

Week 8: Coral Restoration

This week's topic is coral. Coral is a type of animal. It is a Cnidarian so it is related to the Jellyfish and Anemones. The coral populations have decreased significantly within the past 100 years or so due to pollution, human activity, tourism, and natural disasters. So why are corals so important? Corals are said to be the reef builders. They actually build the reef by a process of calcification. Coral reefs are important for many reasons including support a large diversity of fish, supporting local tourism industries, and providing over \$375 billion worth of goods and services every year according to NOAA. Because the populations of corals have significantly decreased, scientists are working to re-grow the coral. Scientists have discovered a way to gently take small sections from an adult coral and then place them into the proper conditions and the coral piece will actually grow into a completely new and healthy coral colony.

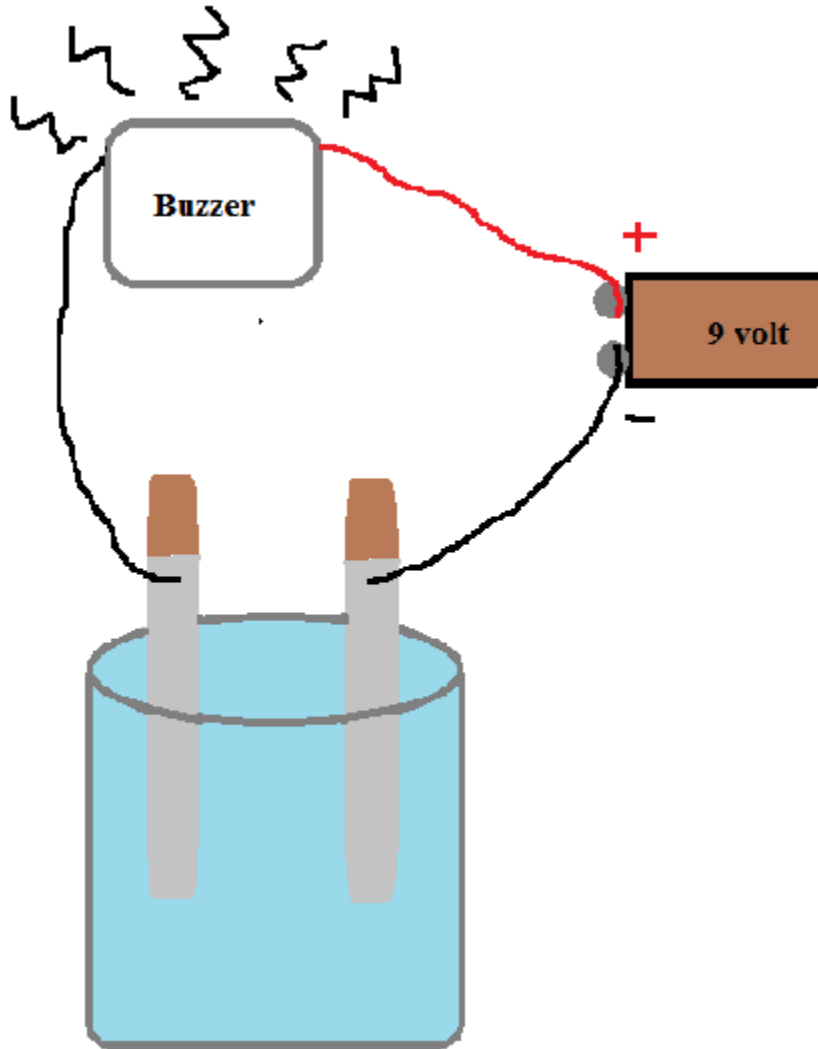
Exercise 1:

Saltwater Tester

Materials:

- Two Popsicles sticks/ craft sticks
- aluminum foil
- a buzzer/or small light bulb with leads
- 9 volt battery
- another lead wire
- salt
- water
- Two containers for the water (a bowl works)

First, take two Popsicle sticks and cover them in aluminum foil. Attach the red wire of the buzzer to the positive side of a 9-volt battery. Now attach one craft stick to the black wire of the buzzer and the other craft stick to the negative side of the battery. Test to make sure the buzzer works by touching the two craft sticks together. Now that everything is working correctly, place the two craft sticks into a glass of salt water. (Be careful not to touch the ends together). Now try it in the fresh water.



What is happening?

