OUTLINES FOR TEACHING ACTIVITIES

ACTIVITY 1 The disappearing act

Before class:
1. gather the materials and duplicate worksheets.

During class:
1. do the demonstration of adding Koolaid to water after challenging the students to predict the outcome.
2. introduce the words SOLUTION and DISSOLVE.
3. show the students the materials available and challenge them to design their own test to find out which go into solution and how fast; number of times stirred before material disappears is good test.
4. help students while they work in groups.
5. review results; check corn starch later to see if conclusions were valid.

ACTIVITY 2 Water, water everywhere

Before class:
1. prepare aquatic habitat cards; may also make water samples to taste.
2. duplicate flow charts and keys for students.

During class:
1. introduce terms SALT WATER, BRACKISH WATER and FRESH WATER; may include tasting samples of each if there is a clean paper cup for each student.
2. challenge students to discover what kind of habitat they are and distribute habitat cards and flow chart type key.
3. have one student read as all follow on chart to demonstrate use of chart, then let students work on own; check results as they work.
4. trade cards to keep going.
5. repeat process using formal scientific key if desired.
6. review by having students list pairs of characteristics on board.

ACTIVITY 3 Salty or fresh?

Before class:
1. gather materials, mix solutions and duplicate the worksheets.
2. have students practice the use of balances if needed.

During class:
1. challenge the student with the problem: which is heavier, fresh or salt water? Show them the available equipment and have them suggest ways for you to proceed.
2. use unequal volumes and unequal containers to demonstrate unfair tests.
3. let students work in groups to see if they can answer the question you posed; help groups think about ways to work.
4. review results of different groups and have students draw conclusions; introduce the word DENSITY if older students.

ACTIVITY 4 The layered look

Before class:
1. mix the solutions, gather equipment and duplicate worksheets.

During class:
1. define an ESTUARY and challenge the students to predict what might happen when the salt water and fresh water in an estuary meet.
2. demonstrate what might happen by siphoning:
   a. colored salt water into plain fresh water and
   b. plain salt water into colored fresh water.
3. BEWARE: do not let students shake or move surface on which tanks or jars rest.
4. discuss why it was done twice and fair tests.
5. complete worksheet and then do Activity 5.

ACTIVITY 5 Some like it salty some do not!

Before class:
1. same preparation as all of Activity 4; may be done with fish alone if brine shrimp are not available.

During class:
1. show the students the goldfish (or guppies) and the brine shrimp; do the students have any clues to what these animals prefer: salt water or fresh water?
2. challenge the students to predict what the behavior of each kind of animal might be if added to one of the layered systems.
3. put one fish and some of the brine shrimp in each jar or tank and observe behavior; BEWARE: do not bump or shake the tanks.
4. remove the animals.
5. discuss observations.

ACTIVITY 6 The great salinity contest!

Before class:
1. prepare salt solutions; USE KOSHER OR CANNING SALT; distribute them among numbered containers, keeping a written record of which solution went in which jar; one jar gets very salty water and 46 get fresh water; the remaining jars are water of intermediate saltiness.
2. gather equipment and duplicate worksheets.

During class:
1. distribute one unknown solution per student and challenge the students to discover who has the saltiest water and the fresh water.
2. may use any means, but NO TASTING of unknown solutions ever.
3. check results as students work.
4. have them review the techniques they used to come to their conclusions.
5. give prizes in the salt water lottery to the one with saltiest and the several with fresh water.

ACTIVITY 7 Oxygen for life

Before class:
1. prepare water low in dissolved oxygen at home.
2. gather materials and duplicate worksheets.
3. practice dissolved oxygen tests in class.

During class:
1. challenge class to predict where the dissolved oxygen in water comes from.
2. unseal jars and test for dissolved oxygen.
3. pour out one half of the water, put the lid on and shake; open and shake several times; test for dissolved oxygen again after shaking.
4. complete the worksheets and discuss the results.

ACTIVITY 8 Dirty water

Before class:
1. order or collect pond water.
2. prepare aged water and collect materials.
3. duplicate worksheets.

During first class:
1. challenge students to predict what might happen when soil erodes and enters an aquatic environment, in this case a freshwater pond.
2. demonstrate by shaking soil in jar of water.
3. make model ponds:
   a. control with aged tap water and pond water.
   b. aged tap water, pond water and 1 teaspoon of plant fertilizer.
   c. aged tap water, pond water and 1 tablespoon of plant fertilizer.
   d. aged tap water, pond water and water which has been shaken with soil, after the soil has been allowed to settle.
4. place in good light.

Following two weeks:
1. record changes with camera.
2. complete worksheets and discuss.

ACTIVITY 9 What's in the water?

Three weeks before class:
1. order or collect pond water.

