Dofinansowane przez
Unię Europejską

Lesson Plan for 7th Grade of Primary School

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Topic: Buoyant Force, Floating Bodies - Consolidation of Knowledge

Subject: Hydrostatics and Aerostatics

Duration: 1 lesson

Curriculum Content from the Core Curriculum:

- V.7: The student:
  - analyzes the forces acting on a body immersed in liquids or gases, using the concept of buoyant force and Archimedes' principle, analyzes the condition for bodies to float
  - experimentally determines the value of the buoyant force

General Objectives:

The student:

- I. Uses concepts and quantities to describe phenomena and indicate their examples in the surrounding reality.
- II. Solves problems using physical laws and relationships.
- III. Plans and conducts observations or experiments and draws conclusions based on their results.
- IV. Uses information derived from the analysis of source materials.

Skills Developed During the Lesson in Terms of Key Competencies:

- Understanding and creating information (the ability to read, write, understand, and create information, the ability to communicate, using appropriate aids, formulating and expressing arguments orally and in writing).
- Mathematical competence and competence in the field of natural sciences (mathematical thinking and perception in perceiving problems in everyday situations, the ability to calculate, knowledge of measures, understanding terms and concepts, using appropriate aids, conducting experiments, the ability to use and handle technical devices, the ability to draw and present conclusions).
- Digital competence (responsible use of digital technologies and interest in them for learning purposes, the ability to use information).
- Personal and social competence (the ability to work in a group, understanding the principles of conduct and communication, the ability to communicate constructively).

Specific Objectives:

The student:

- demonstrates experimentally what the buoyant force depends on.
- measures the buoyant force using a dynamometer for a body made of a homogeneous substance with a density greater than the density of water.
- analyzes and compares the values of buoyant forces for bodies immersed in liquids of different densities.

Methods and Forms of Work: lecture elements, discussion, experiment, group work, working with source material.

Teaching Materials and Aids: worksheet, dynamometers, containers with fresh and salt water, laptop, multimedia projector, Internet.

Adaptation for Students with Special Educational Needs (SEN):

Questions directed to students with learning difficulties should be precise. Clear and short instructions. The teacher should make sure that students understand the instructions properly by asking additional questions. It is good to seat students with learning difficulties near the teacher, thanks to which their concentration will increase, the number of distracting stimuli will be reduced, and direct teacher control will increase.

Success Criteria (NaCoBeZu):

In today's lesson:

- we will recall what buoyant force is.
- what its direction and sense are.
- we will experimentally demonstrate what the buoyant force depends on.
- we will recall what determines whether a given body sinks or not.

Lesson Stages:

Lesson Phase (Time)	Teacher's Actions	Student's Activities	Instruction Content for Students
Introductory Phase (2 min) Topic: Buoyant Force, Floating Bodies – Reinforcing Knowledge. NaCoBeZu (What we will focus on): • We will recall what buoyant force is. • What is its direction and orientation? • We will experimentally demonstrate what buoyant force depends on. • We will recall what determines whether a body sinks or floats.	T. introduces students to the lesson topic and objectives (displayed on the board):	S. write down the topic and familiarize themselves with the lesson objectives.	During the experiments

in the main phase of the lesson, we analyze the forces acting on a body submerged in a liquid. We use the concept of buoyant force. We supervise the planning and execution of experiments related to determining buoyant force. Special attention is given to what buoyant force depends on and what the condition for floating bodies is.

Main Phase (30 min) | **Introduction to the Topic**

T. conducts two experiments:

1. Places two blocks of the same volume but different densities in a container of water.
2. Places a raw egg in two containers of water (one with fresh water, the other with salt water).

T. asks:

- Why does the egg float in salt water but sink in fresh water?
- Why did one block sink to the bottom while the other floated on the surface?

"I hope that by the end of the lesson, each of you will be able to answer these questions."

T. explains: "In today's lesson, we will recall and reinforce knowledge about buoyant force and the condition for floating bodies."

Reviewing Knowledge

T. displays a presentation on the board with key information about buoyant force and the floating condition of bodies.

Reinforcing Knowledge

a) T. "We already know that the density of a liquid affects the value of the buoyant force. Let's prove it experimentally."