When salt is dissolved into water, it breaks down into sodium and chloride ions. The sodium ion is missing an electron, which gives it a positive charge. These positively charged ions are known as cations. The Chloride ion has an extra electron causing it to have a negative charge; known as an anion. These ions act as an electrical conductor and can carry electrical impulses. When the electrical impulse enters the water, the positively charged cations are attracted to the negatively charged Popsicle stick, or electrodes. The negatively charged anions are attracted to the positively

charged electrodes. This is what allows the electrical impulse to travel through the water and complete the circuit causing the buzzer to go off. If you were to change the amount of saltwater, it would affect the ability to carry the electrical impulse.

How this relates to Jessica and Bruce:

We all know that salt-water animals need salt water to survive but did you know that they actually have an ideal salinity range. Corals for example need water to have a salinity level of about 35ppt, parts per million (this can vary by region and species of corals). That means that the water needs to have 3.5% salt. This is important for osmosis and diffusion to occur within the coral polyps. If these two mechanisms do not work properly, the animal could die. Scientists that are working on restoring the coral populations take special care to monitor the salinity in the aquariums they use to culture coral polyps. Besides needing specific salinity levels many animals have mechanisms that are adapted to salt water. Sharks for example can actually detect weak electromagnetic fields that all living animals produce. Just like our experiment, this ability is hindered in water that has a salinity level of less than 35ppt, and it is completely absent in fresh water.

Definitions:

-Electrodes: A conductor through which electricity enters or leaves an object, substance, or region

-Current: a flow of electric charge

-Cations: a positively charged ion

-Anion: a negatively charged ion

-Ions: an atom or molecule with a net electric charge due to the loss or gain of one or more electrons.

Questions:

1. When you put the Popsicle sticks into the salt water what happened?
2. If you added more salt to the water, would it increase the ability to conduct the electricity or decrease the ability?
3. When you put the Popsicle sticks into the fresh water what happened?
4. What is an ion?
5. Were the Sodium ions a cation or an anion?

Related topics:

This ability to carry electrical impulses is also important for sharks to detect the electrical impulses that living organisms give off.

Osmosis and Diffusion: the bouncy egg experiment

Exercise 2:

pH Testing

Materials:

- litmus paper
- different solutions
 - Milk
 - Water
 - Salt water
 - Coffee
 - Soda
 - Tea
 - Bleach
 - Distilled water
 - Soap mixed with water
 - Baking soda mixed with water
 - Orange Juice
 - Apple Juice

Teachers: If you do not want to buy the litmus paper, you can make your own. Take a head of red cabbage and cut into smaller pieces so you can boil the cabbage. After you boil the cabbage, drain the juice into a container. The juice will be your pH indicator.

Be careful what solutions you want to test because colored solutions may affect the results.

If you go the cabbage route check out this link for more help and ideas for solutions to test <http://chemistry.about.com/od/acidsbase1/a/red-cabbage-ph-indicator.htm>

For the litmus paper users:

Simply put each of the solutions in a small jar or bowl. The students can either drop a small drop of the solution onto the litmus paper or dip a small piece of litmus paper into the solution. This is really up to you and what will work best for your classroom. The solutions will turn the litmus paper a color based on how acidic or basic the solution is.

Compare the turned litmus paper to the color guide that comes with the litmus papers and pick the appropriate pH.

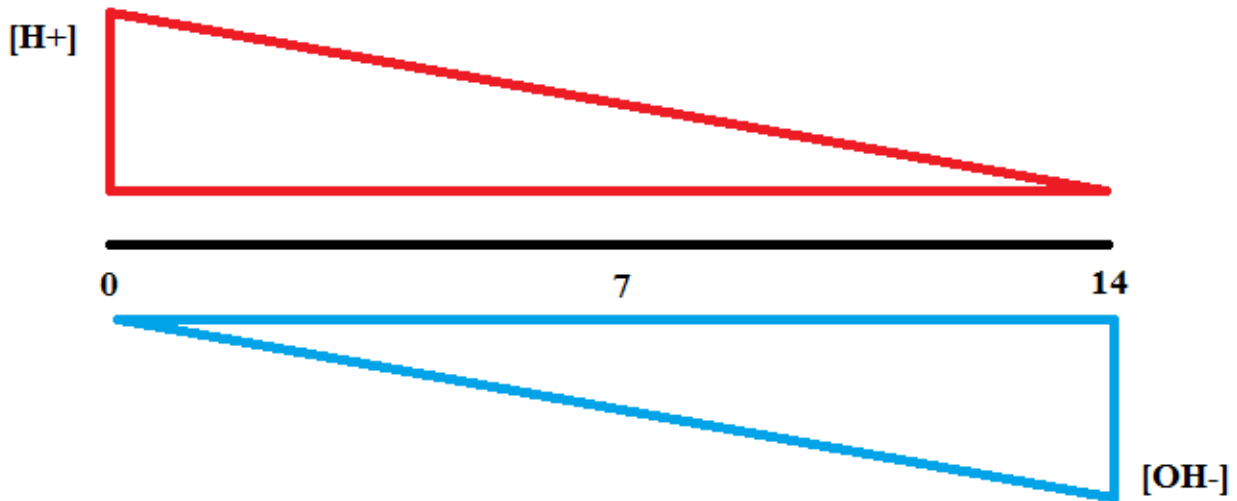
What is happening?

