

Why do we care about corals?

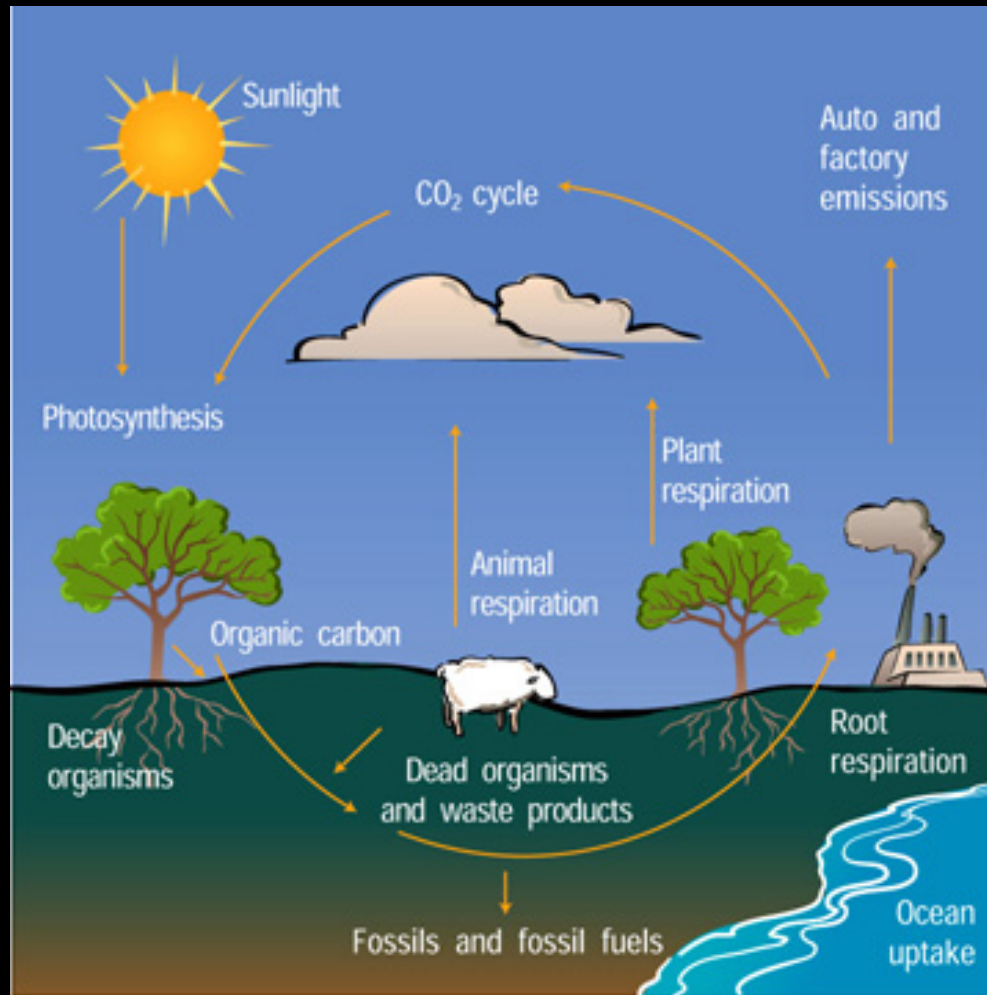
- Habitat
- Barrier for storms
- Economy
- Food
- Medicine
- Recreation
- Cultural Importance

- IN THE NEWS: [MOVIE](#)

US residents say Hawaii's coral reef ecosystems worth \$33.57 billion per year.
(source: NOAA, 2011)



