Activities To Go

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In every issue of The Science Reflector look for this new section including activities you can use in your classroom tomorrow. If you have activities you would like to share please email the editor.

Acid/Base Indicators - Discover natural acid/base indicators.

Characteristics of Life - An introduction to astrobiology.

Acid/Base Indicators

from The Science House's Countertop Chemistry

Chemists use indicators to test whether a substance is an acid or a base. Indicators work by turning a distinctive color in the presence of an acid or a base. You can make your own indicator from all sorts of materials such as the juice of elderberries, blackberries, radish skins, apple skins, cherries, black tea and even kudzu blossoms. Below are instructions for the tried and true red cabbage juice indicator.

Materials	**Substitutions**
hot plate	
1 head red cabbage	
food processer	knife and cutting board
1000 mL beaker	large size saucepan
500 mL beaker	large jar
4-5 250 mL beakers	4-5 small jars
sieve	tea strainer or collander
substances to test **	
distilled water	
rubbing alcohol	

** recommended materials: baking soda, bathroom cleaner (e.g. Formula 409™), washing soda, vinegar, lemon juice, milk, cream of tartar, orange juice, milk of magnesia, lime, soft drinks, or ammonia

Procedure

1. Chop red cabbage up finely. Boil a pint of water in a saucepan.
2. Add the red cabbage carefully to the boiling water and take the saucepan off the heat. Let it stand for 30 minutes or until it is completely cool.
3. Strain the liquid into a jar and throw away the used cabbage. The liquid should be a dark reddish-purple color. Add rubbing alcohol, or refrigerate, to reduce the spoilage of the indicator. Use a 1 : 5 ratio of alcohol to water.
4. The color will change as you add acids or alkalis. To test a substance, pour a small amount of your substance into a small jar. Then add a drop or two of the cabbage juice indicator. A change in color indicates its acidity or basicity.

* See Teacher's Notes

Colors of Red Cabbage Juice and Different pH values

color red rose purple blue green yellow
pH 1 2 3 4 5 6 7 8 9 10 11 12 13 14
ACID neutral BASE

Data and Observations

Substance	Color	Approximate pH	Acid or Base?
lemon juice			
lime			
washing soda			
ammonia			
cream of tartar			
muriatic acid			
Formula 409™			
baking soda			
vinegar			
Sprite™			

Extensions

Soak some filter paper in the cabbage juice indicator. Allow the paper to dry, then cut it into strips. Conduct an "at home" pH test of other household items. Tape your strips to a piece of notebook paper and bring them back to class. Compile your results. What can you say about household cleaners? Where are most household acids found?

How about other natural indicators? Are some better for acids or bases? Which has the greatest range? Which is most consistant?

Teacher's Notes

1. Lemons, vinegar, cream of tartar (potassium acid tartrate), orange juice, and sour milk will be acidic solutions.
2. Pure distilled water is the only substance listed that should be neutral.
3. Tap water may be slightly acidic—owing to dissolved carbon dioxide. Baking soda is a weak base.
4. The strong bases will be bathroom cleaners, ammonia, washing soda, milk of magnesia, and lime.
5. The indicator can be frozen in ice trays and saved for use. The indicator mixed with alcohol will last for months! The strips can be refrigerated and will also last for months.

*An alternate source of cabbage juice is to purchase a can or jar of cabbage, drain off the juice, and discard the cabbage.

Disposal

All solutions can be poured down the sink. Solid bits of cabbage should be put into a solid waste container (and emptied at the end of the school day—owing to their odiferous nature.)

Characteristics of Life

from Astrobiology Activities by Judy Thibodeaux, Kenan Fellow

This activity would be a great introduction to the study of astrobiology to accompany the NASA competition "Packing up for the Moon" or the Plant Growth Chamber Challenge for middle and high school students.

Place students in small groups and have them brainstorm the characteristics by which living things on earth are recognized. Have them create a written list of their ideas. They may need some suggestions to prompt critical thinking about this list.

Their lists should include some of the following concepts:

Living things:
have carbon-based chemistry
have a membrane or wall that creates an internal environment
use energy
require liquid water
require nutrition
extract energy from the environment
consume raw materials
produce wastes
exhibit some type of growth, cell division, reproduction or replication

Distribute a hand lens and one pair of objects to each small group. Have students examine the objects and list the characteristics that tell them which objects are alive and which are not. With the following pairs, students will know which one is alive, yet articulating how they know this can be very challenging.

live flower and a similar kind of silk, paper, or plastic flower
live leaf and a similar kind of silk, paper or plastic leaf
live tree leaf and a dead tree leaf of the same kind
live grass and dead grass of the same kind
a live insect and a plastic insect from a toy store
a live earthworm and a gummy worm candy
a live ant in a container and a picture of an ant

Student Activity Guide

1. Obtain a pair of objects from your teacher. Examine them and write down the characteristics you observe associated with life.
2. Repeat Step 1 with a new pair of objects.
3. In your group develop a common set of characteristics that can be used to identify life.
4. Write down an example of a carefully worded question that helped identify characteristics that are fundamental to life.
5. Write down an example of a poorly worded question that led to a misleading answer which really did not help identify characteristics that are fundamental to life.
6. In your group develop a common set of characteristics that can be used to identify life. This task is similar to what you did in Question 3, but since then, you have thought about it more and your list could be quite different.

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