

PROJECT 4

A_{IM}

To compare the effectiveness of different materials as insulators of heat.

A_{PPARATUS AND MATERIAL REQUIRED}

A cylindrical metallic container, a cylindrical plastic container (with height same as that of metal container but having a much larger radius), a thermometer, an insulating lid for plastic container with a hole for inserting a thermometer, different insulating materials in powder or liquid forms.

T_{ERMS AND DEFINITIONS}

Insulators of heat are those substances, which do not allow the flow of heat through them easily.

P_{RINCIPLE}

The underlying principle of comparing the effectiveness of different materials as insulators of heat is to compare their thermal

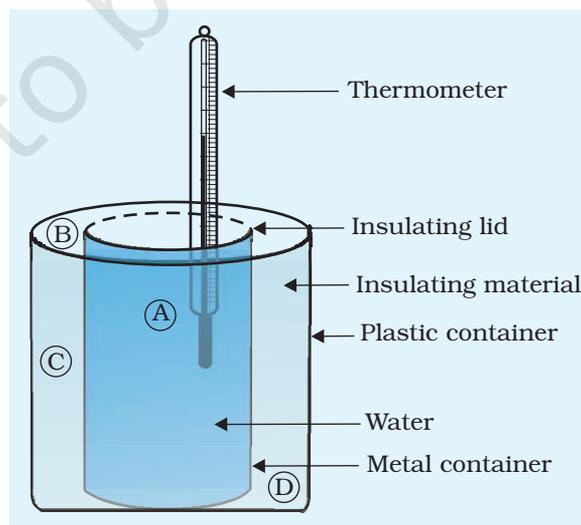


Fig. P 4.1:

conductivities. A material having a lower thermal conductivity will be more effective as an insulator.

PROCEDURE

1. Place the metal container A inside the plastic container B leaving equal gap all around it. Fill the gap, between the two containers with the insulating material you want to study (Fig P4.1).
2. Pour in container A hot water (having temperature nearly 60 °C).
3. Cover both the containers with a non-conducting lid.
4. Fix a thermometer, in a hole provided in the lid, in such a way that the thermometer bulb is well within the water.
5. Record time for every 5 °C fall in temperature.
6. Repeat the above procedure for different insulating materials.
7. Plot temperature v/s time graph for different materials on the same graph paper.

OBSERVATIONS

Least count of the thermometer = ... °C

Table P 4.1: Fall in temperature with time for different materials as insulators

S. No.	Name of the Material	Variation of temperature with time							
1.		Temperature							
		Time							
2.		Temperature							
		Time							
3.		Temperature							
		Time							
4.		Temperature							
		Time							

PLOTTING OF GRAPH AND INTERPRETATION

Plot a graph between time t and temperature θ for different materials on the same graph paper, taking time on x-axis and temperature on y-axis.

Steeper the graph, faster the rate of cooling of water thereby implying lower efficiency of the material used as thermal insulator.

RESULT

From the cooling curves of water drawn for different insulating materials surrounding it can be inferred that the effectiveness of different materials as insulators of heat in decreasing order is

- (a)
- (b)
- (c)
- (d)

PRECAUTIONS

1. Make sure that the gaps C and D are kept the same for all the materials.
2. This method can be used only for the insulating materials available in the powdered/liquid form as the effect of trapped air can be minimised for them.
3. Packing of insulating material in the gaps C and D should be equally uniform in all the cases.
4. Insulating lid should fit tightly to minimise heat loss.

SUGGESTED ADDITIONAL EXPERIMENTS/ACTIVITIES

1. Repeat the same procedure with the cold water (instead of hot water).
2. Repeat the same procedure with other insulating materials other than the ones you have used in this Activity.