**ENERGY SAVING / INSULATORS (LESSON PLAN)**

**AIM**

* Revising that heat passes from a higher temperature body to a lower temperature body
* Getting to know how to express the temperature unit
* Learning how to use an alcohol thermometer to measure the temperature
* Learning how to to estimate the temperature of boiling water
* Learning how to read the water temperature correctly on the thermometer
* Learning how to be correctly enter the measured data to a spreadsheet
* Leatning how to draw a graph T = T (t) using a computer program, interpreting the graph
* finding out which material is a better insulator from the drawn graph
* learning how to support the findings

**AGE LEVEL** 13 – 14 year olds

**TIME** – 4 lessons

**MATERIALS**

* wooden base, knife, plastic ruler, adhesive tape, scissors, thermometer, crucible, water heater
* paper, cardboard, styrofoam 1cm, 2cm or 3cm thick

**PROCEDURE** (group work – 3 or 4 students per group)

STEP 1: Workshop - making RECTANGULAR SOLIDS using different materials

• Each group makes one rectangular solid using one material according to the given dimensions

• since hot water is going to be put a hot water pot in the box, it has to be made so that one of the surfaces can be opened

• Making a small hole for the thermometer into the upper surface

STEP 2: Measuring the water temperature

Pour boiling water into a cup.

• The cup is enclosed in a rectangular solid and the initial temperature of the hot water is measured, and then the temperature is read from the thermometer every minute. The measured temperatures are entered in the chart. The measurement takes 12 minutes.

• At the end of the lesson, we again measured the temperatures and entered them to a spreadsheet, drawing graphs later on.

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| **Insulation materials** | | | | | |
|  | **T (°C)** | | | | |
| **Time (min)** | **paper** | **carboard** | **styrofoam - 1 cm** | **styrofoam - 2 cm** | **styrofoam - 3 cm** |
| **0** | 87 | 85 | 84 | 88 | 85 |
| **1** | 84 | 82 | 83 | 87 | 85 |
| **2** | 81 | 80 | 80 | 85 | 83 |
| **3** | 78 | 78 | 79 | 84 | 81 |
| **4** | 75,5 | 76 | 78 | 83 | 79 |
| **5** | 73 | 73 | 74 | 82 | 78 |
| **6** | 71 | 72 | 74 | 80 | 76 |
| **7** | 69,5 | 70 | 73 | 79 | 75 |
| **8** | 68 | 69 | 72,5 | 78 | 74 |
| **9** | 66 | 67 | 70 | 76 | 73 |
| **10** | 64,5 | 66 | 69 | 75,5 | 72 |
| **11** | 63 | 65 | 68 | 75 | 70 |
| **12** | 62 | 63 | 66 | 74 | 69 |
| END OF THE LESSON | 46,5 | 47 | 54 | 60 | 57 |

CONCLUSIONS

ANALYSIS OF THE EXPERIMENT RESULTS

The 2 cm styrofoam is the best insulator.