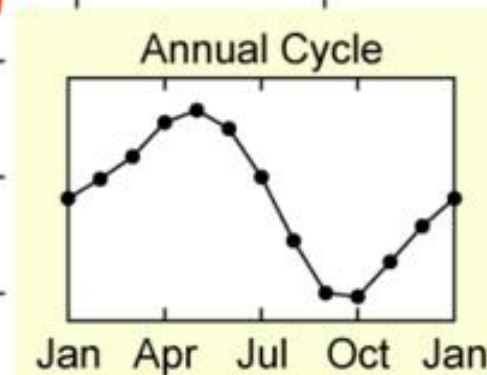
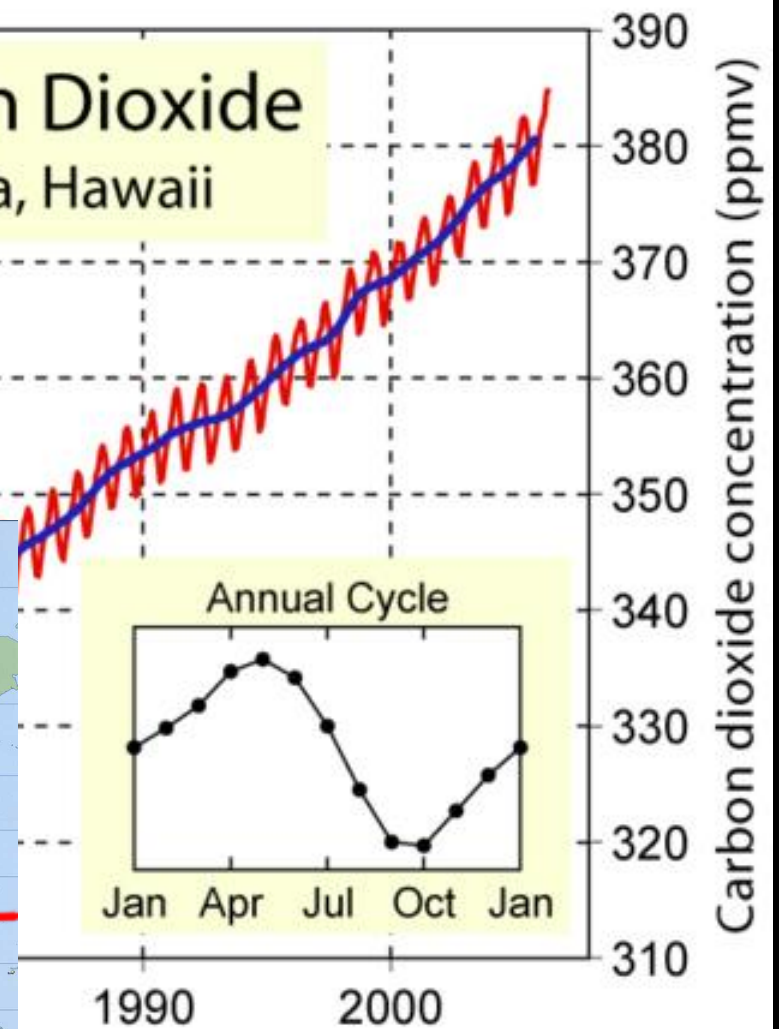
Carbon Cycle



SINKS – take Carbon out of the atmosphere

SOURCES – release Carbon into the atmosphere

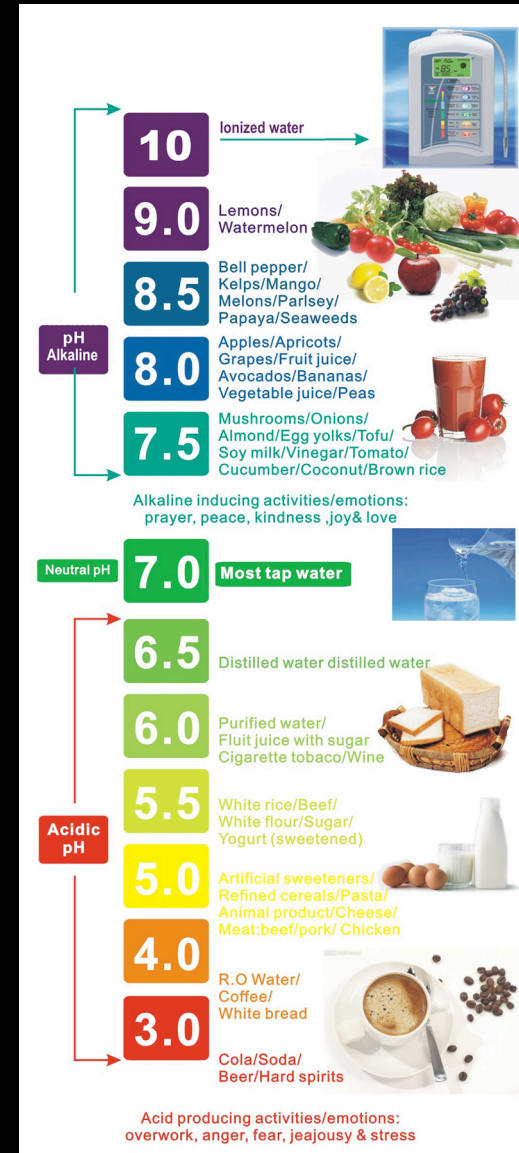
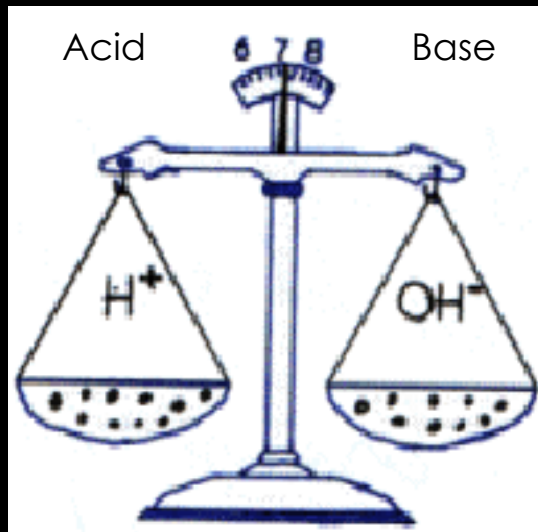
Atmospheric Carbon Dioxide Measured at Mauna Loa, Hawaii