Two weeks before class:
1. collect materials and duplicate worksheets.
2. set up jars with aged tap water, 1 teaspoon of plant fertilizer, and pond water.
3. place jars in good light to grow until class when used.

During class:
1. have students list some of the chemicals they use that are disposed of in water and become water pollutants.
2. challenge them to do an experiment to test the effect of some of these chemicals on a miniature aquatic system.
3. add chemicals to three jars from each set, leaving one as the control, and place in good light.

Following week:
1. observe and record changes with a camera.
2. complete worksheets and discuss results.

ACTIVITY 10 A change in the weather?

Before class:
1. gather the materials and duplicate the worksheet.
2. have students practice reading a thermometer if needed.

During class:
1. challenge the students to predict which will change temperature faster: a big body of water, a small body of water or the air?
2. measure the rate of temperature change in a large container of water, a small container of water and a small container of air.
3. complete worksheet and discuss results in relation to aquatic habitats.

ACTIVITY 11 Plants use oxygen?

Before class (both plants and animals):
1. gather the materials and duplicate the worksheets.
2. the day before class, set out water to age.

During class (plants):
1. on the first day, challenge students with the question, "do plants use oxygen?"
2. briefly discuss photosynthesis and respiration; test water in jar for beginning level of dissolved oxygen; add plants to one jar and seal both; place jars in a warm, dark place overnight.
3. on second day remove jars and test for dissolved oxygen; record results; complete worksheets and discuss results.

During class (animals):
1. challenge the students to design a study of oxygen use by an aquatic animal.
2. test water in jar for dissolved oxygen and gently add an animal;
seal jar and allow it to remain undisturbed for about one hr; test for dissolved oxygen; STOP THE TEST IF THE LEVEL FALLS BELOW 4 PPM; otherwise several measurements may be made if surface of water is sealed with oil after first sample is removed.
3. complete worksheet and compare results.

ACTIVITY 12 When the heat is on

Before class:
1. gather materials and duplicate worksheets
2. age tap water 24 hr

During class:
1. on first day, challenge students to predict the effect of temperature on oxygen use in a "cold-blooded" organism.
2. test dissolved oxygen in one jar and add plants to both.
3. put one jar in a warm place and one in an ice chest or refrigerator; both locations must be in the dark.
4. on second day, test the dissolved oxygen in both jars and calculate the difference.
5. complete worksheets and discuss results.

ACTIVITY 13 When the oxygen goes....

Before class:
1. gather materials and duplicate the worksheets.
2. prepare sealed heated and cooled water samples at home.

During class:
1. challenge the students to predict whether temperature might have an effect on dissolved oxygen in water.
2. unseal and test water samples, having explained how each was treated.
3. compare data and complete the worksheets; discuss results.

ACTIVITY 14 When the oxygen is gone

Before class:
1. gather materials and duplicate worksheets.
2. make and seal low oxygen samples at least 12 hrs before so that they are cooled to room temperature by class time.

During class:
1. challenge students to predict how fish might react when put in water with almost no oxygen.
2. unseal water and gently lower fish into jars; count ventilations and/or observe the part of the jar used and other behavior; remove the fish after 5 minutes.
3. complete worksheets and compare results.

ACTIVITY 15 In hot water?

Before class:
1. gather materials and duplicate worksheets
2. just before class, get hot and ice cold water.

During class:
1. challenge class to predict whether water temperature might influence the distribution of the water in an environment; what happens when hot and cold water meet? Is one heavier than the other?
2. compare weights of equal volumes of hot and cold water.
3. carefully layer hot colored water on plain cold water and the reverse to observe what happens.
4. complete worksheets and discuss the results.

ACTIVITY 16 The great anadromous fish game

Before class:
1. duplicate the game board, cards, rules, glossary and worksheets.
2. gather or purchase game pieces and dice.
3. practice math skills with students.

During class:
1. challenge the students to predict some of the problems that ANADROMOUS fish might experience as they swim upstream to spawn and then return to the sea.
2. play game in groups.
3. keep score on worksheet.

Following day:
1. complete worksheet and average class data.
2. discuss results.

ACTIVITY 17 A change in the weather

At beginning of school year:
1. order film.

Before class:
1. duplicate the worksheet.

During class:
1. challenge the students to be observant; can they pick out one animal or plant in the film and follow what happens to it during the seasons?
2. distribute worksheets before the film as an organizer of thought.
3. complete worksheets following film.

ACTIVITY 18 To each its home

Before class:
1. duplicate flow charts and worksheets and make cards.

