Activity 1:

Nano Survey

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Key Concept:

Nanotechnology has benefits and risks.

Class time required:

Approximately 20 minutes of homework followed by 80 minutes of class time for discussions.

Teacher Provides:

- A copy of student handout **"Nano Survey"** for each student.

- A copy of ONE of the two different articles on nanotechnology (*Scientists Call for More Research on Nanotechnology*) for each student. Note: Students will be reading different articles. Do NOT indicate this when providing the readings.

- Prepare three posters and place them in three corners of the room.
  - *Benefits will outweigh the risks*
  - *Benefits and risks are equal*
  - *Risks will outweigh the benefits*

Suggested Class Procedure:

Homework to prepare for class discussion:

- Distribute copies of the student handout entitled **"Nano Survey"** to each student. Distribute a copy of ONE of the articles on nanotechnology (*Scientists Call for More Research on Nanotechnology*) to each student. Note: Because students will be pairing up, assign half of the students to read one article and half of the students to read the other article. Do NOT indicate that the articles they are reading are different.

- Ask students to read the information in the article and complete the Nano Survey for homework. Explain that they will be asked to share their answers for this assignment during class discussions during the next class.

During class:

- Students share their definitions for nanotechnology.

- Students move and stand next to the poster that best represents their opinion about the benefits and risks nanotechnology. Students standing near each poster should write:
  - The number of students at the poster.
  - Three facts that support their opinion.

- Explain that students in the class have to read two different articles:

- Each student should pair with a student who read a different article.

- Distribute copies of "**Discussing the Nano Survey"** to each student.

- Students exchange articles so that each member of the team is reading a new article.

- Students work underlined individually to complete questions 2 on the "Discussing the Nano Survey."

- Students work as a underlined team (of 2 or 4 students) to complete questions 3 - 6 on the "Discussing the Nano Survey."

- Each team of students shares ONE benefit, ONE risk, and ONE of the questions that they had about nanotechnology or nanomaterials.

- Teacher ask students **"How might news articles bias people's opinions about the use of nanotechnology and nanoproducts?"**

- Students discuss answers to the question. Teachers who would like more background to lead this discussion may consider reading *Project on Emerging Nanotechnologies: Toward a Comprehensive Strategy for Nanotechnology Risk Communication* http://www.nanotechproject.org/process/assets/files/7091/nano_090225_research_brief_ kahan_nl1.pdf.

- Students work individually to answer question 7. Each student should be prepared to explain why they did, or did not, change their opinion.

- Students move and stand near the poster that best represents their opinion about nanotechnology.

- Several students volunteer to explain why they did, or did not, change their opinion.

Possible Extensions:

- Students develop and conduct a survey on the benefits and risks of nanotechnology that they could use with other classes or with adults.

- Students use an internet search engine to find and then report on two examples of the use of nanotechnology.

- Consider supplementing the readings with videos such as:
  Nanotechnology Takes Off – KQUED QUEST Video
  (www.kqed.org/quest/television/view/189), or similar videos from and Internet search.
  User the search terms "video nanotechnology."

Nano Survey

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1. Read the article on nanotechnology. How would <u>you</u> define **nanotechnology**?

    Students answers will vary. Ask students to share and discuss their answers.

2. List the two <u>most important</u> things that you think people should know about the **benefits** of nanotechnology**,** based on your reading of the article.

    • _____

    _____   ***Note: Student answers for the Nano Survey activity will vary.***   _____
    The purpose for this activity is to prompt student
    • _____   ***discussions about the benefits and risks of nanotechnology.***   _____

    _____

3. List the two <u>most important</u> things that you think people should know about the **risks** of nanotechnology**,** based on your reading of the article.

    • _____

    _____

    • _____

    _____

4. Circle <u>one</u> of the following statements that best reflects <u>your</u> opinion about the benefits and risks of nanotechnology.

    Benefits outweigh   ***Risks outweigh***
    the risks   ***the benefits***

    Explain why you selected the statement that you circled.   Use information from the article to support your opinion.

    _____

    _____

    _____

    _____

    _____

   _____

Discussing the Nano Survey

1. Work with a student who read a **different** article. Exchange articles so that you have a new article (one that you did not read for homework).

2. Read the new article. As you read, make a list of three <u>additional</u> things that <u>you </u>think people should know about the risks and benefits of nanotechnology.

