NANOWARE Educators Guide

MODULE 3: NANOPARTICLES

DELIVERABLE: R1/T1.3



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1. Introduction Part

Grade Level: High School

Subject Area: Categorisaton and Application Methods of Nanomaterials

Time required: 90 minutes.

Learning Objectives (LO): Students will be able to:

- use calculations to analyse the effect size has on the surface area to volume ratio of particles LO1,
- link properties of nanoparticles to their uses to understand the importance of nanotechnology in society LO2,
- transfer mathematics skills to express nanoparticle sizes using scientific notation and calculate volumes and ratios LO3,
- the list uses of nanoparticles and the associated potential risks LO4,

Summary: NANOWARE has developed an information package for teachers that includes background information and documents about nanotechnology in our lives, the specifics of nanoparticles structures, and shapes, comparing nanoparticles with more familiar everyday objects, their types and use in practice. This information package is referred to as the NANOWARE Educators Guide. Below is an overview of its content.







2. Lesson Background Information

Nanoscience is one of the most important research projects in modern science. Nanoscale science is an exciting area of current research. Applications in information technology, medicine, composite materials, and other fields are now open for further exploration. Nanoscience is emerging as a way to describe the behaviour of substances in biology, chemistry, physics, earth science, metrology, medicine, and engineering, having a huge impact on our daily lives. Nanotechnology is beginning to allow scientists, engineers, chemists, and physicians to work at the molecular and cellular levels to produce important advances in the life sciences and healthcare.

Sources:

- 1. <u>https://trynano.org/education-resources/nanotechnology-lesson-plans/</u>
- 2. https://study.com/academy/lesson/everyday-uses-of-nanoparticles.html

Materials:

- https://www.youtube.com/watch?v=j_wQgy97Pi4
- <u>https://www.youtube.com/watch?v=Mr7IEvlfInI</u>
- https://www.youtube.com/watch?v=XcUedMpv_w8
- Access to PowerPoint (optional for classroom presentation)
- Some related videos







3. Suggested Teaching Strategies

To get students' attention to nanoparticles, the teacher may use a video (<u>https://www.youtube.com/watch?v=70dOzvhn-8M</u>) introducing nanotechnology (Activity 1) and may discuss with the students what nanotechnology mean.

Activity 1 Name	"What we know and what we don't know about nanoparticles?" video	ΤοοΙ
Short Description	Show students a video about nanoparticle uses and explain their risks to get their attention. And discuss with the students what nanomaterials mean.	https://www.youtube.com/watc h?v=70dOzvhn-8M
Objectives	To increase students' basic understanding of nanotechnology and nanosciences.	
Keywords	Nanoparticles, Nanotechnology, Nanomaterials	
Ages	14-17	





To help students learn the uses and risks of nanoparticles, the teacher may do "Activity 2- What things make a nanoparticle special: Describe and Discuss?". The teacher may help the students to learn nanoscience and its applications. Through this activity, students will have a chance to develop an understanding of what nanotechnology is.

Activity 2 Name	"What things make a nanoparticle special: Describe and Discuss"	Tool
Short Description	For this activity, show the students a PowerPoint presentation with pictures of nanoparticles and basic definitions to be used as talking points. Give the students an idea "What things make a nanoparticle special". Then, encourage the students to express ideas, prior knowledge, and questions about the topic, while promoting interaction and communication between them.	Presentations of some pictures of nanoparticles.
Objectives	To increase students' basic understanding of nanoparticles and to raise their awareness about their advantages and disadvantages.	
Keywords	Nanoparticles, Nanotechnology	
Ages	9-12	





To encourage the students to express ideas, promoting interaction and communication between them, the teacher may do "Activity 3- Brainstorming". The teacher may help the students to express their views and their opinions. Through this activity, students will have a chance to develop an understanding of nanoparticles and their usage advantages.

Activity 3 Name	Brainstorming	ΤοοΙ
Short	Give an affirmation and invite	Presentations
Description	students to express their views and their opinions.	
Objectives	To encourage students' discussion, communication and reflection to wrap up topics addressed.	
Keywords	Nanoparticles, Nanotechnology, Nanomaterials	
Ages	9-12	

Pre-requisite Knowledge: (general)

Students should search about nanoparticles, their types and their applications in our lives, before taking the lesson. They should know the nanoparticles/nanomaterials description; they should search for their advantages and disadvantages. Students should know how to perform a search on a specific topic either on the Internet or at their schools' facilities.





4. Assessment

Assessment: (rubric for assessment of visualizing nanoparticles knowledge of students)

Learning Objectives	Exception al 4	Satisfactor y 3	Developin g 2	Unsatisfactory 1	Total
Knows how to calculate of surface area to volume ratio of particles LO1.	Can clearly explain LO1	Provides some explanation/de monstration of LO1.	Provides less of an explanation/ demonstrati on but with details	Does not explain LO1.	
			missing.		
Explains the importance of nanotechnology in society LO2.	Can clearly explain LO2.	Provides some explanation of LO2.	Provides less of an explanation but with details	Does not explain LO2.	
			missing.		
Describe nanoparticle sizes using scientific notation and calculate volumes and ratios LO3.	Can clearly explain LO3.	Provides some explanation of LO3.	Provides less of an explanation but with details	Does not explain LO3.	
			missing.		
Explains the best practices in using nanoparticles and their potential risks LO4.	Can clearly explain LO4.	Provides some explanation of LO4.	Provides less of an explanation but with details	Does not explain LO3.	
			missina.		