Demonstrator # 16

Hydrostatics

TEACHER NOTES

Activity title:

Hydrostatics

Theme:

Archimede law

Student age:

14 years

Time:

100 min

Scientific content

gives needed science background (concepts, definitions, laws etc) including pre-requisite knowledge required and science concepts developed in the activity, includes relevant students' difficulties,
Concepts: Archimedes force, float, sink, dependent variable/independent variable, pressure, volume
Elementary and basic skills: observation, identification of variables, practice graphic representation, registration and use of registered data

Learning Objectives

At the end of the lesson pupils will be able to:

- ⇒ identify the main components of the digital system;
- ⇒ correlate the vertical movement of the submarine with the variation of its weight;
- ⇒ identify the factors that influence the weight change;
- ⇒ compare buoyancy and the submarine's weight
- ⇒ interpret the graph obtained using the data registered by the systems of accelerometers;
- ⇒ use accurately the scientific language when describing the experiment, the explanations and support their own opinions.

Inquiry based character of activity

highlights the IBSE character of the activity, specifies a type of inquiry and lists inquiry-based skills (for details, definitions and terminology to use see 'Short guide for designing inquiry-based teaching materials')

- Designing investigation
- Hypothesizing
- Experimenting
- Using technology and math during investigation

Applied Technology (if necessary)

Needed Materials

- **materials**: artisanal made submarine (each work-team), computer, video-projector, experimental working sheets, water tank, system of accelerometers with main station.
- **time**: 100 min

Methodological Guide

describes method, student learning activities (discussions, investigations, data analysis, reflections etc.) and leading questions, includes a suggested time outline

Anticipation

Pupils fill in the table KWL bellow the first column following the sequence: first individually, then discuss with their peer and finally in the working-team; at each step they reciprocally analyze and explain each other their convictions and explanations. Teacher looks out and makes notes on the class map.

Know	Want to know	I learned

The teacher may synthesize on the blackboard/flipchart/observation sheet the pupils' ideas about floating and buoyancy. Following the same sequence, in the same groups, pupils fill in the second column of KWL table adding their own questions, personal or/and group curiosities concerning the same issue: floating and buoyancy.

Teacher enounce:

- **Examples of contextual problems** – for the same volume, the forces are different
- **Observing a film sequence** – a mini-submarine realized from a Kinder egg (with a hole on it) and a effervescent pill, leaved free from the bottom of a small water tank.

Building new knowledge

Pupils realize the group experiment; make notes and observations on the experimental sheet.

- Teacher monitor the group activity and give advices, offer support, guide pupils in their learning.

Two pupils realize de demonstrative experiment with the accelerometers system by fixing one of them inside of their submarine and follow the experimental steps. Simultaneously with this on the video-projector the pupils observe the real motion of the submarine on vertical.

- Teacher guide the pupils' discussion about the motion's elements and their correlation with the variations in the weight of the submarine

Reflection/Consolidation

In the same sequence as in the beginning namely, first individually, with their peer and then in groups the pupil fill in the third column of the KWL table and the teacher summarize these information. Together, teacher with pupils read once again the questions from the second column and look out if there are any answers in the third column and put these questions in a circle. Also, they read once again the information in the third column and identify questions/problems that found their answers without asking specifically for them, and consequently how many new and interesting things they learned about the issue of floating and buoyancy. Also, they put in a circle the answers and facts discovered without asking specifically. As a function of the time available and the number of questions from the second column that rest without answer they may be transformed in problem-solving situation until the end of the teaching hour or they may be suggested as further documentation as homework. Also, as reflection, pupils may compare the motion of their own submarine (the one used in order to perform the group experiment) with the motion of a water racket and with the sequence on the film. Either as homework or as reflection exercise each group will compose a quintet having as theme the submarine.

Assessment

provides suggestions how to asses the activity, preferable with concrete questions and expected student answers

⇒ Observation of group activities;
⇒ oral, conversation;
⇒ written ending sheets

Activity title:

Measure of a body'acceleration on an inclined plane

Introduction

states a driving (research) question and outlines objectives
Which are the forces acting on a body situated on a inclinated plane?
Which is the equilibrium condition for the translation motion on a given direction?
What kind of motion has the body? Describe and argue.