First, let us define acids and bases. Acids are molecules that produce H^+ ions in aqueous solutions, can donate protons, and accept an electron pair in reactions.

Bases are molecules that produce OH^- ions in aqueous solutions, accept protons, and donate electron pairs in reactions. PH stands for the potential of Hydrogen. The pH scale measures the concentration of Hydrogen in a solution. The more acidic a solution is the higher the H^+ concentration. The more basic a solution is the lower the H^+ , but the higher the OH^- concentration. The pH scale is from 0-14 with 7 being neutral.

Acids are less than 7 while bases are greater than 7.

The pH scale is a negative logarithmic function, which means that each change is a tenfold change in the concentration of Hydrogen. For example, a lemon with a pH of 3 is ten times more acidic than a tomato with a pH of 4. It is 100 times more acidic than coffee with a pH of 5.



Notice that a pH of 7 has equal concentrations of H⁺ and OH⁻

How this relates to Jessica and Bruce:

As discussed before, the corals need a very specific salinity level to survive. They also need to have a specific pH range of 8.1-8.3 for them to flourish. Like humans, corals rely on certain chemical reactions to occur in order to survive. Chemical reactions, specifically enzymatic reactions, need a certain pH to occur. If these reactions are altered or stopped, it could be detrimental to the corals.

Let us put this into perspective. Humans need nutrients from food to survive. We rely on special enzymes in our digestive system, like Lipase, that help break down food into smaller pieces or forms that our body can use. These enzymes will only function in a specific pH, if the environment becomes too acidic or too basic the enzyme will not work properly. If that happens, we would have significant loss in the ability of our bodies to obtain the needed nutrients from our food.

One very important reaction that corals need to occur is that of calcification.

Calcification is the process of corals using calcium that is in the water to construct their skeletons. If the pH drops too low, this process can no longer take place and the calcium skeleton can actually dissolve!

Definitions:

-pH: potential of hydrogen

-Acids: molecules that produce H^+ ions in aqueous solutions, can donate protons, and accept an electron pair in reactions

-Bases: Bases are molecules that produce OH^- ions in aqueous solutions, accepts protons, and donates electron pairs in reactions

-pH scale: a negative logarithm function of the concentration of Hydrogen ions in a solution. (A measure of the concentration of Hydrogen ions in a solution)

-Calcification: The accumulation of calcium salts in a body tissue.

Questions:

1. What solution had a neutral pH?
2. What solution had the highest pH?
3. What solution had the lowest pH?
4. Did any of the solutions surprise you?
5. What was the pH of soda?
6. Does this support the theory that sodas eat away the enamel on your teeth?

Related topics:

Your body's pH and how it regulates it. pH of blood?

Buffers

How do antacids work?

Ocean acidification

Exercise 3:

Mock Fragmentations

Materials:

- Plant
- Very sharp scissors or X-acto knife
- Clear bowl or cup
- Potting soil
- Water

Teachers:

This experiment is one that you set up and check on each week for the rest of the semester. The goal is to show students that while scientists are currently working to re-grow the coral populations it will take years for the corals to reach the same population size that they had in the past.

First, take an adult plant and observe the structures. You may want to consult the Internet for the best way to propagate the specific plant that you have but most cases you can follow these basic steps. Take a cutting that measures 4-6 inches long and has at least four leaves on it make sure you use a sharp knife or scissor to cut it so it is less likely to bruise. Remove the bottom leaves leaving only the top 2-4 leaves.

