

Super Conductor Levitation

Written by: Vishnu Prasad Sivakumar,
Benjamin Jirasakulpeeti

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Classes for which experiment is required

Teacher: Dr Denney (training code 1)

Year Group: 10

Items to be prepared by laboratory technician (training code 2)

- 1 * 5g Aluminium Coil
- 1 * 10g Aluminium coil
- 1 * 500ml Liquid Nitrogen
- 1 * 5g Magnet
- 1 * 10g Magnet
- 1 * 20g Magnet

Procedure or reference, including variations

- 1) Use a magnetometer to measure the magnetism of a 5g magnet in the SI units of Tesla. Record the result.
- 2) Wind the 5 grams of aluminum foil around the 5g magnet. Record the magnetism using the SI units of Tesla.
- 3) Wind 5 more grams of aluminum foil around the magnet. Record the magnetism using the SI units of Tesla.
- 4) Observe if there are any changes in the magnetism of the 5g magnet.
- 5) If there are no changes in the magnetism of the 5g magnet, then set up the magnetic track.
- 6) Using the instrument provided, introduce enough Liquid Nitrogen into the body of the superconductor.
- 7) Using the instrument provided, introduce enough Liquid Nitrogen into the body of the superconductor.
- 8) Repeat steps 6-7 for all the other magnet masses.
- 9) Repeat steps 6-8 two more times and then calculate the average of the results for each of the masses.

Equipment to be used

adhesive tape

Potential hazards

Do not tape over mouth or nose, or use as a restraint.

beaker, medium (250 mL to 1 L)

Potential hazards

Breakage of beaker. Cuts from chipped rims.

Standard handling procedures

Inspect and discard any chipped or cracked beakers, no matter how small the damage. Sweep up broken glass with brush and dustpan; do not use fingers.

ruler

Potential hazards

Long rulers can be used as swords. Wooden and plastic rulers burn if placed in bunsen flame. Plastic ruler may fracture into sharp shards if broken. Wooden rulers may have splinters.

Standard handling procedures

Check for splinters before use of wooden ruler.

stopwatch

Potential hazards

If connected to a string, can be swung around to hit people or other objects.

Chemicals to be used

nitrogen, liquid

N₂

Class: 2.2

PG: none

Users: Tch

Training: 1,2,5

UN: 1977

CAS: 7727-37-9

GHS data:

WARNING



Contains refrigerated gas; may cause cryogenic burns or injury

Potential hazards

DANGER OF FROSTBITE IF LIQUID RETAINED NEXT TO SKIN IN SHOES OR IN CLOTHING; IF SWALLOWED, GAS PRODUCED FROM LIQUID MAY CAUSE STOMACH TO EXPLODE. Brief contact of bare skin with liquid nitrogen is harmless, since the liquid boils to form an insulating layer of gas; prolonged contact causes freezing and death of tissue, which may need surgical removal. Does not support respiration.

Standard handling procedures

Use long rubber apron, boots higher than bottom of apron and either bare arms or arms covered in long gloves to upper arm. Avoid spilling liquid nitrogen on clothes, since it soaks instantly into fabric and freezes skin; avoid spilling liquid nitrogen in shoes or boots, since it freezes the feet and toes. Store in approved dewars, not in conventional "thermos" flasks, especially ones with plastic exteriors which can become brittle due to the low temperature. Do not transport in a lift with people due to possibility of lift failure and asphyxiation. Do not use in a confined space.

Chemicals to be produced

nitrogen, gas generated during experiment

N₂

Class: 2.2

PG: none

Users: 11-12

Training: 1-5

CAS: 7727-37-9

GHS data: Not classified as a hazardous chemical.

Potential hazards

Not toxic, but does not support respiration.

Standard handling procedures

May be generated safely by warming solution of ammonium sulfate and sodium nitrite, with passage of gas through absorbent to remove traces of toxic nitrogen oxides; reaction may become vigorous.

Others

Magnetic Track

Superconductor

Knowledge

I/we have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and biological items, including living organisms.

I/we have read and understood the (Material) Safety Data Sheets for all chemicals used and produced.

I/we have copies of the (Material) Safety Data Sheets of all the chemicals available in or near the laboratory.

Agreement by student(s)

I/we, Vishnu Prasad Sivakumar, Benjamin Jirasakulpeeti, agree to conduct this experiment safely in accordance with school rules and teacher instructions.

Risk assessment

I/we have considered the risks of:

fire	breakage of equipment	electrical shock	radiation
explosion	cuts from equipment	escape of pathogens	waste disposal
chemicals in eyes	sharp objects	heavy lifting	inappropriate behaviour
inhalation of gas/dust	rotating equipment	slipping, tripping, falling	allergies
chemicals on skin	vibration and noise	falling objects	special needs
runaway reaction	pressure	heat and cold	other risks

Assessment by Student(s)

I/we have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009.

I/we consider the inherent level of risk (risk level without control measures) to be:

Low risk

Medium risk

High risk

Extreme risk

Control measures:

Handle the beaker with care.

Deal with the magnets carefully.

Handle the glass superconductor track with extreme caution.

Additional measures: safety glasses, gloves, demonstration

With the specified control measures in place, I/we have found that all the risks are "low risk". Risks will therefore be managed by routine procedures in the classroom, in combination with the specified control measures.

Certification by Teacher

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009. I confirm that the risk level and control measures entered by student(s) above are correct and appropriate.

Name: **Signature:** **Date:**

Certification by Laboratory Technician

I have assessed the risks associated with preparing the equipment, chemicals and and biological items, including living organisms, for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009.

I consider the inherent level of risk (risk level without control measures) to be:

☐ Low risk ☐ Medium risk ☐ High risk ☐ Extreme risk

Where the risk level is "medium risk", "high risk" or "extreme risk", the following control measures will be employed:

Control measures (attach further pages as required):

☐ safety glasses ☐ gloves ☐ lab coat ☐ apron ☐ fume cupboard

With the specified control measures in place, I have found that all the risks are "low risk". Risks will therefore be managed by routine procedures in the laboratory, in combination with the specified control measures.

Name: **Signature:** **Date:**

Monitoring and review

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

Attach further pages as required