Thinking about the question

- **Examples of contextual problems** – for the same volume, the forces are different
- **Observing a film sequence** – a mini-submarine realized from a Kinder egg (with a hole on it) and a effervescent pill, leaved free from the bottom of a small water tank

if needed provides information about the science addressed

Materials needed

artisanal made submarine (each work-team), computer, video-projector, experimental working sheets, water tank, system of accelerometers with main station.
if needed provides list of materials

Safety

If needed lists warnings and cautions concerning the investigation

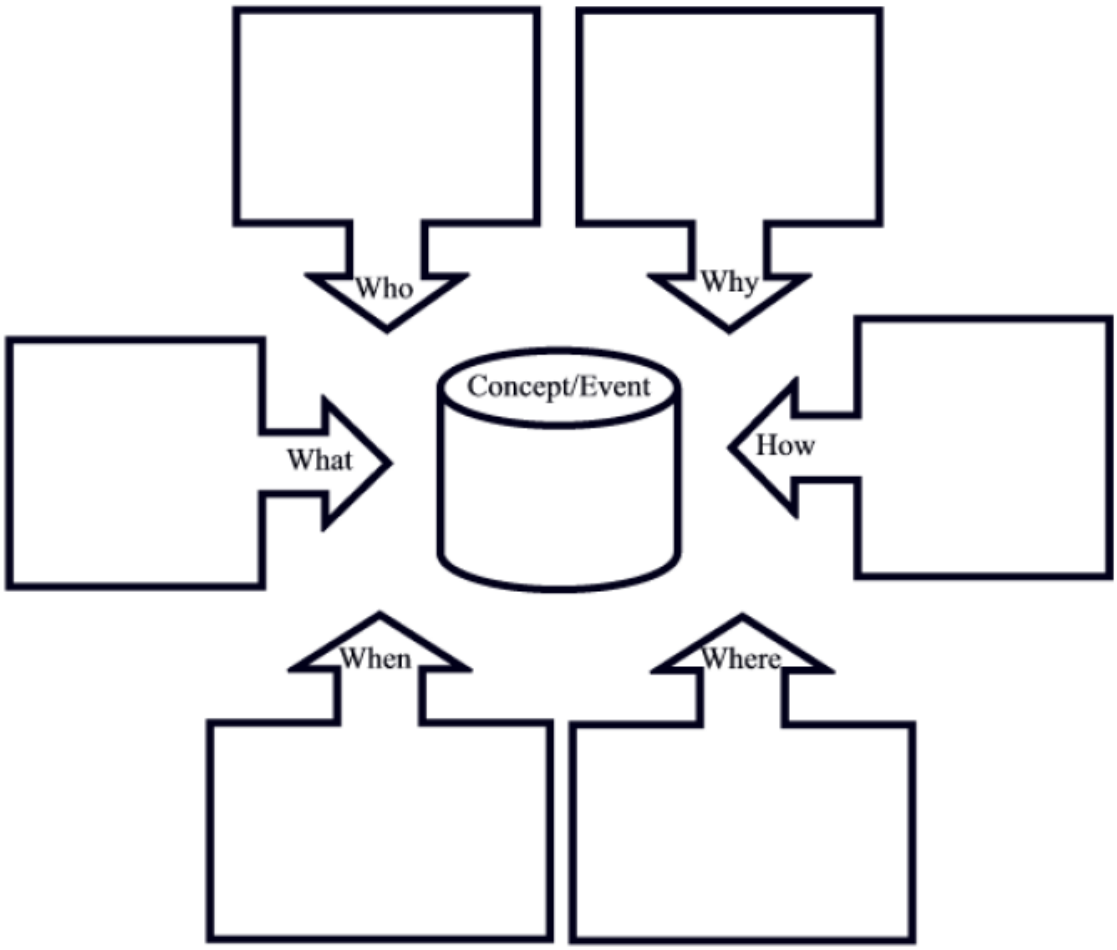
Investigation

1. *Select a hypothesis from the list of questions in column Want to know.*
2. *Experiment, observe, identify forces.*
3. *Explain the motion observed. Compare with your initial ideas.*

Depending on the type of inquiry involved provides guidance on how to carry out the investigation

Analysis

If needed suggests analysis that can help interpret data



Further investigation

If needed provides suggestions for a next possible investigation or additional, deeper investigations

Assessment

An artificial satellite is circling the globe at the equator, going eastward at constant speed. Its acceleration is:

a) zero;
b) eastward;
c) northward;
d) downward;
e) upward.

A tennis ball is struck into a high lob. As it travels it will have a constant:

a) horizontal velocity;
b) vertical velocity;
c) horizontal acceleration;
d) net velocity;
e) net acceleration.

In the spin cycle of a washing machine the clothes must be accelerated at 75 m/s^2 in order squeeze the

water out of them. If the radius of the basket is 30 cm how many revolutions must it makes per minute?

If needed includes student assessment