

Teaching the Temperature Dependence of Electrical Resistance of Materials through Arduino Investigation

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Abstract : This study examines the problem of students' poor comprehension of the thermal dependence of resistance by investigating this idea using an evidence-based inquiry approach. It suggests a practical exercise to improve secondary school students' comprehension of how materials' resistance to temperature changes. The suggested exercise uses an Arduino and Peltier device to test the resistance of aluminum and graphite at various temperatures. The study attempts to close the knowledge gap between the theoretical and practical facets of the subject, which students frequently find difficult to grasp. With the help of a variety of resistors made of various materials and pencils of varying grades, the Arduino experiment investigates the resistance of a metallic conductor (aluminum) and a semiconductor (graphite) at various temperatures. The purpose of the research is to clarify for students the relationship between temperature and resistance and to emphasize the importance of resistor material choice and measurement methods in obtaining precise and stable resistance values over dynamic temperature variations. The findings show that while the resistance of graphite decreases with temperature, the resistance of metallic conductors rises with temperature. The results also show that as softer lead pencils or pencils of a lower quality are used, the resistance values of the resistors drop. In addition, resistors showed greater stability at lower temperatures when their temperature coefficients of resistance (TCR) were smaller. Overall, the results of this article show that the suggested experiment is a useful and practical method for teaching students about resistance's relationship to temperature. It emphasizes how crucial it is to take into account the resistor material selection and the resistance measurement technique when designing and picking out resistors for various uses. The results of the study are anticipated to guide the creation of more efficient teaching methods to close the gap between science education's theoretical and practical components.

Keywords : electrical resistance, temperature dependence, science education, inquiry-based activity, resistor stability

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