THERMAL CONDUCTIVITY: CONCEPT AND APPARATUS

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KEYWORDS: Laboratory, Experiment, Heat transfer, Temperature probes

The study of the physical mechanisms involved in heat transfer phenomena is important as they influence many aspects of our life. However, thermal physics practicals are one of the most challenging in the Junior Physics lab, mostly due to conceptual difficulty, equipment problems and safety issues.

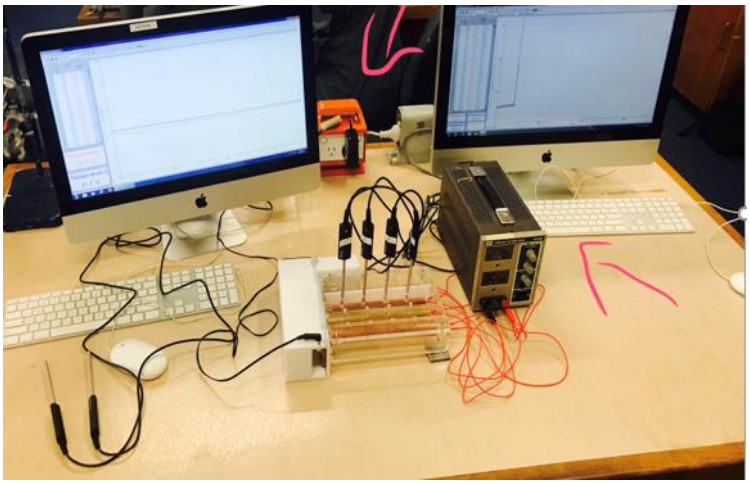
In this presentation we describe one of our new thermal experiments – thermal conductivity. This topic is of considerable pedagogical importance since it requires a good understanding of the physical mechanisms involved in heat transfer and can be exploited in junior and senior physics courses in different ways.

This practical consists of two parts – qualitative and quantitative. In the first part we describe how a daily experience such as the touch of hot and cool objects with the hands can be used to learn concepts related to heat transfer. The second part is devoted to quantitative measurements of thermal conductivity.

If you apply heat to one end of a copper rod and hold the other end, the atoms in the hot end become excited, i.e., they have higher energy, and share their energies with their neighbours, and they in turn share energy with their neighbours, and so on along the rod. So eventually, your end of the copper rod starts becoming warm. Heat flux determined by the following equation:

Eq(1). $$H = \frac{dQ}{dt} = -kA\frac{dT}{dx}.$$

In-house built apparatus consisting of four rods, four heaters, heat sink, and 4 thermal probes provides opportunity to explore Eq1, as we can vary *A* and *k*, by varying rod's diameter and material. Four thermal probes provide temperature gradient. During the practical, students determine the thermal conductivity of each rod using Eq.(1), the heat conduction equation.



Proceedings of the IUPAP International Conference on Physics Education, ICPE 2022 5-9 December 2022, page 146, ISBN: 978-1-74210-532-1.