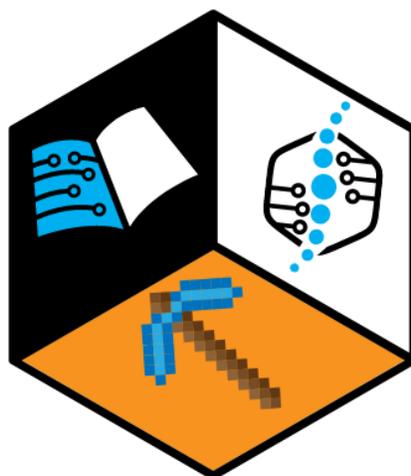


NANOWARE Lesson Plans

MODULE 2: NANOMATERIALS

DELIVERABLE: R1/T1.3 LESSON PLANS



NANOWARE

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DIGICULT

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1. Lesson Information

Title: Nanomaterials

Subject: Categorisation and application methods.

Grades: 9-12

Brief Description: Students will learn about the basic typology of nanomaterials and the differences among them. They will learn about nanomaterials' differentiation and understand how nanomaterials are used in practice.

Objectives: Students will:

- Know how different nanomaterials are characterized
- Understand how nanomaterials are used in practice
- Differentiate the types of nanomaterials

Analyse the synthesis of nanomaterials

Duration:

2. Lesson Procedure

This lesson should begin with a recap of any introductory lesson on nanoscience and nanotechnology, to remind students of the basics (basic definitions, differences in scale, etc.).

Essential questions to guide the unit:

- Can you imagine nanomaterials occurring naturally? (Guide students towards the answers: volcanic ash particles, smoke particles, hemoglobin, the brilliant colours on a peacock's feathers)
- Can you imagine how humans produce artificial nanomaterials? (Guide students towards the concept of pollution)
- What are the benefits of producing/engineering nanomaterials?



- Why can properties of matter at the nanoscale be different than those of materials at the bulk scale?

Activity 1: “The Mighty Power of Nanomaterials” video

Students will watch a video introducing nanomaterials.

Materials Needed

- Internet connection, YouTube access.

Activity Procedure

By watching the following video: <https://www.youtube.com/watch?v=lkYimZBzguw> students will be intrigued to learn more about nanomaterials, their synthesis, and their properties. They will also appreciate the huge potential of nanomaterials. A discussion should follow along these lines.

Activity 2: “Bucky Balls, Nanotubes and Graphene” video

Students will watch a video to learn the basics about bucky balls, nanotubes and graphene.

Materials Needed

- Internet connection, YouTube access.

Activity Procedure

Students will watch the video: <https://www.youtube.com/watch?v=PqApsO-rqpo> and gain an insight into nanoscience and its applications. Discuss the importance of structure in nanomaterials.

Activity 3: Describe and discuss!

Students will learn about basic nanomaterials through visual aids.

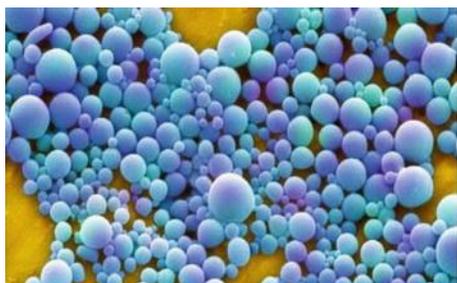
Materials Needed

- PowerPoint Slides, Computer, projector.

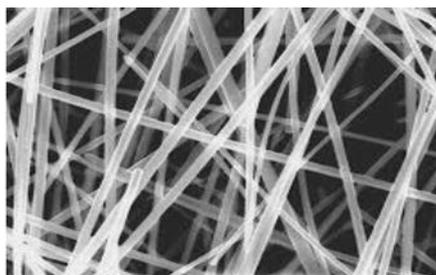
Activity Procedure

The teacher will share a PowerPoint presentation with pictures of nanomaterials and basic definitions to be used as talking points.

