

**AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)**

**FACULTY OF SCIENCE & TECHNOLOGY**

**DEPARTMENT OF PHYSICS**

**PHYSICS 2 LAB**

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**Section: X, Group: 03**

**LAB REPORT ON**

*Determination of the specific heat of a liquid by the method of cooling.*

**Supervised By**

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**Submitted By**

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1. **Theory**

When a hot body is placed in a constant temperature surrounding, it loses heat by conduction, convection, and radiation. If the body be kept in such a way that the heat lost by conduction and convection may be neglected, then the quantity of heat emitted by the body in the given time depends only on the temperature of the body and that of its surrounding the area and the nature of the surface exposed, and is completely independent of the nature of the liquid. The specific heat capacity refers to the amount of heat required to cause a unit of mass (say a gram or a kilogram) to change its temperature by 1°C. If the difference of temperature between the body and its surrounding is not large, then according to Newton’s law of cooling, the rate of emission of heat is proportional to the temperature difference.

Diagram

Description automatically generated

Let, the mass of the calorimeter along with the stirrer = m kg

Specific heat of the material of the calorimeter and the stirrer = S J/kg/K

Mass of the experimental liquid in the calorimeter = kg

Specific heat of the liquid = J/kg/K

Time taken to cool the liquid from temperature to = sec

Mass of water having volume equal to that of the liquid = kg

Specific heat of water = J/kg/K

Time taken to cool water from temperature to = sec

So, rate of cooling of the liquid = J/s

So, rate of cooling of water = J/s

According to Newton’s Law of cooling, rate of cooling in these cases is equal. So

J/s = J/s

1. **Apparatus**

The components required to carry out this experiment include: -

* + Calorimeter along with stirrer
  + Chamber consisting of two walls
  + Sensitive thermometer
  + Electronic Balance
  + Electronic heater or burner
  + Stopwatch

1. **Experimental Data**

**Table:** Time - Temperature record.

|  |  |  |  |
| --- | --- | --- | --- |
| **No. of**  **Observation** | **Time**  **(min)** | **Temperature ()** | |
| **Water** | **liquid** |
| 1 | 0 | 74 | 73 |
| 2 | 1 | 72 | 72.5 |
| 3 | 2 | 70.5 | 71 |
| 4 | 3 | 69.5 | 69.5 |
| 5 | 4 | 68.5 | 68 |
| 6 | 5 | 67.5 | 66.5 |
| 7 | 6 | 67 | 65.5 |
| 8 | 7 | 66 | 64 |
| 9 | 8 | 65 | 63 |
| 10 | 9 | 64.5 | 62 |
| 11 | 10 | 63.5 | 61 |
| 12 | 12 | 62.5 | 59 |
| 13 | 14 | 61 | 57 |
| 14 | 16 | 60 | 55 |
| 15 | 18 | 58.5 | 54 |
| 16 | 20 | 57.5 | 52.5 |
| 17 | 22 | 56.5 | 51 |
| 18 | 24 | 55.5 | 50 |
| 19 | 26 | 54.5 | 48.5 |
| 20 | 28 | 53.5 | 47.5 |
| 21 | 30 | 53 | 46.5 |
| 22 | 33 | 51.5 | 45 |
| 23 | 36 | 50.5 | 44 |
| 24 | 39 | 49.5 | 42.5 |
| 25 | 42 | 48.5 | 41.5 |
| 26 | 45 | 47 | 40.5 |

1. **Analysis and Calculation**

Measurements:

Mass of the calorimeter + stirrer, m =

SP of the material of the calorimeter, S = cal

Mass of the calorimeter + stirrer + water, m2 = gm

Mass of water, – m = = 170.5-82.5=gm

Specific heat of water, cal

Mass of calorimeter + stirrer + liquid, = g

Mass of the liquid, = – m = g

From the graph,

Time taken to cool by the liquid, min

Time taken to cool by the water, min

So, the specific heat of liquid

= cal

1. **Result**

The specific heat of the given liquid is cal

1. **Discussion**

This experiment was conducted to determine the specific heat of a liquid via the method of cooling. The specific heat capacity varies from material to material. While stirring the liquid or water, the stirrer is made sure not to meet the base and sides of the container to avoid loss of heat to surrounding. The water and liquid are stirred to ensure even distribution of heat. The calorimeter is made sure to be kept dry before weighing it to ensure accurate measurements and to ensure no trace of other foreign liquid is present. Measurements can be repeated, and a mean taken to get reliable data. Equal volumes of water and liquid must be taken otherwise errors and anomalous readings will occur. A black base of the calorimeter will ensure the most heat absorption and radiation which yields in the efficiency of the experiment. It is better not to take a volatile liquid as their low boiling temperature does not aid in the experiment instead hampers it.

Systematic error (zero error) of the electronic balance, stopwatch may result in inaccurate readings. Human parallax error will also contribute to inaccurate readings.

Relatively a low-risk experiment however adequate safety precautions must always be appropriated. If the liquid sample taken is toxic, goggles and mask can be worn. Gloves can be worn so as to not directly come into contact with the liquids at high temperatures.

1. **References**

Resources for the:

* Fundamentals of Physics: 18.4 Adsorption of Heat (Chapter: 18, Page: 524,525).
* Practical Physics (by Dr.Giasuddin Ahmed & Md. Shahabuddin): Exp. 26: To determine the specific heat of a liquid by the method of cooling(Page-146)