- T. divides students into groups of 2-3 people.
- T. hands out worksheets (attached as Annex 1) and asks them to complete Task A.
- T. monitors students' work and answers their questions.
- T. asks one student to read the observations and conclusions from the experiment.

b) T. "Some objects sink in a liquid, while others float near the surface."

- T. refers back to the earlier experiment.
- "Why did one of the objects sink while the other, despite having the same volume, remained near the surface?"
- T. asks students to complete Task B from the worksheet.
- T. asks one student to read the conclusions.
- T. "At the beginning of the lesson, I conducted two experiments. Write down your answers to the questions I asked at the start:
    - Why did the egg float in salt water?
    - Why did one of the blocks sink while the other remained partially submerged at the surface?" | S. read Task A from the worksheet, conduct the experiment according to the instructions, and write down their observations and conclusions. | S. complete the task using available resources such as textbooks and the Internet. | S. discuss answers in groups.

Evaluation (5 min) | T. "Take part in the quiz."

Students solve the **grouping** activity on LearningApps.org:

https://learningapps.org/display?v=ppufjc9i525

T. "Complete the evaluation form displayed on the board (attached as Annex 2)." | S. receive

feedback on the correctness of their answers. | S. complete the evaluation form on the interactive board before leaving the classroom. |

Appendix No. 1 – Worksheets for Tasks A and B

Task A

Does the density of the liquid in which a body is submerged affect the buoyant force?

Set of tools and materials:
Dynamometer, block (weight – rectangular prism), two containers (beakers, glasses), fresh water, saturated saltwater solution

Experiment Procedure – Instructions:
a) Prepare the dynamometer and the block.
b) Measure the weight of the block in the air – **F1**.
c) Record the result in the worksheet, **Table 1**.
d) Submerge the block in fresh water and read the force value, the weight of the block in fresh water – **F2**.
e) Record the result in the worksheet, **Table 1**.
f) Next, submerge the same block in saltwater and read the dynamometer reading – **F3**.
g) Record the results in the worksheet, **Table 1**.
h) Calculate the buoyant force for the block in fresh water and saltwater **F1 - F2** and **F1 - F3**.
i) Record the results in the worksheet, **Table 1**.

Table 1:

Object	**Weight of the block in the air (F1 [N])**	**Dynamometer reading after submerging the block in fresh water (F2 [N])**	**Dynamometer reading after submerging the block in saltwater (F3 [N])**	**Buoyant force**
Block				In fresh water (F1 - F2) / In saltwater (F1 - F3)

Observations: (Refers to dynamometer readings)

Conclusion: (Refers to buoyant force)

Task B

Some objects sink in a liquid, while others float near the surface.

Do the density of the object and the density of the liquid affect whether the object sinks or floats?

Using a density table (which can be found in books or on the Internet), complete the table by filling in the missing density values. Enter **F** (Floats) if the object floats in the given liquid or **S** (Sinks) if the object sinks in it.

Table 2:

Object	Floats (F) or Sinks (S) in	Mercury d = …….	Alcohol d = …….	Kerosene d = …….	Water d = …….
Steel screw d = …….					
Pine wood d = 500 kg/m³					
Ice cube d = …….					
Piece of glass d = …….					
Piece of butter d = 860 kg/m³					
Cork fragment d = 200 kg/m³					

Conclusion:

- If the density of the object is greater than the density of the liquid, the object ……
- If the density of the object is less than the density of the liquid, the object ……

Appendix No. 3 – Evaluation Sheet

Before leaving the classroom, mark your opinion about the lesson by placing an "X" under one of the pictures.

If you think you have learned a lot and enjoyed this lesson	You are not fully satisfied with the lesson	If you think you haven't learned anything and did not enjoy the lessons

Bibliography:

- https://leszekbober.pl/fizyka/ciala-stale-i-ciecze/prawo-archimedesa/
- https://zpe.gov.pl/a/prawo-archimedesa/DoUC7T4Cg
- Physics Curriculum for Primary School "Meetings with Physics" Grażyna Francuz-Ornat, Teresa Kulawik
- "Meetings with Physics" Physics Textbook for 7th Grade of Primary School
- Physics Workbook for 7th Grade of Primary School "Meetings with Physics"
- Physics Core Curriculum