Erasmus+

Erasmus+ project
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Short-term joint staff training event, Poland 17-20 December 2018

General layout of a demonstration natural science lesson

Date: 19-th December, 2018
Teachers : Renata Mazur, Halina Brożek
Grade: VI primary school
Lesson subject: Qualities of liquids
Lesson aims in the following categories:

a) basic knowledge:
   1) students know in which states of matter organic substances occur in nature (using water as an example)
   2) students know the qualities of selected liquids.

b) Skills:
1) students can give examples how to find a use for various states of matter
2) students can perform simple experiments related to the examination of liquid properties.
3) students can draw conclusions from the conducted experiments.
4) students can read the pH values of different solutions correctly.

<u>Methods and forms of work</u>

1) Research method: students `experiments
2) The method of knowledge assimilation: a talk, filling in worksheets and handouts.
3) Problem method: didactic game

<u>Form of work: with the whole class</u>

<u>Training aids</u>

1. Students`worksheets (handout 1)
2. Items needed to carry out the experiments by students:
   -burette
   - transparent glass vessels of various shapes
   -syringes
   -litmus paper for reading the pH values of the liquids
   -different types of liquids

-device for testing the electrical conductivity in liquids
-electric kettle, mirror, ice cubes
-diagrams, boards, animations
-didactic game

4. The course of the lesson

1) Preparatory stage
a) Organizational and procedural measures
b) Introduction to the subject of the lesson
The purpose of today's lesson will be to study some of the properties of liquids, both physical and chemical. The teacher encourages all the students to be active during class.
b) Writing down the subject of the lesson: Qualities of liquids
2) Implementation stage
Students are given worksheets for today's lesson which they will have to complete together during the class. After filling in the worksheets they are supposed to enclose them to their exercise books.

Doing a talk.

Each matter of state has its own characteristic features. In the solid state, the substance retains its own shape. It is difficult to change its volume which is why we say it is not very compressible. In the liquid state, the substance takes on the shape of the container in which it is located, but it is still difficult to change its volume. In the gaseous form, the substance always fills the entire container in which it is located and is compressible. This means that it has no specific shape or volume.

What is the explanation for that?
We already know that each substance is made of particles. They are in constant motion. Even in solid bodies the particles slightly vibrate. The physical state of the substance is related to the motion of particles. The fastest particles are in gases, while in solids they almost do not change their position. In liquids the particles can move, which causes changes in the shape of the fluid.

gas **liquid** **solid substance**

- **Animation: Liquid shape**

Let's check it out :
Experiment 1. (R. Mazur)

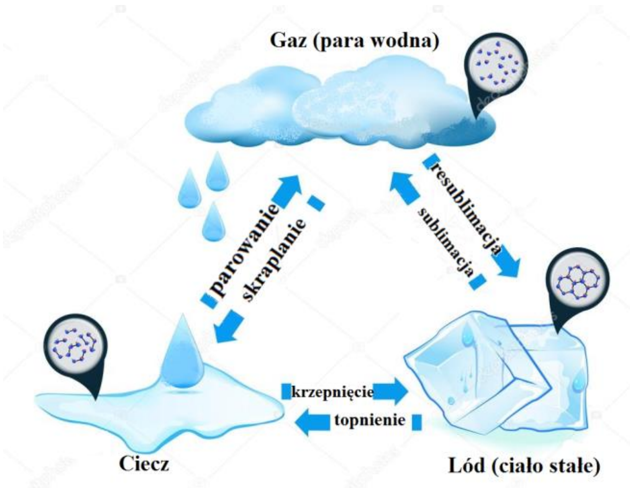
What shape do the liquids have?

Pour the coloured water into the cylinder, glass, or bottle and observe what shape the water takes in.

Conclusion: Liquids take the shape of the vessel they are in because the intermolecular forces between the particles are too weak for the liquid to retain its shape.

Experiment 2 (R. Mazur)

Can the liquid be compressed and change its volume?



Checking the compressibility of the liquid by compressing the dyed water with the piston of a syringe whose the other end is closed with the finger. (3 students, 3 different sizes of syringes).

• Animation Liquid incompressibility

Conclusion: Liquids are incompressible. The volume of liquid can not be changed.

Experiment 3. (H. Brożek)

What determines the physical state of water?

Water at room temperature: water in a glass (liquid)
What will happen to the water after placing it in the freezer? (ice cubes display)
Water at 0ºC and below: solidifies and turns into ice (solid)
What will happen to the ice at room temperature? (solid will turn into liquid - melting)
What will happen to the water after heating it to 100ºC (boiling in the kettle)

Let`s check:
After boiling water in the kettle - water vapour escapes from the kettle. At 100ºC, the water boils. Boiling occurs quickly, in the whole volume of liquid and only at 100 ° C. The water particles now move very fast and break away from the base of the kettle, turning into steam and floating in the air. This is the evaporation (the liquid turns into gas). However, unlike boiling, evaporation occurs slowly at any temperature higher than the melting point and only on the surface of the liquid.

What will happen when we place a cool mirror over the steaming water from the kettle?

