

Focusing Questions: What substances do we find in local and global environments? What role do they play, and how do changes in their concentration and distribution affect living things?

Key Concepts:

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| • chemicals essential to life | • ingestion and absorption of materials | • hazards, probabilities and risk assessment |
| • substrates and nutrients | • concentration and dispersal | • uncertainties in environmental monitoring and in assessing toxicity and risk |
| • air and water quality | • evidence of toxicity | |
| • organic and inorganic material | • stability and biodegradability | |
| • acids and bases | | |

Students will be able to:

1. Investigate and describe the role of different substances in the environment and how they support or harm humans and other living things

_____ identify common organic and inorganic substances that are essential to the health and growth of humans and other living things, and illustrate the roles served by these substances (e.g., identify calcium as an essential material for bones; identify minerals that are known to enhance plant growth but that limit growth if too little or too much is available)

_____ describe the forms of organic matter made by plants and animals (carbohydrates, proteins and lipids)

_____ describe and illustrate processes by which chemicals are introduced to the environment or their concentrations are changed (e.g., dilution in streams, biomagnification through food chains)

_____ describe the uptake of materials by living things through ingestion or absorption, and investigate and describe evidence that some materials are difficult for organisms to break down or eliminate (e.g., DDT, mercury)

_____ identify questions that may need to be addressed in deciding what substances—in what amounts—can be safely released into the environment (e.g., identify questions and considerations that may be important in determining how much phosphate can be released into river water without significant harm to living things)

2. Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality

_____ identify nutrient sources for living things within a variety of environments

_____ describe and illustrate the use of biological monitoring as one method for determining environmental quality (e.g., assess water quality, by observing the relative abundance of various vertebrate and invertebrate species)

_____ identify chemical factors in an environment that might affect the health and distribution of living things in that environment (e.g., available oxygen, pH, dissolved nutrients in soil)

_____ apply and interpret measures of chemical concentration in parts per million, billion or trillion

_____ identify acids, bases and neutral substances, based on measures of their pH (e.g., use indicator solutions or pH meters to measure the pH of water samples)

_____ investigate, safely, and describe the effects of acids and bases on each other and on other substances (e.g., investigate and describe the reaction that results when baking powder is dissolved; describe the role of acids and bases in neutralizing each other)

_____ describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners)

3. Analyze and evaluate mechanisms affecting the how potentially harmful substances spread within an environment

_____ describe how materials transfer through air, water and soil; and identify factors that may speed or slow distribution (e.g., wind speed, soil porosity)

_____ describe mechanisms for biodegradation, and interpret information on the biodegradability of different materials

_____ understand information on the biological impacts of hazardous chemicals on local and global environments, by:

- interpreting evidence for environmental changes in the area of a substance release
- interpreting LD50 data and other information on toxicity [Note: LD50 refers to the amount of a substance found to be lethal to 50% of a population, if ingested.]
- identifying concerns with the disposal of household wastes, such as paints and oils, and industrial wastes

_____ describe and evaluate methods used to transport, store and dispose of hazardous household chemicals

_____ investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks (e.g., interpret and explain the significance of manufacturer's information on how wood preservatives can be safely applied; recognize that some individuals may have greater sensitivity to particular chemical substances than do others in the general population)

_____ identify and evaluate information and evidence related to an issue in which environmental chemistry plays a major role (e.g., evaluate evidence that the use of insecticides to control mosquitoes has an effect/has no effect on bird populations)