



# MANUEL FOR NTSE KIT

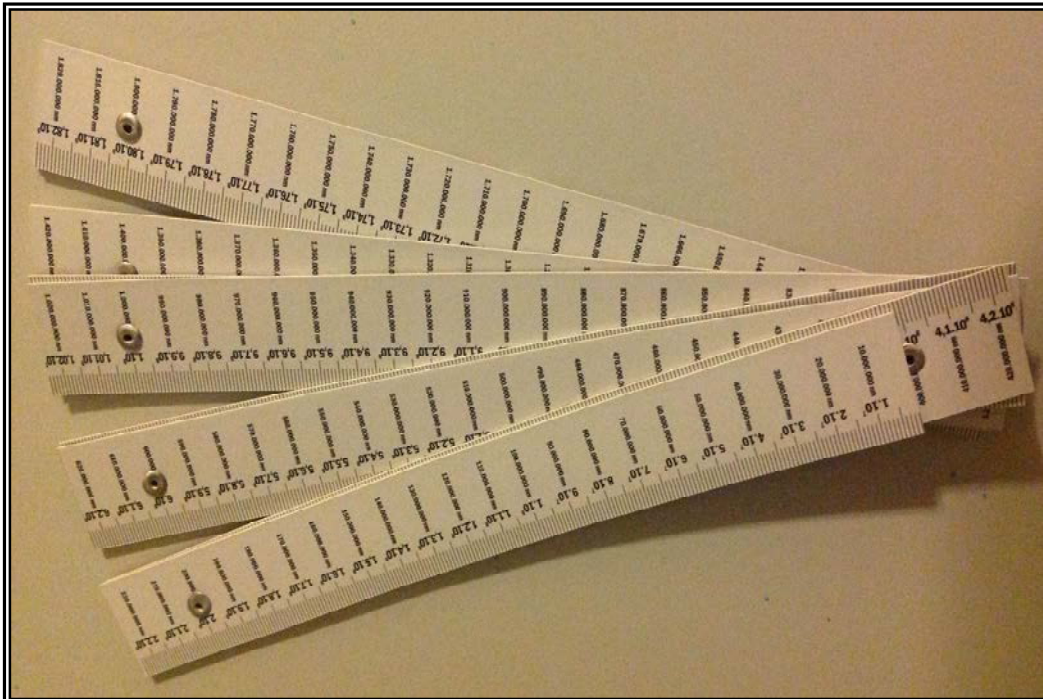
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*NTSE - Nano Technology Science Education*  
*Project No: 511787-LLP-1-2010-1-TR-KA3-KA3MP*

# The Nano-Scaled Ruler

Nano-Scaled Ruler has values its one side in nanometer (nm) and the other side in centimeter (cm).



Nano-Scaled Ruler in nanometer.

There are 1.000.000.000 ( $1 \cdot 10^9$ ) nanometer in a meter.

- Fix the Nano-Scaled Ruler horizontally on a measuring length.
- How long is your object in centimeters (nm)?