The water vapour settles on the mirror and in contact with the cool mirror it begins to turn into water droplets (condensation - liquid turns into gas)

CONCLUSION: The physical state of liquids depends on the ambient temperature.

Diagram (explanation with the use of the board)

Experiment 4. (R. Mazur)

Do liquids conduct electricity?

Let's check it out using several liquids. (During the experiment students have to complete the charts on their worksheets)

For the experiment we will use a power source, electrodes and the following liquids:

1) Distilled water - does not conduct electricity (due to the lack of electric charge)
2) Distilled water with salt (we add salt which in the water breaks into positive and negative ions) - conducts electricity. It can be noticed that after application of voltage to the electrolyte solution the ions move to the electrodes in opposite directions (negative ions to the positive electrode and vice versa) - which is the flow of electric current. That is why in liquids we deal with the so-called ionic current conduction.
3) Tap water - conducts electricity (admixtures dissolved in water - minerals or other water pollutants have a decisive influence on its electrical conductivity).
4) Vinegar (acetic acid 10%) - conducts electricity.
5) Sugar solution in water - it does not conduct electricity.
6) Water from pickled cucumbers (acid) - conducts electricity very well.
7) Lemon juice (acid) - conducts electricity very well.
8) Food oil - it does not conduct electricity (it is an insulator).
9) Ethanol - does not conduct electricity.
10) Milk - it conducts electricity.
11) Washing-up liquid dissolved in distilled water - conducts electricity.

Testing substance (liquid)	Current conductivity YES / NO
1. Distilled water	
2. Distilled water with salt	
3. Tap water	
4. Vinegar (acetic acid 10%)	
5. Sugar solution in water	
6. Water from pickled cucumbers (acid)	
7. Lemon juice (acid)	
8. Food oil	
9. Ethanol	
10. Milk	
11. Washing-up liquid	

Conclusion:

CONCLUSION: Liquids conduct electricity only when there are electric charges in them, i.e. ions (they are electrolytes). Liquids that do not conduct electricity are nonelectrolytes, e.g. distilled water, oil, sugar water solution.

Electrolytes, i.e. aqueous solutions of acids, bases and salts under the influence of water undergo ion dissociation - they disintegrate into ions (cations and anions). The electrically conductive liquids include: aqueous solutions of acids, bases and salts. These liquids are called electrolytes.

Experiment 5. (H. Brożek)

Do all liquids have the same pH? (we will use the samples of distilled water, lemon juice, liquid soap, Coca-cola, human saliva, tea, coffee)

For the experiment, we will use litmus paper and a pH scale. The pH scale is a quantitative scale of acidity and basicity of solutions of aqueous chemical compounds. It takes values from 0-14. It is based on the activity of hydrogen ions in aqueous solutions. The knowledge of the pH of some substances (eg detergents) is useful in everyday life because detergents can remove dirt from clothing.
Another application:
Vinegar with a very low pH content (pH around 2.9). protects pickled cucumbers or marinated mushrooms against rottenness.

In our everyday life the pH scale is very important for example in healthy eating. Foods that we eat and drink practically every day (including fruit and vegetables) have an acidic reaction (eg apple, tomato, carton juices). Drinking more fluids (such as the juices mentioned) can lead to stomach acidity. We can get rid of it by chewing gum for example because it is alkaline and neutralizes the excess of acid. When we do litmus tests with different substances we approximately determine the pH value of the solution looking at the colour which is compared with the scale of the standards (from the shades of red for acidic solutions through orange and yellow to green and purple for alkaline solutions).
The relation between the pH scale and reaction of the solution

acid reaction   neutral reaction   alkaline reaction

CONCLUSION: Liquids have different pH reactions. Acidic solutions have a pH lower than 7, alkaline have a pH greater than 7. Distilled water (chemically pure) - neutral (pH = 7). Lemon juice - acid reaction (pH about 2.4), liquid soap -

alkaline reaction (pH about 10), Coca-cola - acid reaction, pH = 2.5 (due to the content of phosphoric acid), human saliva - neutral reaction (pH about 6.5), tea, coffee - acid reaction (pH about 5).

c) Summary stage

Didactic game (R. Mazur)
(The game “Who Wants to Be a Millionaire?” called "Liquid Properties" is placed in online learning resources at https://learningapps.org/view5837335)

6. Additional handouts

1) A worksheet for the students

Students` worksheet

Studying the properties of liquids

1. Experiment 1 - What shape do the liquids have?
Conclusion:
....

2. Experiment 2 - Can the liquid be compressed and change its volume?
Conclusion: ....

3. Experiment 3 - What determines the physical state of water?
Conclusion: ....

4. Experiment 4 - Do liquids conduct electricity?

Testing substance (liquid)	Current conductivity YES / NO
1. Distilled water	
2. Distilled water with salt	
3.Tap water	
4.Vinegar (acetic acid 10%)	
5.Sugar solution in water	
6. Water from pickled cucumbers (acid)	
7. Lemon juice (acid)	
8. Food oil	
9. Ethanol	
10. Milk	
11. Washing-up liquid	

Conclusion:……………………………………………………

Experiment 5 – Do all liquids have the same pH?

Conclusion: ………………………………………………….