6-8 years

pri-sci-net inquire investigate evaluate connect

Science Content:
Physics

Target Concepts/Skills:
Gaseous state of matter, presence of air in the environment, air as matter taking up space

Target Age group:
6-8 years

Duration of activity:
2 x 45 minute lessons

Summary:
Pupils investiate how air behaves in water. At the first stage of the inquiry process children investigate how air escapes from a plastic cup immersed in a container full of water. Before carrying out the investigation they are asked to make predictions and discuss the behaviour of the plastic cup with a paper at the bottom in different positions in water and whether they think that the paper gets wet. The investigation leads children to find out that air fills up space and when air is trapped in the cup, it does not allow water to enter and the paper remains dry. A second investigation involves the same experiment but this time there is a hole at the bottom of the plastic cup.

Objective:
By the end of the activity children should be able to:

- Understand that air as matter fills up a surrounded space
- Use observations made to explain the behavior of air trapped in a cup under water;
- Recognize that trapped air stops water from entering the top of an inverted cup;

Resources:
For every group:

- Big container with water;
- Plastic transparent cup of volume 100-200ml;
- Plastic transparent cup of volume 100-200ml with a hole in the bottom;
- Paper sheet cut into circles to fit the bottom of the cup;
- Paper kitchen towels
- Worksheet where to record observations made

Air as Matter

Authors: Kristina Zoldosova, Trnavska Univerzita v Trnave, Slovakia

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

pri-sci-net inquire investigate evaluate connect

Air as Matter

1. Engage (Forming hypotheses)

The teacher prepares a big jar with water and small piece of paper. He/she asks the pupils if it is possible to immerse a piece of paper into the big jar and the paper stays dry. Pupils discuss their ideas and express their opinion on how this can be done. The teacher takes a cup and puts the piece of paper at the bottom of the glass and fixes it there. The teacher taps the cup when upside down to test whether the paper is well fixed.

The children use task 1 to try out their ideas. The target for further inquiry develops from this stimulating situation and the teacher highlights it through the following question: Why does the paper remain dry when the cup is immersed in water in upside down? The research question has been identified.

The teacher asks the pupils to investigate the demonstrated situation. He/she encourages them to find out, how can we immerse the glass with paper fixed on its bottom to the big jar full of water so that the paper stays dry. Pupils in groups propose different ways of doing that and further verify whether it works or not. They are getting more empirical information about the phenomenon in question. The empirical information they obtain can further help them create more precise predictions. When the teacher notices that pupils are not finding out any new ideas and they have a feeling they already know how the phenomena behaves, he/she can approach to additional stimulation of the pupils, as they need to become to specific explanation of observed phenomena. Because of this, the teacher asks the pupils to solve Task 1 from related worksheets. The task represents a form for specific expression of pupils' predictions. Few different situations with glass, paper and jar full of water are represented there. Pupils are asked to mark the situations in which a piece of paper put on bottom of the glass stays dry. Further they should color that part of glasses which contains air. They are asked to do it in every of the 8 represented situations. The main target of this task is to provoke pupils to think precise way about the situation. While the pupils work on this task, they should not have a possibility of empirical verification. That is why the teacher removes the equipment from groups. We need the pupils to think formal way. During the work on the Task 1, the teacher walks between groups of pupils and asks some of the pupils to explain why they have marked specific options. He/she should ask the pupils questions aimed at explanation of how water goes into the glass of water, eventually how air escapes from the glass immersed in the water. The teacher approaches to pupils individually, so the pupils get a feeling they have a possibility to explain their idea without any restrains (usually they are afraid of speaking about idea in front of whole class before previous discussion in group or with teacher).