Place one cutting in water and place another cutting in soil. Place the cuttings where they will receive plenty of light, however, avoid direct sunlight. Make sure you water the plants every other day to help keep the soil moist and to help keep the oxygen level up in the water plants. (This helps keep algae from growing). Check on the plants every few days to look for root growth (which hopefully you will be able to see from the side of the container).

What is happening?

We are creating (hopefully) two new plants from one individual. The two new plants will be genetically identical to the original plant. This is an example of asexual reproduction. Once the cuttings are planted, a few different chemicals and environmental stimuli are responsible for the development of roots. One common example of these hormones is auxin. You may have dusted some form of auxin on the cuttings if you used a commercial rooting hormone. Typically, when a plant is trying to grow new roots it uses all of its energy on the new roots and secondary growth of the plant is put on hold. Once the roots become established, the plant will continue its secondary growth.

How this relates to Jessica and Bruce:

Corals can reproduce both sexually and asexually. An adult coral polyp can reproduce by budding, which is where the new polyp or "bud" forms directly on the parent polyp. Corals can also reproduce asexually by fragmentation. This is when an entire colony of polyps branches off and forms a new colony. This is when a piece of the coral containing many polyps is broken off and is able to continue to grow. This can happen when damage occurs to the coral by boats, divers, or strong weather. As long as the piece that broke off from the original colony is in good condition and the environmental conditions are good the piece can continue to reproduce by budding and can eventually grow into a completely new colony. This project like the coral takes a lot of time and energy to see it through. Many corals will only grow about 3/4 and inch a year! Scientists have to make sure that all the needed conditions are met for the coral to grow and they must check on the coral every few days. Sometimes even when the conditions are all met, the coral still does not grow due to unknown factors and you may witness that in your classroom experiments. Even with scientists, helping the corals to re-grow, it will take a long time for the populations to reach the sizes they were in the past. Think about that next time you go to the beach and you see a piece of coral for sale.

Definitions:

-Asexual reproduction: mode of reproduction by which offspring arise from a single parent, and inherit the genes of that parent only, it is reproduction that does not involve meiosis, ploidy, reduction, or fertilization

-Propagation: the process of creating new plants from a variety of sources; seeds, cutting, bulbs or other plant parts

-Roots: organ of the plant that typically lies below the surface of the soil

-Stems: the main structure axis of a vascular plant that contains the vascular tissue

-Leaves: a flattened structure of a higher plant that is attached to a stem directly or via a stalk. Leaves are the main photosynthetic organ of the plant

-Budding: a form of asexual reproduction in which a new organism develops from an outgrowth or bud due to cell division at one particular site.

-Primary growth: growth in vascular plants, especially an increase in length, that results from cell division and differentiation of an apical meristem.

-Secondary growth: growth in vascular plants from production of secondary tissues by a lateral meristem, usually resulting in wider branches and stems.

Questions:

1. How long do you think it will for your plant to grow roots?
2. What are some conditions that have to be met for the plant to survive?
3. What is asexual reproduction?
4. How is asexual reproduction in plants similar to that of corals?

Related topics:

Reproduction of corals

Plant resistance to pesticides

Vegetative reproduction

Plant parts

Hydroponics

Links:

Saltwater Tester

<http://pbskids.org/zoom/activities/sci/saltwatertester.html>

http://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_desal/cub_desal_lesson01_activity1.xml

Plant Propagation:

<http://www.examiner.com/article/75-plants-you-can-propagate-an-easy-way>

<http://gardening.afterschooltreats.com/wfdata/frame133-1011/pressrel16.asp>

<http://www.kidsgardening.org/node/13042>

Corals:

http://oceanservice.noaa.gov/education/kits/corals/coral07_importance.html

Answers:

1. When you put the Popsicle sticks into the salt water what happened?
 - a. The electrical circuit was complete and the buzzer went off
2. If you added more salt to the water, would it increase the ability to conduct the electricity or decrease the ability?
 - a. It would increase the ability because there are more available ions to carry the charge.
3. When you put the Popsicle sticks into the fresh water what happened?
 - a. The electrical circuit was not completed and the buzzer did not go off
4. What is an ion?
 - a. An atom or molecule with a net electric charge due to the loss or gain of one or more electrons.
5. Were the Sodium ions a cation or an anion?
 - a. cation
1. What solution had a neutral pH?
 - a. Results will vary. Typically milk, water, and distilled water are very close to neutral
2. What solution had the highest pH?
 - a. Results will vary. Bleach is usually one of the highest.
3. What solution had the lowest pH?
 - a. Results will vary.
4. Did any of the solutions surprise you?
 - a. Answers will vary.
6. What was the pH of soda?
 - a. Results will vary. Typically, it is around a pH of 5.
7. Does this support the theory that sodas eat away the enamel on your teeth?
 - a. Yes. Sodas are 1000 times more acidic than the water and milk people drink.
1. How long do you think it will for your plant to grow roots?
 - a. Answers will vary
2. What are some conditions that have to be met for the plant to survive?
 - a. Proper sunlight, water, and temperatures.
3. What is asexual reproduction?
 - a. Mode of reproduction by which offspring arise from a single parent and inherit the genes of that parent only, it is reproduction that does not involve meiosis, ploidy, reduction, or fertilization.
4. How is asexual reproduction in plants similar to that of corals?

- a. It only required a small living section from the adult coral or plant for the new organism to grow.
- b. We placed the small section of the parent plant and transferred it to ideal conditions to ensure growth. Scientists do this same thing with corals.
- c. Both the new plant and the new coral will be genetically identical to their parent plant or parent coral.

Tennessee State Standards:

Grade 6 :Embedded Inquiry

Conceptual Strand

Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.

Guiding Question

What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?

Grade Level Expectations

GLE 0607.Inq.1 Design and conduct open- ended scientific investigations.

GLE 0607.Inq.2 Use appropriate tools and techniques to gather, organize, analyze, and interpret data.

GLE 0607.Inq.3 Synthesize information to determine cause and effect relationships between evidence and explanations.

GLE 0607.Inq.4 Recognize possible sources of bias and error, alternative explanations, and questions for further exploration.

GLE 0607.Inq.5 Communicate scientific understanding using descriptions, explanations, and models.

Checks for Understanding

0607.Inq.1 Design and conduct an open-ended scientific investigation to answer a question that includes a control and appropriate variables.

0607.Inq.2 Identify tools and techniques needed to gather, organize, analyze, and interpret data collected from a moderately complex scientific investigation.

0607.Inq.3 Use evidence from a dataset to determine cause and effect relationships that explain a phenomenon.

0607.Inq.4 Review an experimental design to determine possible sources of bias or error, state alternative explanations, and identify Questions for further investigations.

0607.Inq.S Design a method to explain the results of an investigation using descriptions, explanations, or models.

State Performance Indicators

SPI 0607.Inq.1 Design a simple experimental procedure with an identified control and appropriate variables.

SPI 0607.Inq.2 Select tools and procedures needed to conduct a moderately complex experiment.

SPI 0607.Inq.3 Interpret and translate data in a table, graph, or diagram.

SPI 0607.Inq.4 Draw a conclusion that establishes a cause and effect

relationship supported by evidence.

SPI 0607.Inq.5 Identify a faulty interpretation of data that is due to bias or experimental error.

Grade 6 :Embedded Technology & Engineering

Conceptual Strand

Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.

Guiding Question

How do science concepts, engineering skills, and applications of technology improve the quality of life?

Grade Level Expectations

GLE 0607.T/E.1 Explore how technology responds to social, political, and economic needs.

GLE 0607.T/E.2 Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

GLE 0607.T/E.3 Compare the intended benefits with the unintended consequences of a new

GLE 0607.T/E.4 Describe and explain adaptive and assistive bioengineered products.

Checks for Understanding

0607.T/E.1 Use appropriate tools to test for strength, hardness, and flexibility of materials.

0607.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.

0607.T/E.3 Explore how the unintended consequences of new technologies can impact society.

0607.T/E.4 Research bioengineering technologies that advance health and contribute to improvements in our daily lives.

0607.T/E.5 Develop an adaptive design and test its effectiveness.

State Performance Indicators

SPI 0607.T/E.1 Identify the tools and procedures needed to test the design features of a prototype.

SPI 0607.T/E.2 Evaluate a protocol to determine if the engineering design process was successfully applied.

SPI 0607.T/E.3 Distinguish between the intended benefits and the unintended consequences of a new technology.
technology.

SPI 0607.T/E.4 Differentiate between adaptive and assistive engineered products (e.g., food, biofuels, medicines, integrated pest management).