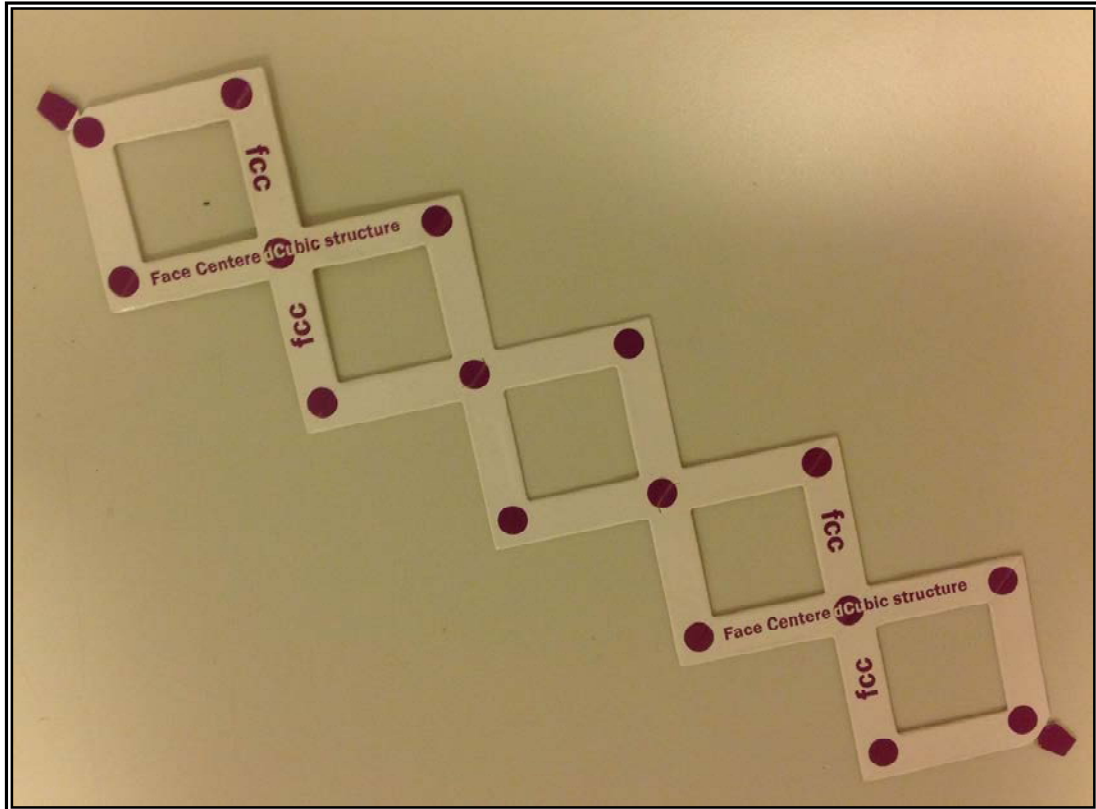
# The Nano-Scaled Ruler



Nano-Scaled Ruler in meter.

- Fix the Nano-Scaled ruler horizontally on a measuring length.
- How long is your object in centimeters (cm)?
- Convert the measuring length from cm to nm?

# Face-Centered Cubic (fcc) Structure



**fcc** template

- Fold fcc template along the scored lines (the first scored line, the third scored line and, the fourth scored line clockwise, and the other three lines counter-clockwise) to make a model of unit cell for fcc.
- Insert the tabs into the slots to hold it together.

# Face-Centered Cubic (fcc) Structure



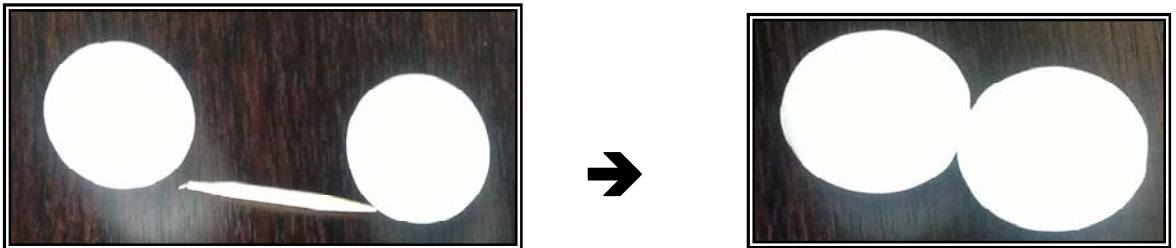
**fcc** template

Your model represents a fcc structure (nm in size).

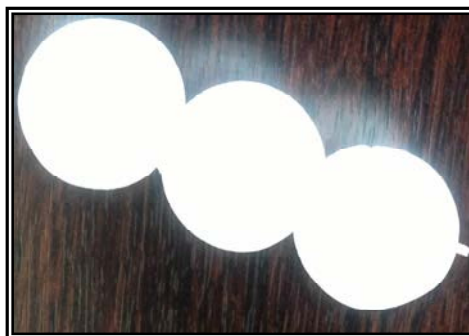
# Hexagonal Closed-Pocket (hcp) Structure



- Separate into three parts at a toothpick.
- Take two balls and attach each other with the toothpick.



- Take three balls attach each other with the toothpick by side by.



# Hexagonal Closed-Pocket (hcp) Structure

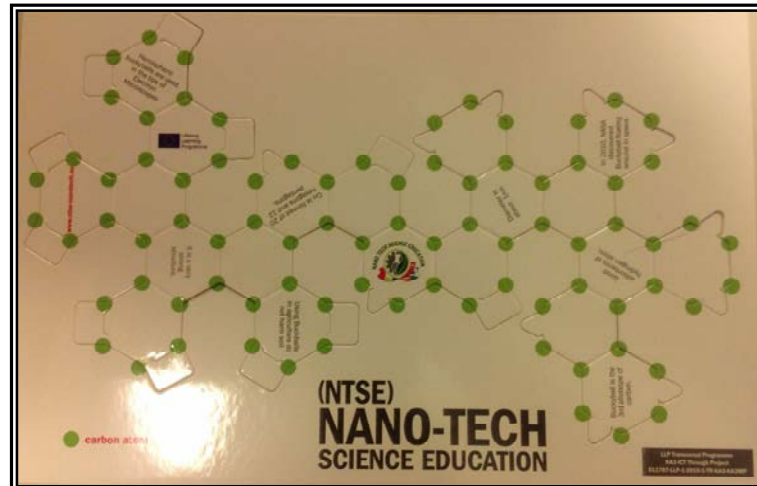


- Prepare two hexagonal objects (two times).
- Take two balls and attach each other with toothpick, and place the other ball in the middle of the ball pair.



