

Lesson Plan: ART IN PHYSICS

Information

School: ZŠ a MŠ Ostrava-Zábřeh, Kosmonautů 15, příspěvková organizace

Students: Michael Čep, Adam Holuša, Lukáš Jašurek, Milan Ámal Džuga, Bára Kaňoková, Adéla Orálková

Subject: Science (primary school, grade 4 - 7)

Goals (targets, results):

To raise interest in physical laws

To make experiments demonstrating liquids' surface tension

To make experiments demonstrating liquids' density and dissolving

To explain the results of the experiments

Means: for each student or a group worksheets, evaluation worksheets, crayons, pencils,

Experiment 1:

Ingredients: water, fat milk, oil, ground pepper, liquid food dye, washing-up liquid or a bar of soap

Equipment: 3 plates or bowls, ear sticks or toothpicks, a dropper

Experiment 2:

Ingredients: water, vegetable oil, salt, food dye

Equipment: a glass jar, a dropper, a spoon

Experiment 3:

Ingredients: water, vegetable oil, food dye, CO₂ (citric or ascorbic acid)

Equipment: a glass jar, a dropper, a bottle

Description

Begin:

1° activity: Students introduce themselves, the project ideas and topic of the lesson 5'

The first activity was introduction of our team and Erasmus+ project aims. Then our team shortly introduced our country and the topic of the lesson based demonstration of physical laws - liquid surface tension, liquid density and dissolving.

“Hi, we are team from Ostrava. Ostrava is in the Czech Republic. It is a small country near Poland, Germany and Austria. We are in grade 8, we are 13 years old. My name is Ámal and these are my friends Michal, Adam, Lukáš, Bára, and Adéla. We are very happy to be here. We like your country. **We will talk about Science**, specifically Art in Physics. **Do you like experiments?** I do. But first we will show you how to make them.”

2° activity: Science Show - experiment 1 on liquids' surface density (Adéla, Lukáš) 5'

First fill half of a small plate with water. Then sprinkle a thin layer of ground pepper on the surface. Next touch the water with a toothpick. After this dip another toothpick in washing-up liquid. Then touch the middle of the water with the stick's tip. As the washing-up liquid touches the water, watch the grains of pepper. What happens to them?



Next, half fill another small plate with milk. Then add two or three drops of liquid food dye in different places. Use several colours. Touch the milk and the colour spots with a toothpick. Next dip another toothpick in washing-up liquid and touch the colour spots in the milk. What happens to the dyes as you do this? You can touch the colour in several places. Then draw the stick in milk.

Finally, half fill the third small bowl with oil. Then add two or three drops of liquid food dye in different places. Use several colours if you have them. Dip a clean toothpick next to the coloured spots and then draw the toothpick through the colour spots. Next repeat with the toothpick dipped in washing-up liquid. What happened? Did the colours blend or moved away? When?

Explanation of scientific background of these experiments, explanation of surface tension and how the physics laws work in these experiments are described in worksheet 1 for students.



3° activity: Science Show - experiment 2 on liquids' density and dissolving (Bára)

5'

Fill about 2/3 of a glass jar with water. Add just enough of vegetable oil to form a layer on top of the water and wait until the different layers settle. Next add a spoon of salt, shake gently salt into the jar for five seconds. What can you see? When we sprinkled the salt into the jar, the salt formed a glob and sank to the bottom. The salt glob took some light oil to the bottom. As the salt from the glob reached the water in the bottom, the salt started slowly to dissolve and the whole glob became lighter. The molecules of oil in one moment became stronger than the weight of the salt glob and it started to float up to the surface. We could also see that the bubbles floating up were formed by the oil which covered the salt glob. Add another spoon of salt in the jar, this time sprinkle it fast. Compare the first and second reaction. There is no important difference. The way how fast we sprinkled the salt made a little difference to forming globs. Now you can add drops of a food dye. What happens? The colour does not mix with oil. But the food colour is heavier than oil and the bubble sinks down. As the colour reaches the water, it starts to dissolve. You can add another colour. Wait for the colour bubbles to get down from the oil layer and compare the difference. In which liquid (water or oil) the water colours were dissolved better? Now add more salt to restart the reaction. You will see that the globs take up some molecules of the heavier water because now it is coloured. As the salt is dissolving also the water molecules stuck to the salt are released from the globs. And you will see coloured bubbles in the oil layer going down slowly.



4° activity: Science Show - experiment 3 on immiscible liquids (Ámal)

5'

Fill about 1/3 of a bottle with water. Add vegetable oil almost to the top and wait until the different layers settle. Next add drops of food dye, you can use more colours. Watch what the drops will do. After a while add 1 or 2 effervescent tablets (or add melted citric or ascorbic acid in little water). Add more tablets to restart the reaction. What happens? We demonstrated the scientific principles of immiscible liquids (liquids that won't mix). Some teachers use them to explain density of liquids. During the reaction is released CO₂ which floats slowly up and pupils can better observe bubbles especially if they colour the water first. How does it work? The oil floats on the water because it is less dense (lighter) than the water. Oil doesn't mix with water either so it will not dissolve into the water. The salt however, is denser than water and heavier. When you shake the salt onto the oil, it clings to the oil and after a bit of it piles up, drags the denser glob to the bottom of the jar. Salt also will dissolve in water. After a while, the salt begins to dissolve in the water until it reaches a point where it can no longer hold down the glob of oil - the glob floats back to the surface where you can sprinkle more salt on it and repeat.



5° activity: Experiments in little groups

20'

Divide pupils in little groups and let them repeat the experiments. Give them worksheets and let them explain what they see to check their understanding. Finally ask for feedback and clean the tables.

Experience

Try-out: 2016-25-10, Sevlievo, Bulgaria,

Lesson 1: class 4A from Sevlievo primary school, Bulgaria, 10 year old pupils

Lesson 2: class 4C from Sevlievo primary school, Bulgaria, 9 years old pupils

Try out: ZŠ a MŠ Kosmonautů 15 primary school, Ostrava-Zábřeh, Czech Republic

22-04-2016, class 8. A, 13 year old pupils, communication language: English

19-04-2016, class 4. B, 9 year old pupils, communication languages: Czech, English

17-04-2016, class 5. B, 10 year old pupils, communication languages: English, Czech

Evaluation

Czech students: They enjoyed teaching children both in the Czech Republic and Bulgaria. They would like to do it again. It was fun. It was easier to explain physics laws in mother tongue.

Bulgarian pupils: They enjoyed the experiments. The most popular was the last experiment with the lava lamp. Two boys like experiments with milk the most. Two girls liked experiment with pepper the most. For one boy the best part was pouring oil into water and another boy chose adding colours into oil.

They wrote into our feedback forms what they learnt: Various experiments which we can do with water and it is great. (a girl), To work with water, oil, colours. (a boy), Pepper moves in water when I add washing-up liquid. (a boy), I learnt something about team work. (a boy), To pay attention. 2x (boys), Some tablets make bubbles. (a boy), Water is heavier than oil. (a boy).

Recommendations for us: „Speak louder.“ (a boy)

Teachers: Pupils were involved in the lesson. Demonstrations were clear and easy to follow. Bulgaria school translated the worksheets into their language, their teachers helped to check pupils' understanding of the demonstrated physical laws.



<https://www.slideshare.net/alengaholas/art-in-physics-preparation-and-evaluation-of-lesson-in-bulgaria>