Superconductivity

Work with liquid nitrogen and explore the properties of superconductors.

Spokesperson:	……
Scientific writer:	……
Safety manager:	……
Technical Coordinator:	……

Lab Activities

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1. Tubes, magnets & gravity.

Task:

Carefully follow the instructions on page 2.

Observation

Summarise your observations. What happens?

Explain your observations. Include a drawing.

2. A superconducting tube.

Prediction

What happens when you drop a magnet on top of a cooled superconducting tube?

- ☐ The magnet will be repelled and pushed out of the tube (moving upwards).
- ☐ The magnet will stand still.
- ☐ The magnet will fall very slowly through the tube.

Explanation

Why will this happen?

- ☐ The superconducting tube becomes a permanent magnet.
- ☐ Some processes in the superconducting tube will completely compensate for the gravitational force.
- ☐ Some processes in the superconducting tube will compensate partially for the gravitational force.

Task:

Now, try it out!

- Carefully follow the instructions on page 2.
- Did your observations match your predictions? Yes ☐ No ☐

Prediction

What do you think would happen if you were to do the same experiment but with a disc instead of a tube?

3. A superconducting disc.

Task:

Carefully follow the instructions on page 3.

Now go to page 4. Can you reject 2 of these 3 hypotheses? Design the experiments!

Test 1 **Hypothesis number:**

Experiment design (use drawings if you like):

Prediction bases on hypothesis:

Outcome of the experiment:

Did your observations match your predictions? Yes ☐ No ☐

Experiment 2 **Hypothesis number:**

Experiment design (use drawings if you like):

Prediction bases on hypothesis:

Outcome of the experiment:

Did your observations match your predictions? Yes ☐ No ☐

Explanation
The Meissner-Ochsenfeld effect.

What is the difference between the superconducting tube and the disc?

Why is the magnet tilted for the disc but not for the tube?

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4. The flux - pinning effect.

Task

Carefully follow the instructions on page 5.

Observation

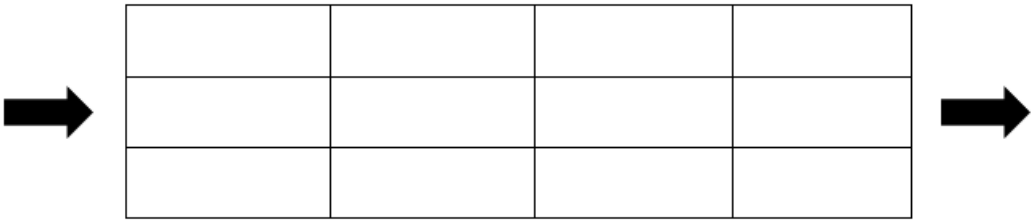
- What happened when you lifted the magnet?
- Which movements where allowed, which were not?
- What is the difference between the Flux-Pinning-effect and the Meissner-effect? Find more on pages 9-10.
- Try to explain this effect by comparing the magnetic field lines in the sketches together with the images of the 2 different superconductor disks on page 6.

Explanation

Bonus! Levitating train.

Prediction

Think about a configuration of the magnets, which would allow the superconducting train to move to the right. Mark for each rectangle below which magnetic pole is facing upwards (N or S).

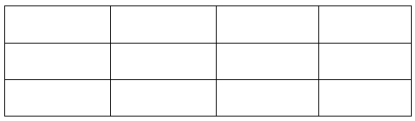
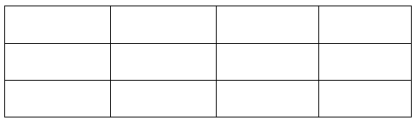
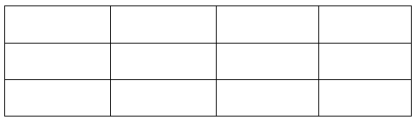


Task

Carefully follow the instructions on page 9.

Observation

Compare different magnet configurations.

Arrangement	Does is work?	Pattern shown by the Flux-Foil
	Yes ☐ No ☐	
	Yes ☐ No ☐	
	Yes ☐ No ☐	

Explanation

Which magnet configuration works? Why?