Grade 6:Standard 12 - Forces in Nature

Conceptual Strand 12

Everything in the universe exerts a gravitational force on everything else; there is an interplay between magnetic fields and electrical currents.

Guiding Question 12

What are the scientific principles that explain gravity and electromagnetism?

Grade Level Expectations

GLE 0607.12.1 Describe how simple circuits are associated with the transfer of electrical energy.

GLE 0607.12.2 Explain how simple electrical circuits can be used to determine which materials conduct electricity.

Checks for Understanding

0607.12.1 Prepare a poster that illustrates how electricity passes through a simple circuit to produce heat, light, or sound.

0607.12.2 Determine a material's electrical conductivity by testing it with a simple battery/bulb circuit.

0607.12.3 Compare and contrast the characteristics of objects and materials that conduct electricity with those that are electrical insulators.

State Performance Indicators

SPI 0607.12.1 Identify how simple circuits are associated with the transfer of electrical energy when heat, light, sound, and chemical changes are produced.

SPI 0607.12.2 Identify materials that can conduct electricity.

Grade 7 : Embedded Inquiry

Conceptual Strand

Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.

Guiding Question

What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?

Grade Level Expectations

GLE 0707.Inq.1 Design and conduct open- ended scientific investigations.

GLE 0707.Inq.2 Use appropriate tools and techniques to gather, organize, analyze, and interpret data.

GLE 0707.Inq.3 Synthesize information to determine cause and effect relationships between evidence and explanations.

GLE 0707.Inq.4 Recognize possible sources of bias and error, alternative explanations, and questions for further exploration.

GLE 0707.Inq.5 Communicate scientific understanding using descriptions, explanations, and models.

Checks for Understanding

0707.Inq.1 Design and conduct an open-ended scientific investigation to answer a question that includes a control and appropriate variables.

0707.Inq.2 Identify tools and techniques needed to gather, organize, analyze, and interpret data collected from a moderately complex scientific investigation.

0707.Inq.3 Use evidence from a dataset to determine cause and effect relationships that explain a phenomenon.

0707.Inq.4 Review an experimental design to determine possible sources of bias or error, state alternative explanations, and identify questions for further investigation.

0707.Inq.5 Design a method to explain the results of an investigation using descriptions, explanations, or models.

State Performance Indicators

SPI 0707.Inq.1 Design a simple experimental procedure with an identified control and appropriate variables.

SPI 0707.Inq.2 Select tools and procedures needed to conduct a moderately complex experiment.

SPI 0707.Inq.3 Interpret and translate data in a table, graph, or diagram.

SPI 0707.Inq.4 Draw a conclusion that establishes a cause and effect relationship supported by evidence.

SPI 0707.Inq.5 Identify a faulty interpretation of data that is due to bias or experimental error.

Grade 7 : Embedded Technology & Engineering

Conceptual Strand

Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.

Guiding Question

How do science concepts, engineering skills, and applications of technology improve the quality of life?

Grade Level Expectations

GLE 0707.T/E.1 Explore how technology responds to social, political, and economic needs.

GLE 0707.T/E.2 Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

GLE 0707.T/E.3 Compare the intended benefits with the unintended consequences of a new technology.

GLE 0707.T/E.4 Describe and explain adaptive and assistive bioengineered products.

Checks for Understanding

0707.T/E.1 Use appropriate tools to test for strength, hardness, and flexibility of materials.

0707.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.

0707.T/E.3 Explore how the unintended consequences of new technologies can impact society.

0707.T/E.4 Research bioengineering technologies that advance health and contribute to improvements in our daily lives.

0707.T/E.5 Develop an adaptive design and test its effectiveness.

State Performance Indicators

SPI 0707.T/E.1 Identify the tools and procedures needed to test the design features of a prototype.

SPI 0707.T/E.2 Evaluate a protocol to determine if the engineering design process was successfully applied.

SPI 0707.T/E.3 Distinguish between the intended benefits and the unintended consequences of a new technology.

SPI 0707.T/E.4 Differentiate between adaptive and assistive engineered products (e.g., food, biofuels, medicines, integrated pest management).

Grade 7 : Standard 4 - Heredity

Conceptual Strand 4

Plants and animals reproduce and transmit hereditary information between generations.

Guiding Question 4

What are the principal mechanisms by which living things reproduce and transmit information between parents and offspring?

Grade Level Expectations

GLE 0707.4.1 Compare and contrast the fundamental features of sexual and asexual reproduction.