OCEAN ACIDIFICATION RESEARCH ON COCONUT ISLAND

What is pH?

What does it tell you about the solution?

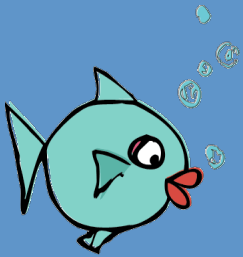


How does CO₂ affect ocean pH?



What causes pH to decrease?

pH decreases
H⁺ ↑



Carbonate: CO₃²⁻

Bicarbonate: HCO₃⁻

Carbonic Acid: H₂CO₃

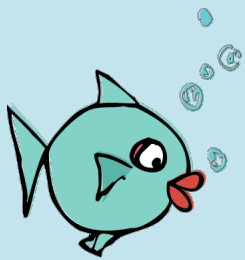
Calcium Carbonate: CaCO₃

HOW DOES CO₂ AFFECT CORALS?

What are coral skeletons made of?



HOW DOES CO₂ AFFECT CORALS?



Why does the coral skeleton dissolve?



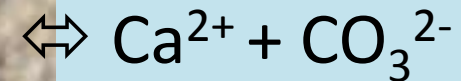
Coral dissolves
Ca²⁺ in water ↑

Carbonate: CO₃²⁻

Bicarbonate: HCO₃⁻

Carbonic Acid: H₂CO₃

Calcium Carbonate: CaCO₃



HYPOTHESIS-TESTING

What is a scientific hypothesis?

- A proposed explanation (i.e., an educated guess) for something you can **observe** and is **testable**.

How do you make a hypothesis?

- Make an “If... then...” sentence.
- If I change VARIABLE X, then I expect RESULT Y.

EXAMPLE: If you increase the water temperature in an aquarium, then the fish will start spawning.

BAD EXAMPLE: If a fish spawns, then it is protecting its territory.

How do you test a hypothesis?

- Test experiment: Only change one variable.
- Control experiment: Don't change any variables.

CLASS ACTIVITIES

- Watch demonstration
- Plan your experiment
 - Must test for Calcium and pH
 - Expose test experiments to CO₂
 - Make a comparative experiment
- Write down your hypothesis and results table
- Get teacher's approval and set up experiment
 - Minimum of 5 grams and 40mL water
- Students test their hypothesis in experiments
- Clean up and Questions

