**ACTIVITY: Meissner effect – Nick Strickland video clips**

**Activity idea**

In this activity, students watch video clips of IRL research scientist Dr Nick Strickland talking about superconductivity and the Meissner effect and then answer a series of questions and solve some simple electrical problems related to the content.

By the end of this activity, students should be able to:

* describe the Meissner effect
* explain in simple terms how the Meissner effect comes about
* give meanings for the terms ‘electrical resistance’, ‘electric current’, ‘voltage’ and ‘magnetic field’
* state some of the uses the Meissner effect has been put to.

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**Introduction/background**

We have a number of videos of Dr Nick Strickland, a research scientist from Industrial Research Limited (IRL) in Wellington. In these clips, Nick is talking about superconductivity and the Meissner effect.

The Meissner effect is used in some forms of levitated transport systems, and its development is ongoing.

The activity involves students firstly viewing the video clips and then answering a series of questions and solving some simple electrical problems related to the content.

**What you need**

* Access to these video clips:
  + [High-temperature superconductor end uses](http://link.sciencelearn.org.nz/videos/1056-high-temperature-superconductor-research-at-irl)
  + [High-temperature superconductor research at IRL](http://link.sciencelearn.org.nz/videos/1057-superconductors-and-high-temperature-superconductors)
  + [HTS110](http://link.sciencelearn.org.nz/videos/1068-hts110)
  + [Meissner effect](http://link.sciencelearn.org.nz/videos/1062-meissner-effect)
  + [Superconductors and high-temperature superconductors](http://link.sciencelearn.org.nz/videos/1057-superconductors-and-high-temperature-superconductors)
* Copies of the student worksheet.

**What to do**

1. Access the video clips listed above featuring Dr Nick Strickland.
2. Have students watch the clips and complete the student worksheet.
3. Discuss the students’ responses.

**Student worksheet – Questions about the Meissner effect and Nick Strickland**

***A. Facts and figures***

1. Who is Nick Strickland?
2. What is the Meissner effect?
3. What is the significance of a given superconductor material’s critical temperature?
4. Liquid nitrogen boils at -196°C. This liquid is used to cool the ceramic superconductor used in the video clip below its critical temperature. Why, then, is this ceramic material referred to as a ‘high temperature’ superconductor?
5. The superconductor video shows a real-time computer graphic of electrical resistance changing as temperature is lowered. Sketch on the blank graph axes below what this shows. Label the axes and any key points of importance.
6. What does the term ‘levitate’ mean?
7. How can the Meissner effect be utilised in rail transportation?

***B. Find out more***

1. Helium has a very low boiling point that is close to absolute zero. What do you understand the term ‘absolute zero’ to mean?
2. Ceramic high-temperature superconductors can be cooled with liquid nitrogen whereas metal alloy superconductors have to be cooled with liquid helium. How are these 2 coolants produced, and how do their per litre costs compare?
3. For simple electric circuits, resistance (R) is defined as the ratio of the voltage (V) across a conductor to the current (I) passing through it (R = V/I). This is known as Ohm’s law. When a superconductor is cooled to below its critical temperature, its resistance drops to zero. Can Ohm’s law be applied to superconductors? Justify your answer.
4. Researchers at IRL in Wellington have developed a high temperature superconducting ceramic material known as BSCCO. Which elements are present in this ceramic?