve.​

**(List**: Give a sequence of brief answers with no explanation.)

**2.2.U3 Substances can be hydrophilic or hydrophobic.**

State that polar and ionic molecules are hydrophilic.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

State that non-polar, non-ionic molecules are hydrophobic.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Given a diagram of a molecular structure, determine if the molecule is hydrophilic or hydrophobic.

**2.2.A1 Comparison of the thermal properties of water with those of methane**.

Compare the physical properties of methane and water.

**(Compare and Contrast:** Give an account of similarities and differences between two (or more) items or situations, referring to both(all) of them throughout.)

Explain why water and methane have different thermal properties based on their molecular structures.

(**Explain**: Give a detailed account including reasons or causes)

**2.2.A2 Use of water as a coolant in sweat.**

Explain sweating as a mechanism to cool the body.

(**Explain**: Give a detailed account including reasons or causes)

**2.2.A3 Modes of transport of glucose, amino acids, cholesterol, fats. oxygen, and sodium in blood in relations to their solubility in water.**

State if the following molecules are hydrophobic or hydrophilic: glucose, amino acids, cholesterol, fats, oxygen, and sodium chloride.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Outline the mechanism of transport in the blood of the following molecules: glucose, amino acids, cholesterol, fats, oxygen, and sodium chloride.

**(Outline**: Give a brief account or summary)

**2.2.NOS Use of theories to explain natural phenomena- the theory that hydrogen bonds form between water molecules explain the properties of water**.

State why scientists cannot prove without a doubt that hydrogen bonds exist between water molecules.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**Key Terms**

Element

trace element

matter

proton

neutron

electron

metabolic reaction

coolant

vaporization

covalent

polar

ionic

ion

cation

carbohydrate

lipid

polarity

thermal

anion

hydrogen bond

organic

monomer

polymer

carbon

hydrogen

sodium

iron

condensation

hydrolysis

hydrophobic

hydrophilic

adhesion

oxygen

nitrogen

phosphorous

density

capillary action

solvent

 surface tension

nucleic acid

protein

sulfur

calcium