During class:
1. introduce idea of many places within an aquatic habitat by using pond as an example; key out one of the pond animals as an example.
2. practice use of flow chart with one card and then have students identify the part of an aquatic habitat each group uses on their own, trading cards and filling in the numbers on the key.
3. read correct answers and give examples; use pictures if possible.
4. do language arts worksheet at home or in another session to reinforce concepts.

ACTIVITY 19 Keeping your head above water

Before class:
1. mix the solutions and gather the materials.

During class:
1. challenge the students to do experiments with floating and sinking in fresh water and salt water:
a. if a heavy object sinks in both fresh and salt water, does it displace the same amount of water? Do the displaced fresh and salt water weigh the same?
b. does a floating object displace the same amount of water in fresh and salt water? Do the displaced volumes weigh the same?
c. what happens to the weight of an object that floats as it is lowered into water and weighed with a spring scale?
d. is it possible for an object to sink in fresh water and float in salt water?
e. can the shape of a ball of clay determine whether it sinks or floats? If so, what shapes make a difference and why?

ACTIVITY 20 Sinking slowly

Order movie at beginning of school year.

Before class:
1. gather materials and duplicate worksheet.

During class:
1. introduce PLANKTON and observe plankton in film, photographs, live or preserved, or drawings.
2. challenge the students to design their own plankton that sink slowly using materials provided.
3. students build and test plankton.
4. hold contest to see whose sinks slowest.
5. discuss designs and analyze reasons for success and failure of various models.

ACTIVITY 21 Sink or swim

Be on the lookout for a supply of fish which you can freeze for this class.

Before class:
1. gather materials including fish with guts intact.

During class:
1. do fish printing first if it is to be done.
2. challenge students to discover why a fish is able to stay at the desired level in the water by doing a dissection.
3. discuss safe dissection procedures and allow students to work in groups while you help groups; use worksheets to guide activity.
4. discuss what was seen and review.
5. how does the swim bladder work? Use balloon in dead fish to demonstrate.

ACTIVITY 22 Grace under pressure

Before class:
1. gather materials and duplicate worksheet.

During class:
1. challenge students to predict what happens to water pressure as depth increases.
2. use milk cartons with holes at three depths to illustrate; measure results and test several variables such as carton diameter and hole diameter.
3. test what happens to a balloon as it is forced under water.
4. complete worksheets and discuss observations.

ACTIVITY 23 Life at the surface

Before class:
1. gather materials and duplicate worksheets.

During class:
1. have students fill plastic cups to the rim with water and then see how many marbles (pennies) they can add before it spills over.
2. use above example to explain SURFACE TENSION.
3. challenge the students to make a paper clip sit on surface tension and then use detergent to sink it.
4. using materials provided, challenge the students to design a model animal that sits on surface tension and is heavier than water.
5. have a contest with the models to see who has built the heaviest that will stay up on surface tension.
6. fill in worksheets and discuss.

ACTIVITY 24 At the races

Before field trip:
1. gather materials and duplicate reading and worksheets.
2. have students read Moving through water.

On the field trip:
1. pick fish and identify them; observe their behavior.
2. time fish swimming over measured course and record on worksheet.

In class on another day:
1. complete worksheets and compare results; rank fish with regard to speed and compare shapes and swimming techniques.

ACTIVITY 25 Light to sea by

Before class:
1. gather materials for this demonstration; no worksheets.

During class:
1. challenge students to observe what happens to light when it shines through water in an aquarium under several different sets of conditions:
 a. what happens to the intensity of the light when it shines through the long versus the short dimensions of the aquarium?
b. what happens to the colors in the spectrum when they shine through the long dimension of the aquarium?
c. what happens to light when it shines through muddy or turbid water?
2. discuss observations.

ACTIVITY 26 Hide and seek

Before class:
1. gather materials and photographs.

First class session:
1. make goggles, using at least three layers of cellophane.
2. make red fish, reviewing external anatomy.

Before second session:
1. use tape to hide fish in plain sight in classroom, using a pair of goggles to check for match with background; look for darker colors of same value such as blue, green, brown, gray and black.
2. TURN THE LIGHTS OFF AND PULL SHADES TO DARKEN ROOM.

Second session:
1. meet students outside class and challenge them to be fish that are living in 3040 ft of water off the coast of California, looking for dinner; dinner is the red fish.
2. let students enter and search for fish.
3. stop search and review results; distribute underwater photographs that demonstrate lack of color when artificial lights are not used and discuss.

ACTIVITY 27 A light snack

Before class:
1. gather materials and purchase plants; age tap water; duplicate worksheets.

Day one:
1. place ***Elodea*** in jars with aged tap water and seal; place overnight in warm, completely dark location.
2. introduce PHOTOSYNTHESIS in class discussion.