2. Inquiry (Designing and running experiments and observations)

After finishing work on Task 1, pupils discuss in whole class discussion about their ideas. The teacher moderates the discussion so that all ideas are expressed, if appropriate. The teacher then takes again his/her equipment. He/she takes glass in upside down position and asks the pupils what will happen if he/she will immerse the glass into the jar full of water and while the glass is immersed he/she will slope the glass a little. The teacher only speaks about it; he/she does not demonstrate it in the water. The pupils should elaborate this task without empirical investigation. It means the teacher again removes the equipment from the working groups of pupils. The pupils are asked to draw the situation in the Task 2 from related worksheets. Exactly they are asked to draw what will happen in a case we will slope the glass with dry piece of paper at its bottom while the glass is immersed in the water. Similarly to the previous task, they are asked to mark on their drawings where air is and where water is. The teacher inspires them to think precise way.

The pupils realize that bubbles escape from the glass immersed in water and while the bubbles escape water goes into the glass. In the case where only few bubbles escape from the glass, the paper fixed at bottom of the glass stays dry. Pupils can observe water surface movement inside of the glass as air (in form of bubbles) escapes. That is why we need to use transparent jars. Further the teacher constructs a conclusion which is based on what the pupils found. The teacher should make sure of pupils know that observed bubbles are air. He/she asks the pupils to create their own idea about explanation according what has been found out in previous observations. The teacher can direct their attention (if needed or if appropriate) to a situation in which the paper stays dry, even if it is immersed in the water. The pupils should discuss their ideas in groups to find out more information. They should work with what they already found in previous investigation. The students do task 3 with the plastic cup with the small hole in its bottom.

European Commission

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

CAPACITIES

3. Evaluation (Evaluating evidence)

To conclude, the teacher asks the pupils to solve Task 4 from the related worksheets. Pupils are asked to explain, why the paper put on bottom of a glass immersed upside down in the water stays dry and why it becomes wet in a case of using holey glass. The pupils are targeted to use of observed evidence. This way we are coming back to assigned inquiry problem.

The teacher can then direct the pupils to use the obtained knowledge in the following situation (Task 5): We have an empty bottle with funnel in its mouth. The funnel is sealed off with plasticine around a neck of the bottle. We are trying to pour water into the bottle, but only a little water gets into the bottle. Pupils are asked to explain why it is not possible to pour water into the bottle. Teacher asks them to use the findings from previous tasks.

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

Worksheet

Task (1) – Mark the positions in which a piece of paper put on bottom of the glass stays dry. Color that part of glass which contains air in every of the following situations.
For each of the situations below, mark whether you think that the paper at the bottom will be wet or remain dry.

1

2

3

4

5

6

7

8

b) Now try our each one and write next to each position what you notice.

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

Air as Matter

Task (2) – Choose one of the situations where the paper remains dry. Tilt the plastic to the side and notice what happens to the air. Draw a picture of what you see in the space below.

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

Air as Matter

Task (3) – Make a small hole in the bottom of the plastic cups! Mark the situations in which you think the paper at the bottom stays dry. Try out all the situations. In which one does the paper remain dry, if at all?

1

2

3

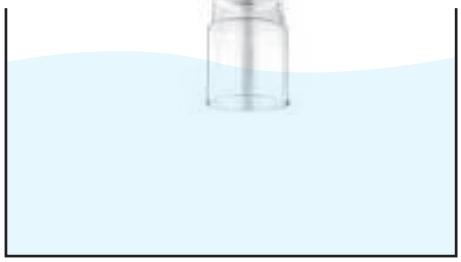
4

5

6

7

8



b) Now try our each one and write next to each position what you notice.

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647

Task (4) – Explain, why the paper remains dry when the cup is immersed upside down but gets wet when the same is done with the cup having a hole in the bottom.

Task (6) – We have an empty bottle with a funnel in its mouth. The funnel is sealed off with plasticine around the neck of the bottle. Explain why it is not possible to pour water into the bottle. Use your findings from the previous tasks to help understand what is happening.

This project Pri-Sci-Net has received funding from the European Union Seventh Framework Programme (FP7 2007 /13) under grant agreement No.266647