Diffusion

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Subject: Physics.
Country of creation: Slovakia.
Countries of testing: Czech Republic, Romania, Spain and Hungary.

Aims of the GP

To visualize the process of diffusion by carrying out an experiment. Students will also learn how to work with digital sound and a digital camera in order to create a movie.

Teaching material

Water and $KMnO_4$

ink

food color

Camera or mobile phone to take photos

Movie Maker or similar software

Age of the students

13-15

Preparation and teaching time

Preparation: 30 min. Class time: 1 x 50 min period.

Lesson plan

Students work in groups of 2 or 3. Every group needs computer with connection to the Internet, Movie Maker, Audacity...

The teacher starts speaking about diffusion and diffusion processes in science. Diffusion describes the spread of particles through random motion from regions of higher concentration to regions of lower concentration.

The teacher explains and makes a visualization of the experiment to pupils. One can use water and $KMnO_4$. Water quickly changes color.
The students:

- Use the camera and take pictures of this process.
- Explain briefly the process.
- Record this information.

- Use Movie Maker and make a short movie about experiment.
- Use this movie in a slide presentation.

Students should take care about the structure of the presentation:

- Explanation of the experiment.
- Movie about the experiment.
- Results of the experiment and its interpretation by answering the following question: On what does the process of diffusion depend on?
    - On the ambient temperature (room temperature).
    - On the form of the substance.
    - On the size of the elements.
    - On the distance among the elements.

The students present their job and evaluate it with one another (peer evaluation).

Figure 11: Diffusion experiment. Pictures by Zuzana Christozova

Questionnaire

You or your parents surely make tea at home. What happens if we put the tea bag into a glass of water? After some time we can see that the water is colored by the tea – first less colored, later on more. The particles of the tea are penetrating among the particles of water. This wouldn't be possible if the particles in water tea didn't move constantly. This process is called

Evaporation.
Diffusion.
Neutralization.

Diffusion is the result of

The motion of the particles.
Chemical reactions among substances.
Neutralization.

Diffusion describes the spread of particles through random motion from regions of

Higher concentration to regions of lower concentration.
Lower concentration to regions of higher concentration.

How does the process of diffusion depend on ambient (or room) temperature?

If the ambient temperature is higher, the process of diffusion will be faster.
If the ambient temperature is higher, the process of diffusion is slower.
Diffusion process does not depend on ambient temperature.

How does the process of diffusion depend on the form (or state) of the substance?

The diffusion process is fastest in gases.
The diffusion process is fastest in liquids.
The diffusion is fastest in solids.

The distance between particles is smallest in a

Solid.
Liquid.
Gas.

How does the process of diffusion depend on the size of particles?

If particles of the substance are bigger, the diffusion is slower.
If particles of the substance are bigger, the diffusion is faster.

How does the process of diffusion depend on the distance among the particles of the elements?

If the distance among particles is bigger, the diffusion process is faster.
If the distance among particles is smaller, the diffusion process is faster.
The diffusion process does not depend on the distance among particles.

The diffusion of water through a cell membrane is called

Osmosis.
Hydrostatic pressure.
Compressive force.

What is the result of diffusion?

A homogeneous mixture.
A reduction of the temperature of the mixture.
A new chemical compound.

Teacher reviews

According to the Czech teacher "the GP on Diffusion was the one that both my pupils and I enjoyed the most. Children loved the work with a camera and subsequent cutting of the video and, last but not least, creating the presentations. I got carried away a little bit with the enthusiasm of my pupils and as a result we gave more time to this GP than planned. It was definitely not a waste of time because in the presentation the pupils caught not only the process of diffusion but also the dependence of its speed under different conditions". Similarly, the Spanish teacher considered this a good GP because it is simple but it helps the students to relate Science with Technology. The GP combines features that are present in the daily life of a scientist, as it asks the students to make experiments, do calculations, interpret results, take notes and register the process by taking photos, and finally creating a multimedia presentation to communicate the results to their fellow students.

The SPICE project

SPICE was a two-year project (December 2009 – November 2011) carried out by **European Schoolnet** (http://europeanschoonet.org) together with **Direção Geral de Inovação e Desenvolvimento Curricular** (http://sitio.dgidc.min-edu.pt/Paginas/default.aspx) from Portugal and **Dum Zahranicnich Sluzeb MSMT** (http://www.dzs.cz/) from the Czech Republic.

The primary objective of the SPICE project was to collect, analyse, validate and share innovative pedagogical practices, particularly those using inquiry-based learning, whilst enhancing pupils' interest in the sciences. SPICE supported this objective by singling out, analysing and validating good practice pedagogies and practices in maths, science and technology (mostly ICT-based) and disseminating them across Europe. SPICE involved 24 teachers from 16 different educational systems (from 15 different countries). These teachers panel helped the SPICE partners in defining good practices that were then tested in classes by 41 teachers during the school year 2010-2011.

For more information see: **http://spice.eun.org**

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