Day two:
1. open each jar and test level of dissolved oxygen; replace water removed for sample and seal jars again.
2. place one of each pair of jars in bright light and the other in dim light overnight (light should be on all night) for 24 hr.
3. challenge the students to predict which plants will produce more oxygen (have a higher rate of photosynthesis).

Day three:
1. open each jar and test for dissolved oxygen.
2. compare with the level of dissolved oxygen on day two.
3. complete worksheets and discuss.

ACTIVITY 28 Competing for food

Before class:
1. gather materials and duplicate data sheets and worksheets.
2. select safe site.

During class:
1. challenge students to predict the possible consequences for the ZOOPLANKTON population in a pond if the supply of their PHYTOPLANKTON food were limited.
2. to test their predictions, they will be zooplankton competing for food; start with about 2/3 of students for zooplankton as you may want more in the next generation; scatter 10 poker chips or beans per student for pretend phytoplankton and distribute bags to collect food.
3. have students count food; you fill in a data sheet.
4. after one round repeat, having the offspring from one generation as the parents of the next; fill out a new data sheet for each generation.

Follow up class:
1. list number of parents for each generation on the board; complete worksheets and graph population size; discuss results.

ACTIVITY 29 Eating and being eaten

Before class:
1. gather materials and duplicate data sheets; there are no worksheets because students should be allowed to change one rule or ratio at a time; have them record what they do as a class on the data sheets.
2. pick a safe location for this active simulation.

During class:
1. challenge students to test the predator-prey relationships in a pond using themselves as model organisms in the FOOD WEB.
2. in first run assign 1/3 of class to each role, zooplankton (herbivores), small fish (primary carnivores) and big fish (top carnivores); hand out arm bands of different colors for each level.
3. scatter 20 food items (poker chips or beans) for each herbivore in the game each time you run it.
4. small fish must tag zooplankton and large fish must tag small fish in order to get food; tagged player gives up poker chips and sits down.
5. when a player gets enough to eat, he may sit down and not be tagged; herbivores need 10, primary carnivores need 20, and top carnivores need 40.
6. play once and record results; ratios will be out of balance intentionally.
7. now challenge students to change rules to get a system in which some of each level survive; may change numbers, add hiding places or safe spots, have safe times for some. Record results and rules each time.

Follow up class:
1. put results on board and discuss.

ACTIVITY 30 Getting caught

Before class:
1. gather materials and duplicate data sheets.
2. pick safe location for activity.

During class:
1. challenge students to predict what will happen when all of the top carnivores are removed from a pond; then use a simulation to test their predictions.
2. start with balanced system from Activity 29 or use 3/4 herbivores, 1/4 less two primary carnivores and 2 (1 if fewer than 20 students) top carnivores and the same 20 food items per herbivore; food needs are same as in Activity 29; run game and record results.
3. now repeat exact same simulation except that the two (one) top carnivores have been killed by humans; run and record results.

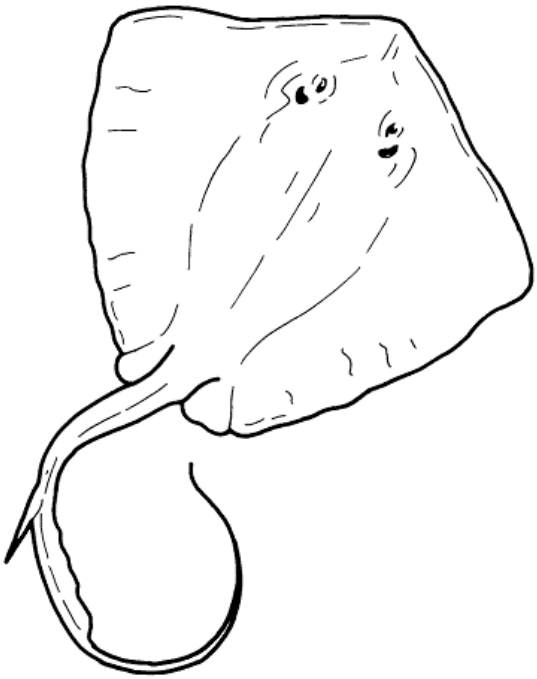
Follow up class:
1. put results on board and discuss.

ACTIVITY 31 Getting to the bottom of things

Before class:
1. gather materials and duplicate worksheets.
2. make model ocean with interesting bottom contours.

During class:
1. challenge students to discover what the bottom of the model ocean is shaped like.
2. working in pairs, use weighted line to measure depth of water at 10 coordinates on the ocean; record results on worksheet and mark out the coordinates tested so that others will not duplicate them.
3. pairs should predict the bottom contours based on their own observations.
4. have students record their results on a master list and compare what they can tell from having many data points with the few they got themselves.
5. drain the ocean and see if their predictions were true.

ACTIVITIES 32-36 are not experimental.



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