**Ocean Acidification Module - Worksheet**

**Materials (per group):**

* 3 large cups (containers)
* 1 small cup (measuring)
* (at least) 3 shells
* Scale
* Gloves
* Tap water
* Solutions: vinegar, soda, lemon juice, milk, tap water, limewater, baking soda, soapy water, seawater
* Citric powder
* pH paper
* Marker
* Stirrers

**Shell experiment set-up:**

1. Fill 3 container cups half-way with tap water.
2. Measure out 1 volume of citric powder with the measuring cup, put it into a water cup.
3. Measure out 3 volumes of citric powder with the measuring cup, put it into a water cup.
4. Be sure to identify the containers.
5. Stir well each container until the powder is fully dissolved (the water should look pretty clear).
6. Weigh three different shells (try to get shells of approximately similar weight - you can combine several small shells to get the same weight as fewer larger ones), and record the weight:

Shell(s) n°1: \_\_\_\_\_\_

Shell(s) n°2: \_\_\_\_\_\_

Shell(s) n°3: \_\_\_\_\_\_

1. Put a shell in each cup (be sure to identify which shell was put into which cup).

**pH measurement:**

1. Make hypothesis as to which solutions are more acidic (rank from most acidic to least acidic - you can ignore the solutions you don’t know):

Vinegar: \_\_\_\_\_ Lemon juice: \_\_\_\_\_ Milk: \_\_\_\_\_

Tap water: \_\_\_\_\_ Limewater: \_\_\_\_\_ Baking soda: \_\_\_\_\_

Soapy water: \_\_\_\_\_ Seawater: \_\_\_\_\_ Soda: \_\_\_\_

1. Dip a strip of pH-paper in each solution, including these prepared with the shells.
2. Read off the pH by looking at the colour scale and record it:

Vinegar: \_\_\_\_\_ Lemon juice: \_\_\_\_\_ Milk: \_\_\_\_\_

Tap water: \_\_\_\_\_ Limewater: \_\_\_\_\_ Baking soda: \_\_\_\_\_

Soapy water: \_\_\_\_\_ Seawater: \_\_\_\_\_ Soda: \_\_\_\_

Shell cup 1: \_\_\_\_\_ Shell cup 2: \_\_\_\_\_ Shell cup 3: \_\_\_\_\_

1. Rank the solutions on a pH scale and identify which solutions are “acidic”, which are “neutral”, which are “basic”:

**pH**

**7**

**14**

**0**

1. Add 1 volume of water (with the measuring cup) to the lemon juice solution.
2. Measure the pH using a strip of pH-paper:

Lemon juice (diluted): \_\_\_\_\_

1. Discuss: How does the pH evolve when the solution is diluted? Why? Up to where could it go?

**CO2 dissolution:**

1. Fill a cup half-way with tap water.
2. Measure the pH of tap water using a strip of precise pH-paper:

Tap water: \_\_\_\_\_

1. Following your teacher’s example, bubble air into the tap water with a straw, for 2min. (You can take turns with the members of your group)
2. Re-measure the pH:

After 2min bubbling: \_\_\_\_\_

**Shell experiment:**

1. (To be tested: measure either here, or at the beginning) Measure the pH of the 3 solutions with shells:

Shell cup 1: \_\_\_\_\_ Shell cup 2: \_\_\_\_\_ Shell cup 3: \_\_\_\_\_

1. One cup at a time, take the shells out of the solution, dry them with paper towels and weigh them:

Shell(s) n°1: \_\_\_\_\_\_

Shell(s) n°2: \_\_\_\_\_\_

Shell(s) n°3: \_\_\_\_\_\_

1. Calculate the difference between the current and initial weights:

Shell(s) n°1: \_\_\_\_\_\_

Shell(s) n°2: \_\_\_\_\_\_

Shell(s) n°3: \_\_\_\_\_\_

1. Did you expect this result? Why do you think the shells dissolved?
2. Assuming the reaction continues at the same speed, how long would it take for the shells to disappear in each solution?

Solution n°1: \_\_\_\_\_\_

Solution n°2: \_\_\_\_\_\_

Solution n°3: \_\_\_\_\_\_

**Limewater experiment:**

1. Measure again the pH of your vinegar solution.

Vinegar: \_\_\_\_\_

1. Add 1 volume of limewater (with the measuring cup) to the vinegar.
2. Measure the pH again:

Vinegar plus limewater: \_\_\_\_\_

1. What happened to the pH? Why do you think this happened?