ROQED PHYSICS LAB

Comparison of molar heat capacities of metals.

Purpose: To learn how to determine the molar heat capacity of metals

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Instruments and materials:
021 - a set of calorimetric bodies,
038 - a calorimeter,
019 - a beaker,
034 - a thermometer,
vessels with cold and hot water,
070 - scales

Theoretical part:

According to the law of conservation of energy, the amount of heat, received by one body when heated is equal to the amount of heat given off by another body when cooled. That is, if heat exchange occurs between bodies, then the internal energy of all heating bodies increases as much as the internal energy of cooling bodies decreases. Using this law, in this work it is proposed to determine the specific heat capacity of some metals.

Approximate specific and molar heat capacities (constant pressure)

Substance	Specific Heat Capacity, c (J/Kg.K)	M (kg/mol)	Molar Heat Capacity, C (J/mol.K)
Aluminum	910	0.0270	24.6
Beryllium	1970	0.00901	17.7
Copper	390	0.0635	24.8
Ethanol	2428	0.0461	111.9
Ethylene glycol	2386	0.0620	148.0
Ice (near 0°C)	2100	0.0180	37.8
Iron	470	0.0559	26.3
Lead	130	0.201	26.9
Marble	879	0.0585	87.9
Mercury	138	0.201	27.7
Salt	879	0.0585	51.4
Silver	234	0.108	25.3
Water	4190	0.0180	75.4

Work progress:

1. Assemble the installation shown on the board.

2. Start the simulation.

3. Pourinto the calorimeter 250 g. water (m_1), measure its temperature (t_1), record the result in the Table.

2. Weigh the metal cylinder (mon the balance$_2$)and record the result in the table.

3. Pour hot water into a glass and place the cylinder in it. Measure the temperature of the water / cylinder (t_2).

5. Transfer the cylinder from a glass of hot water to the calorimeter.

6. Measure the water temperature t in the calorimeter after lowering the cylinder. Record the result in the table.

7. Make a formula for calculating the amount of heat that the water received when heated (with$_1$ - the specific heat of water).

$Q_1 = c_1 m_1 (t - t_1)$,

8. Write a formula for calculating the amount of heat given off by a metal cylinder during cooling (c_2 is the specific heat capacity of the cylinder substance, the value of which must be determined).

$Q_2 = c_2 m_2 (t - t_2)$

9. Knowing that $|Q_1| = |Q_2|$, make the heat balance equation and collect the formula to calculate c_2.

$$c_2 = \frac{c_1 m_1 (t - t_1)}{m_2 (t - t_2)}$$

c

10. Determine the substance from which the cylinder is made from the table of specific heat on the board. Enter its name in the table.

m_1 (kg)	t_1 (° C)	m_2 (kg)	t_2 (° C)	s_1 (J / kg * ° C)	t (° C)	Q_1	Q_2	s_2 (J / kg * ° C)	substance
0.25	...	...	...	4200	...				

11. Conclusion:

A. Each body has its own specific heat, which depends on the kind of substance that makes up this body and its mass.

C. The specific heat of a body does not depend on the kind of substance from which it is made, but depends only on the body temperature.

C. The specific heat of a body depends on its mass, but does not depend on the substance from which it is made.