Rice coral:
Montipora capitata



Test species

Lace coral: *Pocillopora damicornis*



Urchin tests:
Tripneustes gratilla



Shell operculums



Finger coral:
Porites compressa



Various shells



Mushroom coral:
Fungia scutaria

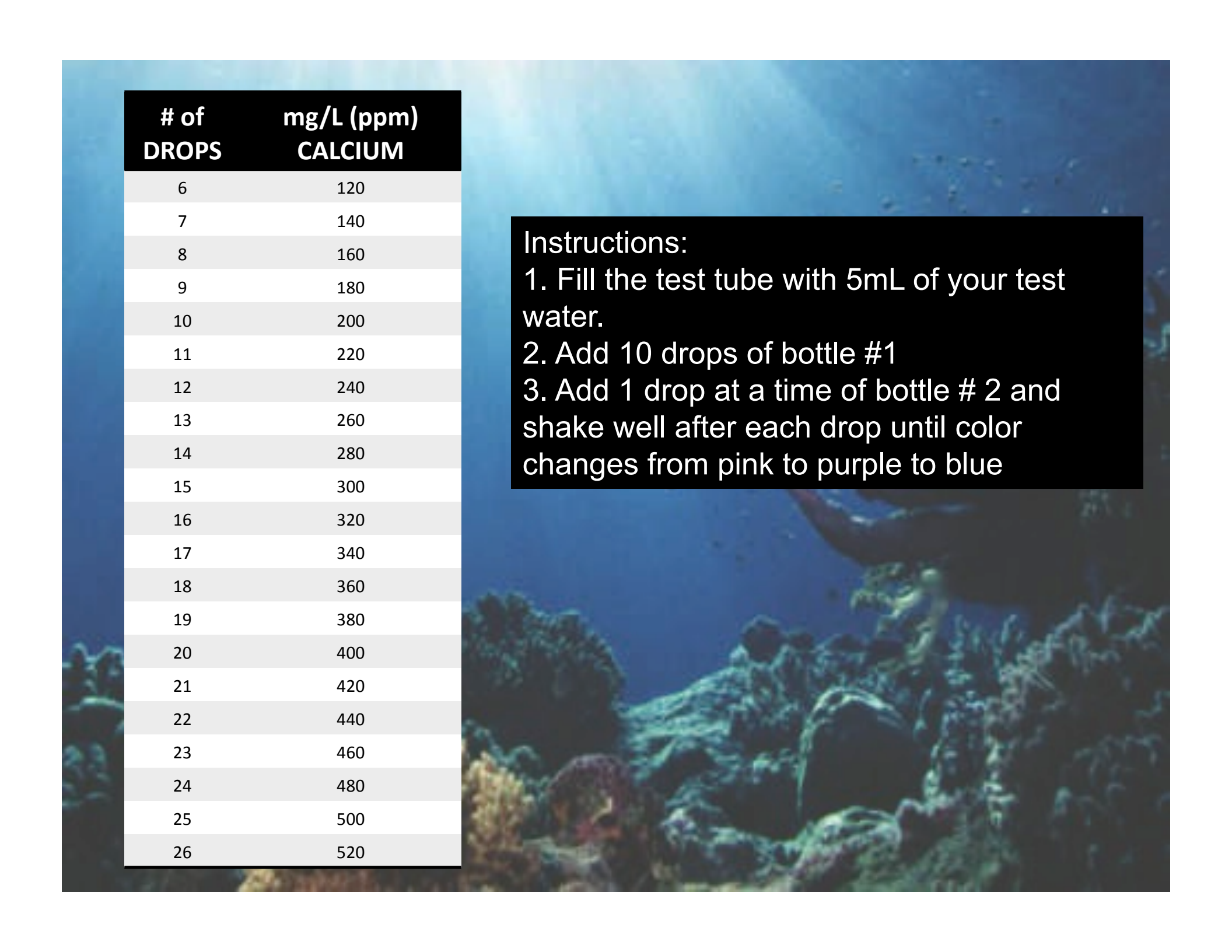
Importance of methods

- Accurate pipetting
- Consistent drops
- New glass tubes
- Interindividual differences → same person per experiment (control/test), 2nd person help count



Guiding questions

- What factors may influence the amount of calcium or carbonate released from the coral skeletons?
- Would the length of time a coral was exposed to acidified water affect the results? How long is long enough to see an effect?
- Does the species of coral matter (i.e., is one species more likely to dissolve or will it dissolve more quickly in acidified seawater than another)?
- Does the morphology of the coral matter?
- What about the pH of the water; if the pH were lowered more than one pH unit, how would that have affected the results?
- Is it important to maintain a constant flow of CO₂ gas during the experiment?
- Is this experiment biologically relevant; meaning is a 1 pH unit drop in seawater even likely in the next 100 years? If not, do you think you would observe similar results with a smaller change in pH? How small?



# of DROPS	mg/L (ppm) CALCIUM
6	120
7	140
8	160
9	180
10	200
11	220
12	240
13	260
14	280
15	300
16	320
17	340
18	360
19	380
20	400
21	420
22	440
23	460
24	480
25	500
26	520

Instructions:

1. Fill the test tube with 5mL of your test water.
2. Add 10 drops of bottle #1
3. Add 1 drop at a time of bottle # 2 and shake well after each drop until color changes from pink to purple to blue

CLEAN UP

- Wash all lab materials in the sinks
 - Clean pipettes by sucking up fresh water twice and rinse the outside.
 - Dump calcium testing waste in waste beaker
- Use sink sponges to wipe down tables, then use blue/yellow rags and cleaner spray
- Sweep floors
- Place chairs on top of table



- Dry corals on paper towels
- Dump water outside on the lawn
- Rinse sensors and probes with distilled water