   * _____
     _____
     _____

   * _____
     _____
     _____

   * _____
     _____
     _____

3. Next, work <u>with your partner</u> to reach consensus (agreement) on the two most important things that people should know about:
   * The **benefits** of nanotechnology
   * The **risks** of nanotechnology

   List these on a poster (like the one shown on the right).
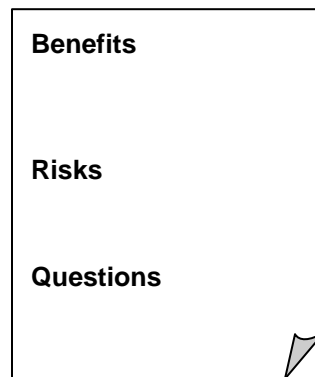
4. On your poster, list at least two **questions** that people could ask to help them understand the benefits and risks of nanotechnology or nanomaterials.

   Samples of possible questions students may ask:
   * *Why is the government spending money on nanoparticle research?*
   * *What health affects could nanoparticles have on people?*
   * *Would nanoparticles affect people with certain diseases or certain characteristics more than other people?*
   * *How do people study nanoparticles when they are too small to be seen?*
   * *Am I being exposed to nanoparticles?*
   * *How long has nanotechnology been in use?*

   Benefits

   Risks

   Questions

   Be prepared to share and discuss this poster with the class.

5. Join with another pair of students to form a team of four students.

6. Discuss the question, **"How might news articles bias people's opinions about the use of nanotechnology and nanoproducts?"**

   Hint: The word "bias" means - to prejudice; to influence opinions in an unfair way

   - Make a list of at least <u>two</u> possible answers to this question.
   - Be prepared to share your answers with the class.

   _____

   _____

   _____

   _____

   _____

7. Work <u>individually</u>. Circle <u>one</u> of the following statements that best reflects <u>your</u> opinion about the benefits and risks of nanotechnology.

   Benefits will outweigh   *Risks will outweigh*
   the risks   *the benefits*

   Did you change your opinion? Explain why or why not.

   _____

   _____

   _____

   _____

8. Do you think the articles that you read about nanotechnology were biased? Explain why or why not.

   _____

   _____

   _____

   _____

Scientists Call for More Research on Nanotechnology

A new report by an international team of scientists associated with major universities calls for more research on the risks and benefits of nanotechnology. The scientists are concerned that products containing nanomaterials may pose a risk to humans and the environment.

Nanotechnology is the ability to measure, see, predict and make things on the extremely small scale of atoms and molecules. Materials created at the nanoscale are called nanomaterials, and they can often be made to exhibit very different physical, chemical, and biological properties than their normal size counterparts.

The potential benefits of nanotechnology include the use of nanomaterials in products to make them stronger, lighter, and more effective. Some examples are food containers that kill bacteria, stain-resistant clothing, high performance sporting goods, faster, smaller computers, and more effective skin care products and sunscreens. But do products containing nanomaterials have potential risks?

While there has not been conclusive research on the potential risks of nanotechnology, scientists are concerned that some of the same properties that make nanomaterials useful might make them harmful to humans or to the environment. For example, preliminary research has shown that tiny nanoparticles may enter the body and move into the brain. Other research suggests a link between inhaled nanoparticles and cardiovascular diseases (heart disease and strokes).

"We need to determine whether the same novel properties that make nanomaterials so useful could also make them harmful, and if so, how to prevent that." explained one of the members of the scientific research team. "Research is needed to assure society realizes all the potential benefits of nanotechnology while minimizing any potential risks."

Modified from: Project on Emerging Nanotechnologies: Toward a Comprehensive Strategy for Nanotechnology Risk Communication http://www.nanotechproject.org/process/assets/files/7091/nano_090225_research_brief_kahan_nl1.pdf.

Scientists Call for More Research on Nanotechnology

A new report by a team of scientists associated with major universities calls for more research on new nanotechnology applications. They recommend that the United States support research to develop new nanoproducts that may dramatically improve human health and the environment.

Nanotechnology is the ability to measure, see, predict and make things on the extremely small scale of atoms and molecules. Materials created at the nanoscale are called nanomaterials, and they can often be made to exhibit very different physical, chemical, and biological properties than their normal size counterparts.

The potential benefits of nanotechnology include the use of nanomaterials in products to make them stronger, lighter, and more effective. Some examples are food containers that kill bacteria, stain-resistant clothing, high performance sporting goods, faster, smaller computers, and more effective skin care products and sunscreens.

Analysts predict that the global marketplace for goods and services using nanotechnologies could grow to $1 trillion by 2015. Examples of the potential applications of nanotechnology in the scientists' report include:

- "Green" products—such as devices that reduce carbon emissions from power plants and remove arsenic from ground water.

- Tests that warn of dangerous pathogens, diagnostic tests using blood or DNA.

- Treatments that deliver medications to diseased organs, or cures that specifically kill cancer cells without harming normal cells.

The team of scientists concluded that "Research is needed to assure society realizes all the potential benefits of nanotechnology while minimizing any potential risks."