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FREE LEARNING NOTES FOR ZAMBIA

FORM 2

Biology

The properties of water and life

Lesson notes for learners · Competence-Based Curriculum

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Water is used by people, animals and plants every day: for washing hands, cooking, drinking and farming. It also has special properties that make it so useful. In this note you find out what these properties are and how each one supports life, from a pot of boiling nshima water to a fish pond in Luangwa.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Name the main properties of water that support life
- Explain cohesion, adhesion and surface tension
- Explain why water is called the universal solvent
- Explain why ice floats and why water resists changes in temperature
- Link each property to an everyday use or to living things

KEY WORDS

cohesion	the attraction between water molecules
adhesion	the attraction between water molecules and other surfaces
surface tension	the skin on the surface of water, caused by cohesion
heat capacity	the amount of heat that water can absorb before its temperature rises
density	the mass of a substance in each unit of volume
universal solvent	a name for water, because it dissolves many substances
solute	a substance that dissolves in a liquid
solvent	a liquid that dissolves another substance to form a solution

1 Water as the universal solvent

Water dissolves many substances, so it is called the universal solvent. In a solution the substance that dissolves is the solute and the liquid that dissolves it is the solvent. Salt and sugar dissolve in water, but sand does not.

This property matters for life. Nutrients dissolve in water and are carried around the bodies of plants and animals. It also makes water useful for cleaning, cooking and drinking.

2 Transparency, room temperature and pH

Water is transparent, which means it lets light pass through. Light reaching underwater plants allows aquatic plants to carry out photosynthesis. Clear water lets more light through than muddy water, so a hand held above a warm lamp feels warmer through clear water than through muddy water.

Water is also a liquid at room temperature, which is the normal indoor temperature that is comfortable for living things. Pure water has a neutral pH: it is neither acidic nor alkaline.

3 Cohesion, adhesion and surface tension

Water molecules attract each other. This attraction is called cohesion. Cohesion makes the top of the water behave like a thin skin, which is surface tension. Some insects can walk on water for this reason, while a person sinks.

Adhesion is the attraction between water molecules and other surfaces.

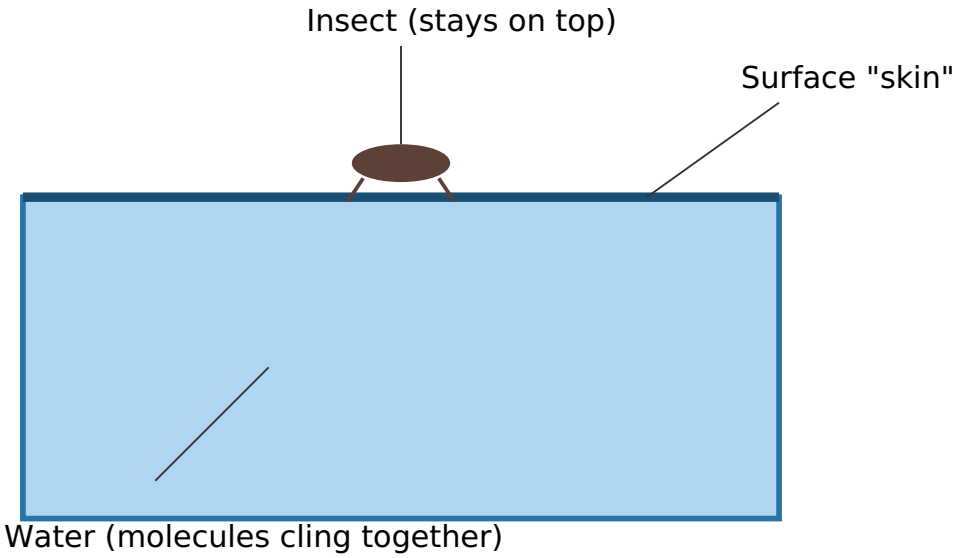

Figure 1. An insect resting on the surface tension of water

4 Density and heat capacity

Water becomes less dense when it turns into a solid. This is why ice floats on liquid water instead of sinking. Density is the mass of a substance in each unit of volume.

Water also resists changes in temperature. It has a high heat capacity, which means it can absorb a lot of heat before its temperature rises. This helps keep living things and water habitats at a steadier temperature, and it makes water useful in cooling systems.

WORKED EXAMPLE

A learner puts sugar, salt and sand into three cups of water and stirs. Which dissolve, and what does this show?

Sugar dissolves in the water

Salt dissolves in the water

Sand does not dissolve

This shows that water dissolves many substances, which is why it is called the universal solvent

TRY THIS

Put sugar, salt and sand into three separate cups of water and stir each one. Record which substances dissolve. Then float a small piece of paper or a light leaf on still water, and try to rest a thin piece of dry grass on the surface to see surface tension at work.

REMEMBER

- Water is the universal solvent because it dissolves many substances
- Water is transparent, so light reaches aquatic plants
- Water is a liquid at room temperature and has a neutral pH
- Cohesion causes surface tension; adhesion is attraction to other surfaces
- Ice is less dense than liquid water, so it floats
- Water has a high heat capacity and resists changes in temperature

? Check yourself

1. Why is water called the universal solvent?
2. What is cohesion?
3. What is surface tension, and what causes it?
4. Why does ice float on water?
5. State the pH of pure water in words.
6. You are a learner at a school in Luangwa. You mix a spoon of salt, a spoon of sugar and a spoon of sand in three cups of water and stir. (a) Which substances dissolve? (b) Name

the solute and the solvent in the salt cup. (c) Explain how this property helps plants and animals.

7. A fish farmer notices that a pond with clear water has plenty of green plants, but a nearby pond with muddy water has very few. (a) Which property of water explains the difference? (b) Explain how it helps the plants. (c) Say what the farmer could do to keep the clear pond healthy.

ANSWERS

1. Because it dissolves many substances.
2. The attraction between water molecules.
3. The skin on the surface of water, caused by cohesion.
4. Water is less dense when it is a solid, so ice is lighter than the same volume of liquid water.
5. Neutral: it is neither acidic nor alkaline.
6. (a) Salt and sugar dissolve; sand does not. (b) The solute is salt and the solvent is water. (c) Nutrients dissolve in water, so they can be carried around the bodies of plants and animals.
7. (a) Transparency. (b) Clear water lets light pass through, so underwater plants can photosynthesise; muddy water blocks the light. (c) Keep the water clear, for example by stopping soil and mud from washing into the pond.

Written by 25Schools to follow the Form 2 Biology syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.