Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

The Recipe for Life

Lesson plan for grades 6-8
Length of lesson: 90 minutes
Authored by: Lindsey Sydow and Megan Franks, Jackson School of Geosciences, University of Texas
Adapted by: Louisa Torrance, Environmental Science Institute 04/25/12

ADDITIONAL SOURCES AND RESOURCES:

- Dallas Zoological Society Partnership: "The Ingredients of Life"
  http://www.weblessons.com/Teacher/guide.php?lessonID=625&dallaszoo
- Teacher's Domain video: "Ingredients for Life: Water"
  http://www.teachersdomain.org/resource/ess05.sci.ess.eiu.water/
- ESA Human Spaceflight DVD: "Ingredients for Life"
  http://www.esa.int/esaHS/SEMWRPRJR4G_education_0.html

POTENTIAL CONCEPTS TEKS ADDRESSED THROUGH THIS LESSON:

§112.18 - §112.20; Science Grade 6, 7, 8: 2A-E, 3A, 4A, 10A, 13A-B

PERFORMANCE OBJECTIVES:

Students will be able to:

- Identify and define biotic components of our world
- Recognize a chemical reaction
- Test the limitations of life

MATERIALS (per group of four):

- Supplementary PowerPoint
- Student Handout
- active dry yeast
- small bowls or small paper cups
- spoons or other stirring objects
- measuring cups and spoons
- stopwatch
- small cooler of ice
- hot plate
- beaker
- milk
- sugar
- honey
- salt

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

- vinegar
- oil
- coke
- alcohol
- corn syrup

CONCEPTS:

Finding the optimal conditions and requirements for seed germination

Understanding that life requires nutrients for respiration and metabolism

Identifying what is necessary for life (nutrients, sunlight, oxygen, etc)

BACKGROUND:

Life requires nutrients for respiration and metabolism (e.g., energy and growth material). Metabolism is the chemical processes that occur within a living organism in order to maintain life. Student groups will design recipes they think will be most effective for activating spores based on their knowledge of (1) what life requires, and (2) the limits of life. They will test 4 recipes and record the rate and quality of yeast respiration (worksheet).

Things to emphasize: 1. Make hypotheses based on previous knowledge/assumptions, 2. Limit the number of variables in your experiments, so that hypotheses can be reasonably supported/disproven

Example experiment: ½ cup liquid used in all recipes, same temperature liquid in all recipes, same volume of sugar used in all recipes. Variables: 1 recipe just water, 1 recipe salt water, 1 recipe milk, 1 recipe salt milk.

PREPARATION:

Have yeast demonstration ready before class. Keep all lab materials off of student tables until instructions and lab safety rules have been explained.

ENGAGE:

Begin with an introduction asking what life requires. Use supplementary power point with notes. Take yeast, and show students what happens when the yeast is combined with sugar and warm water. Lead a discussion as to how students know the yeast is alive, e.g. can see the yeast metabolizing/respiring.

Ask: Why do we need oxygen? Water? Food? What things are necessary for life in other organisms such as slugs, bacteria, or plants? How much of each nutrient does it need? Does all life have the same requirements? If not how are they different? After showing yeast interacting with sugar and water, ask which substance was more important in activating the yeast: The water or the sugar? If wanted, the teacher may do a second experiment (e.g., warm water with no sugar added) to see if the yeast is still able to grow.

Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

Note to teachers: Make sure students are writing down their ideas.

EXPLORE:

Break students up into groups of 2-3 and give each group 2 tbsp of dry active yeast. Do not tell students what it is. Then in each group:

1. Divide your spores evenly into 4 groups.
2. Design 4 recipes to test with your spores—Record the amounts of each ingredient you add.
    a. The volume of liquid should be constant: ½ cup
    b. Make sure you are only changing 1 variable per experiment!
    c. Fill in the table below with all information except "time to metabolize" before starting your experiments.
3. Answer Thought Question #1 BEFORE you begin the next step
4. Inoculate each environment with the spores you divided up earlier and start the timer. Do each experiment separately and watch for at least 5 minutes for metabolism
5. Record the time that you start to see signs of life in each of your environments—take notes on anything you observe (eg, if one recipe causes a more vigorous reaction, if the reaction continues for the whole 5 minutes, etc).
6. Share data with other groups and create a class time line showing how quickly certain recipes react with your spores.
7. Use your data and class data to answer the thought questions.

Sample	Mystery Ingredient(s)	Amount	Liquid Temperature	Time to Metabolize	Notes
1					
2					
3					

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

4					

Thought Question:

1. Make a hypothesis about how each of your 4 environments will impact growth/metabolism.
    a.

    b.

    c.

    d.

EXPLAIN :

- How could you tell when the spores became active?
- Describe why activation occurs. What is this process called?

ELABORATE:

- How did your results compare to your hypotheses? Describe the time and quality of each reaction, or lack of reaction.
- Considering the results from the whole class, which recipe do you think was the most effective? Why?

EVALUATE:

Have students create a lab report explaining their findings.

Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

The Recipe for Life - Student Handout

Instructions:

1. Divide your spores evenly into 4 groups
2. Design 4 recipes to test with your spores—Record the amounts of each ingredient you add.
    a. The volume of liquid should be constant: ½ cup
    b. Make sure you are only changing 1 variable per experiment!
    c. Fill in the table below with all information except "time to metabolize" before starting your experiments.
3. Answer Thought Question #1 BEFORE you begin the next step
4. Inoculate each environment with the spores you divided up earlier and start the timer. Do each experiment separately and watch for at least 5 minutes for metabolism
5. Record the time that you start to see signs of life in each of your environments—take notes on anything you observe (eg, if one recipe causes a more vigorous reaction, if the reaction continues for the whole 5 minutes, etc).
6. Share data with other groups and create a class time line showing how quickly certain recipes react with your spores.
7. Use your data and class data to answer the thought questions.

Sample	Mystery Ingredient(s)	Amount	Liquid Temperature	Time to Metabolize	Notes
1					
2					
3					
4					

Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

Thought Questions:

1. Make a hypothesis about how ***each*** of your 4 environments will impact growth/metabolism.
   a.

   b.

   c.

   d.

2. How could you tell when the spores became active?

3. Describe why this occurs. What is this process called?

1 University Station C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

4. How did your results compare to your hypotheses? Describe the time and quality of each reaction, or lack of reaction. Also, for each, state why you think you got these results.
    a.

    b.

    c.

    d.

5. Considering the results from the whole class, which recipe do you think was the most effective? Why?