- Stack one hexagonal, one triangle and, one hexagonal in order.





Buckyball template

- Pre-cut bucyball template.
- Fold it along the scored lines to make a model of buckyball.



Buckyball model

Your model represents a buckyball model (nm in size).

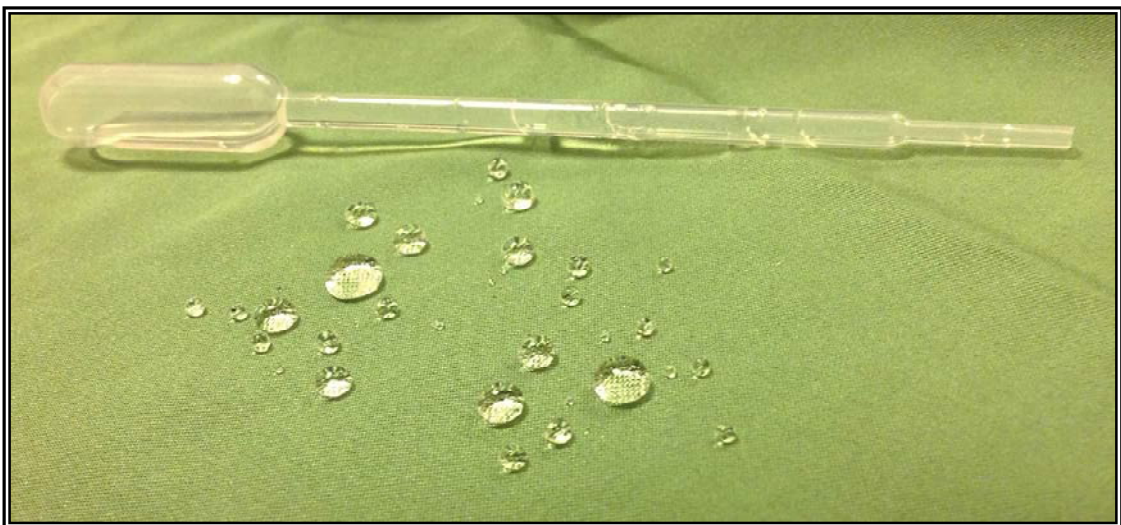


## Hydrophobic Textile

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The fabric that can repel water is known as “hydrophobic”.

Hydro means water and phobic means hate in Latin.



Hydrofobic textile, pauster pipette, and water droplets.

Take some water in your Pasteur pipette and place it onto the surface of fabric drop by drop.

Sprinkle some chalk dust on the surface and drop some water over the surface.

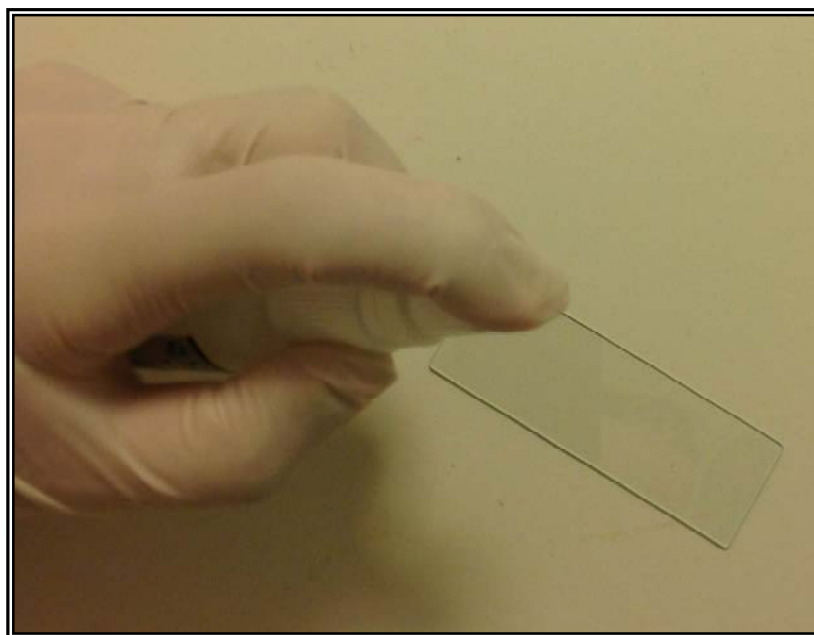
The anti-fog spray is composed of Nano-particles suspended in an alcoholic solution. When the solution dries only the Nano-particles stay on the surface and the alcohol evaporates. Anti-fog agents create a thin film that does not allow the formation of water droplets.



