

Tools for Materials Science - Challenge n°3 - 40'

PORTABLE MICROSCOPES

Thanks to new materials, optics is getting more and more robust, affordable, lightweight and ...portable! Home microscopes will soon become a common and widespread tool, hopefully improving scientific literacy and inquiry based approach in education since childhood. On the other hand such instruments are incredibly powerful and particularly useful in underdeveloped areas enabling to run tests whenever and wherever you like even far away from research facilities.

On the desk you have a set of materials samples and different kinds of portable microscopes plus a USB one plugged to the PC. For each kind of sample you are expected to take pictures/videos and answer the related question. Answer should be connected to what is seen in the pictures.

When using the USB microscope you have to take a screenshot (the software DOES NOT allow you to save pictures) and then paste on a Word file (with its description) on the PC. You will use plexiglass double deck microscopes with your smartphone (either with or without the magnifying lens app) and save the pictures directly in the PC or send them by Whatsapp to your group –See general instruction to share pictures or files.

Q0. What's the **magnification** of both types of microscope? Can you give an estimation of it? (Suggestion: use the millimetre graph paper to calibrate.)

Sample n.1 – SAP (Super Absorbent Polymer) beads

Absorption rate is usually proportional to the absorbing surface area. In spite of this when you put a dry superabsorbent polymer bead into water, it grows much faster at the beginning when it is little. You will notice that in this first stage the shape is not really spherical.

Q1. Can you relate the surface particular structure to the super-absorption behaviour?

Sample n.2 – Gecko-tape

The gecko is famous for being able to run on vertical walls and even ceilings without falling. **Gecko-tape** is a man-made micro-structured adhesive tape made with a polymer and mimicking the real gecko foot, whose adhesion is due to the enormous contact surface between foot and wall achieved with a complex hierarchical nanostructure.

Q2. Can you guess the tape structure? [In addition to microscope analysis you can also stare at it with a LED light (the smartphone flashlight will do) on the other side and moving the tape back and forth till you see something. You may even test it with a LASER

Sample n.3 – Conductive textiles

The two conductive textile strips have a very different behaviour when stretched: in one of them the electrical resistance increases upon stretching, while the opposite happens with the second one.

Q3. Could this be related to the fiber knitting? Are they different?

Sample n.4 – Micro-optics sheets

Micro-optics plastic lenses are usually made with a basic repeated pattern. According to this pattern light may be bent in circles, in straight lines (similar to glass rods), diffused or concentrated. First take the sheets and observe a light bulb or your cell flash light looking through them. Note down the resulting effect.

Then observe with the microscope the same sheets and take snapshots trying to clearly identify the basic pattern (suggestion: move and rotate the sample). You may also try to study two layers one on top of the other while moving or rotating them. You will see images of rare beauty. Try to document them with your pictures.

Q4. Can you relate the overall light effect of the lenses to their structure?

Sample n.5 – Aeroclay

Q5. Aeroclay is a super-absorbing clay foam. Can you find any explanation of such property in their inner structure?

OUTPUT WANTED: meaningful pictures/videos of each sample with short description of what it is + related answer to the question on material specific properties

Answer sheet

GROUP N° _____

Ch.3 --- PORTABLE MICROSCOPES

Q0

Type of Microscope:		
Magnification:		

NB: If you have (also) made a Word file with picture/description/answer in it, please save it on the PC and tell this to the teacher conducting the experiment; in this case you don't have to fill the answer sheet.

Sample n.1

- Picture1 description:
-
- Q1 answer:

Sample n.2

- Picture 2 description:
- Q2 answer:

Sample n.3

- Picture 3 description:
- Q3 answer:

Sample n.4

- Picture 4 description:
- Q4 answer:

Sample n.5

- Picture 5 description:
- Q5 answer:



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