GLE 0707.4.2 Demonstrate an understanding of sexual reproduction in flowering plants.

Checks for Understanding

0707.4.2 Label and explain the function of the reproductive parts of a flower.

0707.4.3 Describe various methods of plant pollination.

State Performance Indicators

SPI 0707.4.1 Classify methods of reproduction as sexual or asexual.

SPI 0707.4.2 Match flower parts with their reproductive functions.

Grade 8 : Embedded Inquiry

Conceptual Strand

Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.

Guiding Question

What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?

Grade Level Expectations

GLE 0807.Inq.1 Design and conduct open- ended scientific investigations.

GLE 0807.Inq.2 Use appropriate tools and techniques to gather, organize, analyze, and interpret data.

GLE 0807.Inq.3 Synthesize information to determine cause and effect relationships between evidence and explanations.

GLE 0807.Inq.4 Recognize possible sources of bias and error, alternative explanations, and questions for further exploration.

GLE 0807.Inq.5 Communicate scientific understanding using descriptions, explanations, and models.

Checks for Understanding

0807.Inq.1 Design and conduct an open-ended scientific investigation to answer a question that includes a control and appropriate variables.

0807.Inq.2 Identify tools and techniques needed to gather, organize, analyze, and interpret data collected from a moderately complex scientific investigation.

0807.Inq.3 Use evidence from a dataset to determine cause and effect relationships that explain a phenomenon.

0807.Inq.4 Review an experimental design to determine possible sources of bias or error, state alternative explanations, and identify questions for further investigation.

0807.Inq.5 Design a method to explain the results of an investigation using descriptions, explanations, or models.

State Performance Indicators

SPI 0807.Inq.1 Design a simple experimental procedure with an identified control and appropriate variables.

SPI 0807.Inq.2 Select tools and procedures needed to conduct a moderately complex experiment.

SPI 0807.Inq.3 Interpret and translate data into a table, graph, or diagram.

SPI 0807.Inq.4 Draw a conclusion that establishes a cause and effect relationship supported by evidence.

SPI 0807.Inq.5 Identify a faulty interpretation of data that is due to bias or experimental error.

Grade 8 : Embedded Technology & Engineering

Conceptual Strand

Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.

Guiding Question

How do science concepts, engineering skills, and applications of technology improve the quality of life?

Grade Level Expectations

GLE 0807.T/E.1 Explore how technology responds to social, political, and economic needs.

GLE 0807.T/E.2 Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

GLE 0807.T/E.3 Compare the intended benefits with the unintended consequences of a new technology.

GLE 0807.T/E.4 Describe and explain adaptive and assistive bioengineered products.

Checks for Understanding

0807.T/E.1 Use appropriate tools to test for strength, hardness, and flexibility of materials.

0807.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.

0807.T/E.3 Explore how the unintended consequences of new technologies can impact society.

0807.T/E.4 Research bioengineering technologies that advance health and contribute to improvements in our daily lives.

0807.T/E.5 Develop an adaptive design and test its effectiveness.

State Performance Indicators

SPI 0807.T/E.1 Identify the tools and procedures needed to test the design features of a prototype.

SPI 0807.T/E.2 Evaluate a protocol to determine if the engineering design process was successfully applied.

SPI 0807.T/E.3 Distinguish between the intended benefits and the unintended consequences of a new technology.

SPI 0807.T/E.4 Differentiate between adaptive and assistive engineered products (e.g., food, biofuels, medicines, integrated pest management).

Grade 8 : Standard 9 - Matter

Conceptual Strand 9

The composition and structure of matter is known, and it behaves according to principles that are generally understood.

Guiding Question 9

How does the structure of matter influence its physical and chemical behavior?

Grade Level Expectations

GLE 0807.9.4 Distinguish among elements, compounds, and mixtures.

GLE 0807.9.9 Explain the basic difference between acids and bases.

Checks for Understanding

0807.9.13 Determine whether a substance is an acid or a base by its reaction to an indicator.

State Performance Indicators

SPI 0807.9.12 Identify the basic properties of acids and bases.

National Standards:

Middle School Life Science:

Growth, Development and Reproduction of Organisms:

1. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. MS-LS3-2
 - a. Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.
 - b. Assessment Boundary: none

Human Impacts:

1. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ESS3-3
 - a. Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).
 - b. Assessment Boundary: none