## Caution!

- Do not inhale the vapours of the aerosol.
- Ensure the room is well ventilated during the anti-fog application.
- Keep away from eyes and wear waterproof rubber gloves when applying the spray.

- Use a dry cloth to clean one slide well. Don't use any detergent.
- Take some water in your Pasteur pipette and place it onto the surface of fabric drop by drop.
- Spray a thin layer of the liquid one side of the slide.
- Distribute the film on the slide with a soft cloth before the anti-fog layers dries.
- Wait 30-60 minutes to let it dry.
- Breathe on the slide.
- To compare, breathe on a slide that has anti-fog layer.



## Magic Sand

Magic sand is regular sand (silicon dioxide:  $\text{SiO}_2$ ) that has been coated with a special Nano-coating. This Nano-coating is hydrophobic ("water hating"). When magic sand is poured onto water, it won't mix the water but will float until the mass of the sand breaks the surface tension of water that makes the sand sink.



# Magic Sand

- Examine the sand. Does it feel like normal sand?
- Pour the magic sand into the water. What happens?
- Put your hand into the water and lift the sand out. Is it still wet?
- Pour the sand slowly onto the water. What happens?
- Pour a layer of sand onto the surface of water. Gently push your finger into the layer of sand and pull it out again. Is your finger wet?

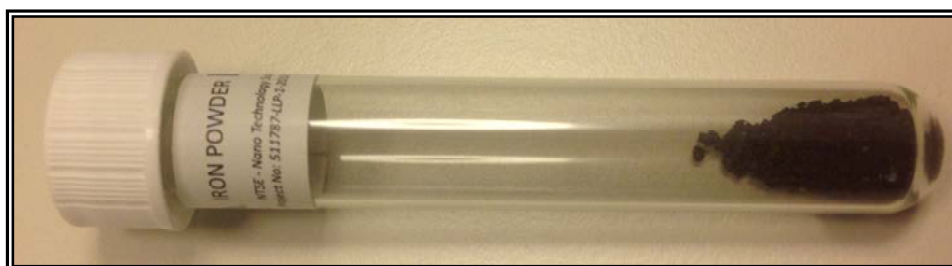


# Ferrofluid

Ferrofluid and iron powder are made of magnetite, an iron oxide. Ferrofluid is a suspension of magnetite nanocrystals which are around 10nm across. Ferrofluid is a unique material that acts like a magnetic solid in the presence of a magnetic field, but like a non-magnetic liquid if there is no magnet around.

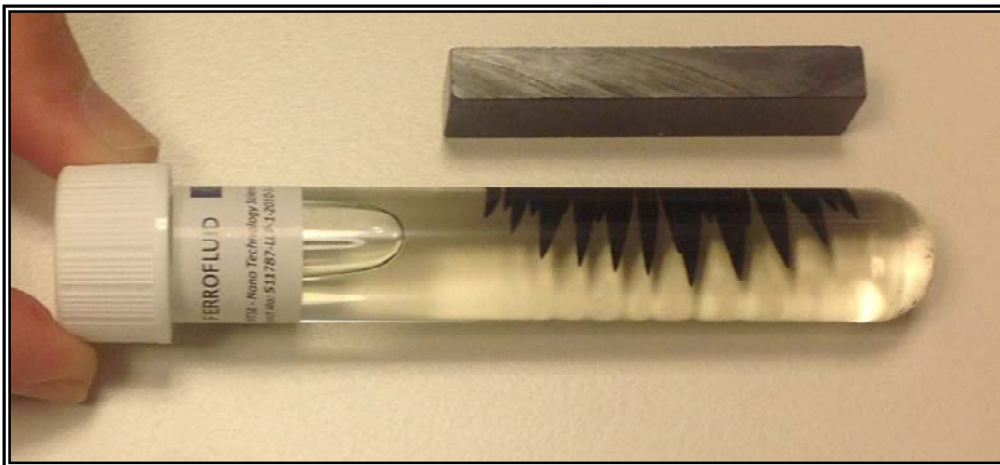


The ferrofluid tube contains isopropyl alcohol, deionized water, and ferrofluid.