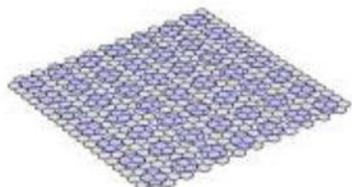
Pictures to be included:



0D(Nanoparticle)



1D(Nanowire)



2D Nanomaterials (plate)



3D Nanomaterials

Image title: Types of nanomaterials

Source: <https://www.intechopen.com/chapters/71346>

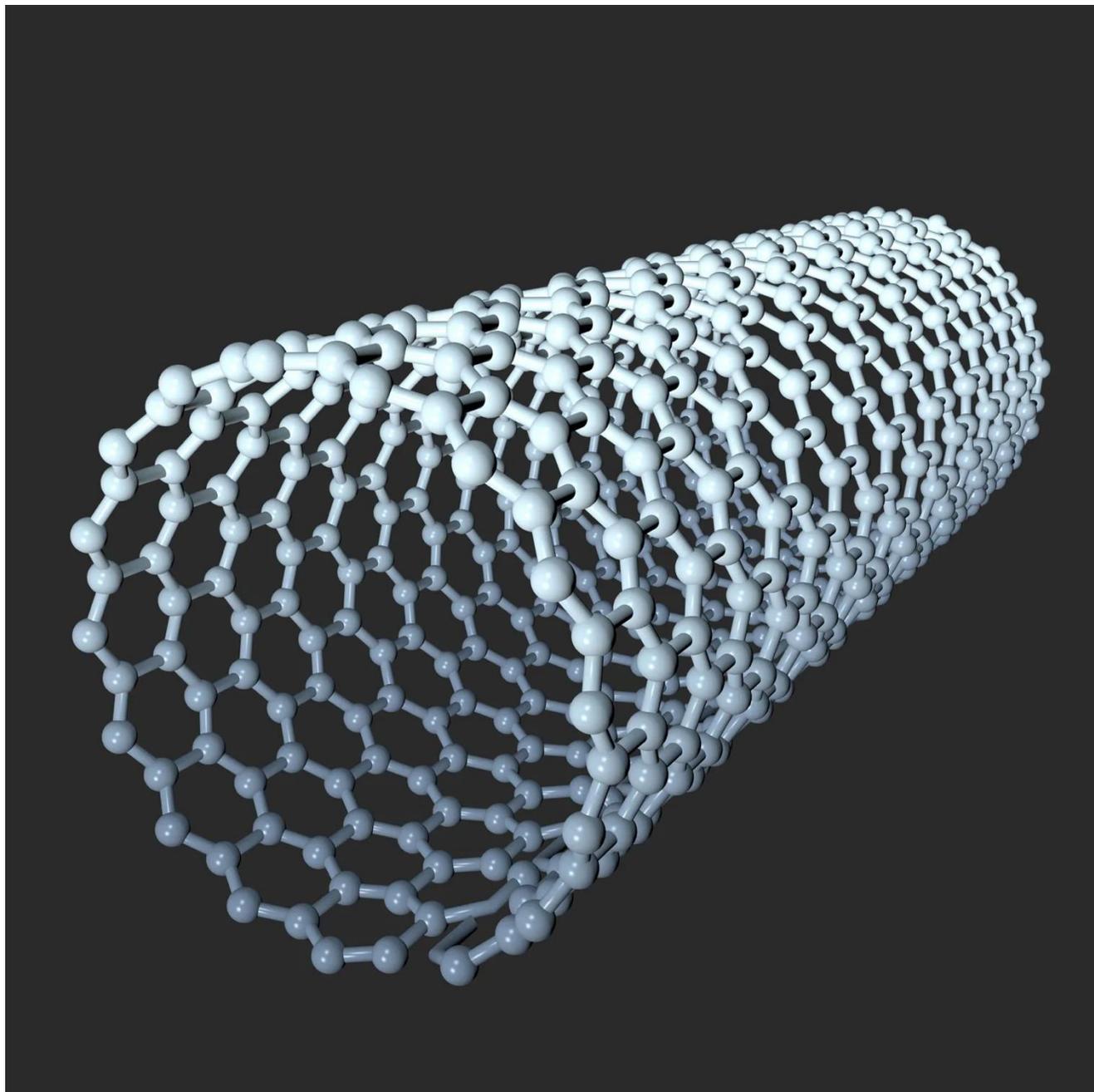


Image title: Illustration of carbon nanotube

Source: Britannica.com

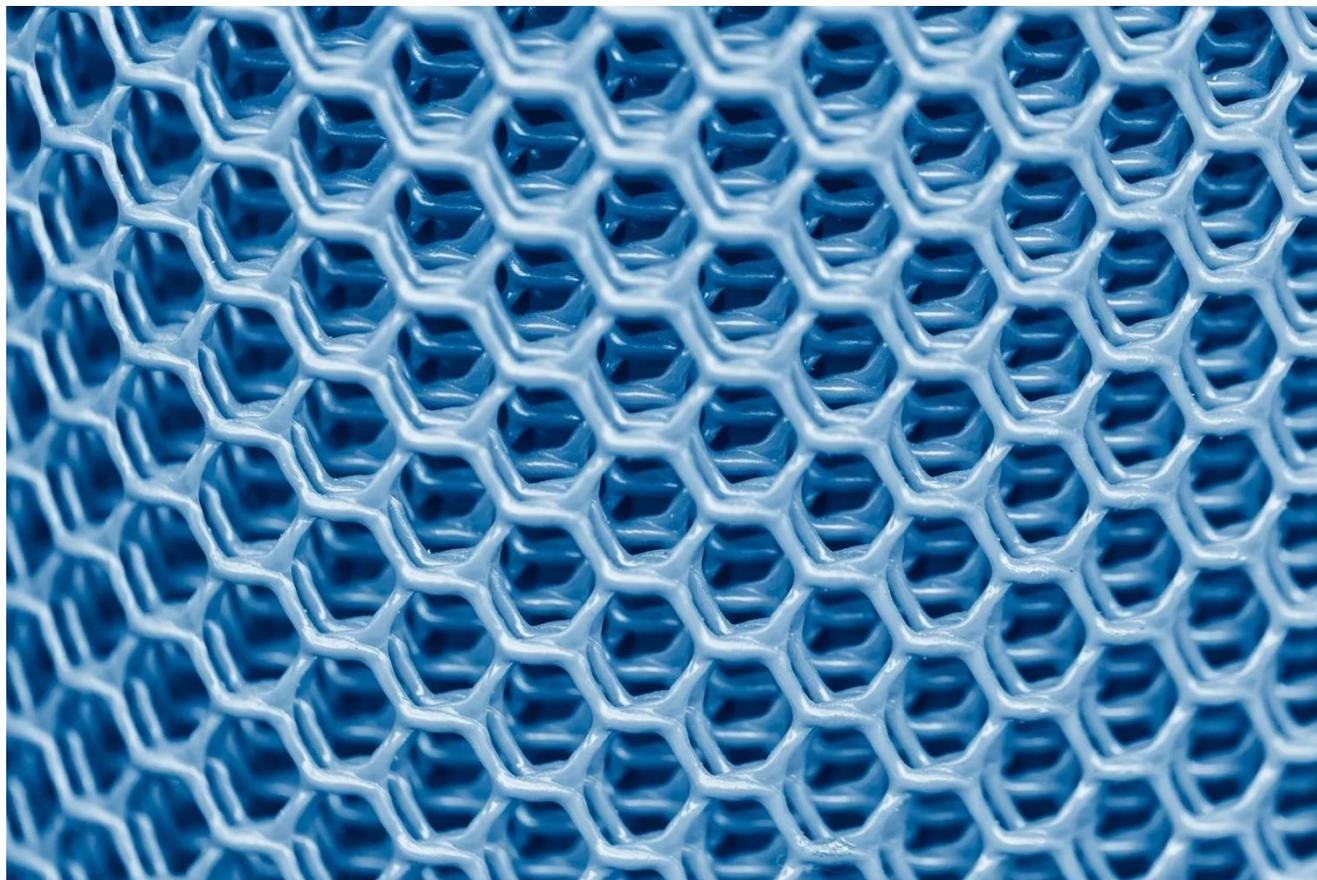


Image title: Pattern of hexagonal nano-geometry in a carbon nanotube.

Source: Britannica.com

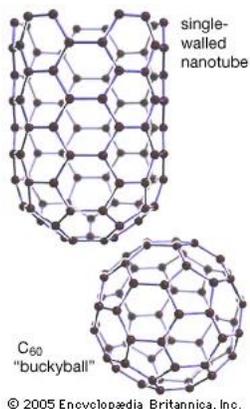


Image title: Two fullerene structures: an elongated carbon nanotube and a spherical buckminsterfullerene, or "buckyball."

Source: Britannica.com

Activity 4: "What is nanomedicine" video

Students will watch a video to understand how nanoscience can improve medicine and other industries.

Materials Needed

- Internet connection, YouTube access.

Activity Procedure

Play the following video to your students: <https://www.youtube.com/watch?v=jGRRNuMmZQ&t=147s>

Then, discuss how the special properties of nanomaterials are/can be used in other industries besides medicine.