# Purpose

In this assignment, you will use, evaluate, and improve a simulation to highlight human impact on coral reef ecosystems. Then, you will propose and evaluate real-world solutions to reduce the negative effects of human activity on this ecosystem and its biodiversity.

Background Information

Coral reefs are some of the most diverse ecosystems on Earth. They contain millions of species, both known and unknown. Not only are coral reefs important to organisms such as sharks and sea turtles, they are also important to the survival of 800 species of hard corals and 4,000 species of fish. Coral reefs provide benefits to humans as well. Some fishermen catch and sell fish that live in these ecosystems. Coral reefs provide income to those who work in the tourism industry because people visit coral reefs to dive and snorkel. Coral reefs also protect coastal areas from the effects of waves and erosion. Finally, scientists believe that substances made by organisms in this ecosystem can be used in medicines.

Before the spread of industry, Earth’s oceans had an average pH of 8.2. During the Industrial Age, energy began to be generated from the burning of fossil fuels. As these processes became more sophisticated, more uses for fossil fuels were discovered. When fossil fuels are burned, carbon dioxide is released into the atmosphere. About one-fourth of the carbon dioxide released is absorbed by the ocean. This causes the pH of the ocean to decrease. It is estimated that the pH of the ocean will decrease to an average of 7.6 by the year 2100 if nothing is done to counteract the effects of human activity.

# Assignment Instructions

1. **Gather materials and necessary information.**
   1. Ask your teacher where you should save your assignment. You may also be able to print the document and complete it by hand before submitting it. Ask your teacher for guidance.
   2. If you have questions, ask your teacher for help.
2. **Complete the performance task.**
   1. **Respond carefully.** Follow the directions, and use your notes to help you complete the assignment.
   2. **Complete the assignment.** Be sure to read each question carefully. If you have any trouble understanding the requirements, ask your teacher for assistance.
3. **Evaluate your assignment using this checklist. When you can answer “yes” to all of the questions, you are ready to submit your assignment.**

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | **Evaluation Question** |
|  |  | Did you answer all of the questions in the assignment? |
|  |  | Do your answers to the questions include supporting evidence from reliable resources? |
|  |  | Are your answers written carefully and spelled correctly? |

1. **Revise and submit your assignment.**
   1. If you were unable to answer “yes” to all of the questions on the checklist, revise your work before submitting it.
   2. Return to the virtual classroom and use the “Add Files” option to locate and submit your assignment. Ask your teacher for assistance if necessary. Congratulations! You have successfully completed your assignment.

# Assignment

**Part I: Launch the** [**Coral Reefs 2 simulation**](https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1059)**. Play around with it for about 10 minutes to familiarize yourself with how it works. Then, answer the questions below.**

1. What does the simulation model? How do the components of the simulation model these ideas? Give an example to support your answer. (3 points)
2. When you decrease the pH in the simulation, the ocean’s acidity increases. What do you expect to happen over time to the population of the corals, algae, and fish in the coral reef as the pH of the ocean decreases? (2 points)
3. Set up the simulation in the following manner. (3 points)
   1. On the data tab, check all boxes **except** those of the red lionfish and the crown-of-thorns starfish.
   2. Zoom out from the graph by clicking on the minus sign on the right side of the graph. Continue clicking the minus sign until the graph shows 100 years on the *x*-axis.
   3. On the conditions tab, set storm severity to 20%, ocean temperature to 27°C, and ocean pH to 7.6.
   4. Run the simulation.
   5. Take a snapshot of your graph, then copy and paste it into the space below.
4. Based on the results from Step 3, answer the questions below.
5. Did the results match your expectations? Use data from the table to support your answer. (4 points)
6. What conclusion can you make about the relationship between the pH and the biodiversity of the coral reef ecosystem in the simulation? (1 point)
7. How is the simulation limited in its ability to model how the ocean’s pH affects biodiversity in this ecosystem? (2 points)
8. How would you revise the simulation so users can evaluate the role of human activity in the pH of the ocean? (2 points)
9. What variables would you add to or change in the simulation to accomplish this? (3 points)

**Part II: Read the text below, then answer the questions.**

Corals, the basic structures of coral reefs, are affected by the increasing acidity (decreasing pH) of the oceans. When the ocean absorbs carbon dioxide, the carbon dioxide reacts with water and other substances to form carbonic acid. This process uses substances in the ocean that corals use to build their skeletons. So, the more carbon dioxide there is in the ocean, the harder it is for corals to build their skeletons. Ocean acidification can also destroy existing coral reefs.

1. Give two possible ways that negative human impact on the pH of Earth’s oceans can be reduced. (4 points)
2. Conduct research to learn more about your proposed solutions. Be sure to look up information about cost, safety, reliability, and social or cultural implications when applicable. What are the pros of each solution? What are the cons of each solution? (10 points)
3. Which solution would be better to implement? Justify your answer. (3 points)
4. What sources did you use? (3 points)