The iron powder tube.

- Put the magnet close to the test tube containing the iron powder, let it slide along the test tube. How does iron powder react?
- Put the magnet close to the test tube containing the ferrofluid and look at the resulting shape. What does it look like?
- Remove the magnet from the ferrofluid tube. What happens?



The ferrofluid tube, and magnet.

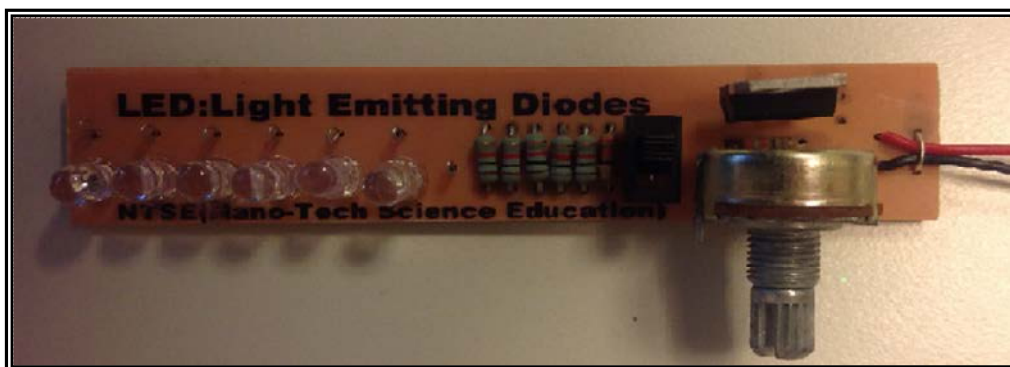
## Caution!

- Do not break, open, and shake the tubes!
- Do not bring the ferrofluid near a flame.
- In case of contact with skin, wash with copious amounts of water and soap.

# LEDs (Light Emitting Diodes)



LED is a semiconducture light sources. Visible light wavelength is between 400nm and 700nm. Wavelengths shorter than 400nm are in the ultraviolet range, and those longer than 700nm are in the infrared range.



The LEDs Device has six LEDs that emit light of different wavelengths, a switch, and a potentiometer.

- Plug the battery snap onto a 9volt battery.
- Open the switch.
- Increase potential difference by turning potentiometer knob.
- Observe five of the LEDs glowing in the different colors.



## LEDs (Light Emitting Diodes)



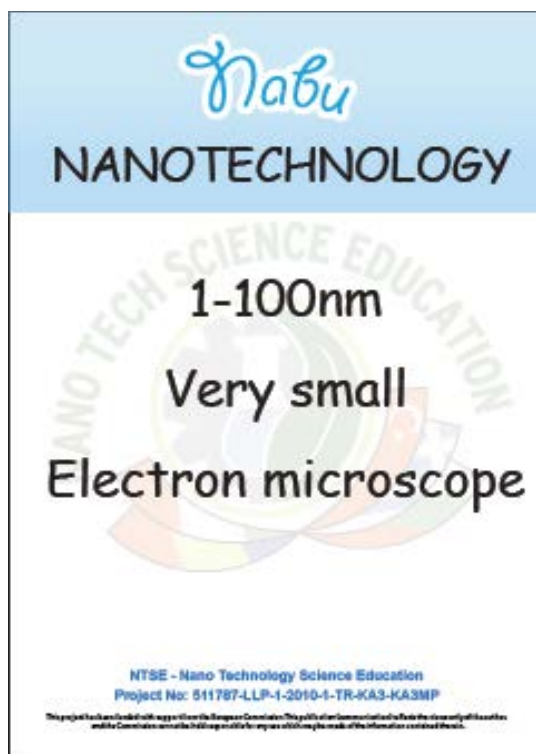
- Observe five of the LEDs glowing in the different colors.
- Decrease potential difference by turning potentiometer knob. Which LED turns off before? Why?



- Close the switch.
- Increase potential difference by turning potentiometer knob.

Observe Infrared (IR) LED not glowing. IR LED emits invisible infrared radiation.

Nabu is a game for teams. One of the people in the team is chosen to describe the missing word by using the key words/phrases on the Nabu card. The members of the same team try to guess the missing word in one minute. If they cannot find, the game passes to the other team. The team who finds the missing word in a minute is the winner. In each game a different team starts first.



Missing Word

Key Words/Phrases