TEKS-Based Activity for Grade 8

Are Seeds in Danger?

Description:

In this activity, students investigate the effect of everyday household chemicals on the growth of plants by observing germination rates of pinto bean seeds.

Note: Radish seeds may be substituted.

Correlation to Texas Essential Knowledge and Skills:

During this activity, students will be exposed to the following Texas Essential Knowledge and Skills:

Note: Some TEKS statements below end with a *;* or *and* and nothing thereafter—this indicates that further TEKS statements follow but are not included here.

(8.14) Science concepts. The student knows that natural events and human activities can alter Earth systems. The student is expected to:

(B) analyze how natural or human events may have contributed to the extinction of some species; and

Note: The TEKS listed here are the main content TEKS for this activity; however, this activity may also cover additional content and process skills included in other TEKS.

Time Frame:

3 lessons (45 minutes each)

Materials:

8-ounce cups (2 per student group)
Waterproof marker (1 per student group)
Pinto been seeds (40 per student group)
Paper towels (one sheet per 5-ounce cup)
Sandwich-sized plastic zipper bags (2 per student group)
Common household chemicals such as dish or laundry detergent, pine-scented bathroom cleaner, motor oil, or plant fertilizer (one small bottle or container of each of these)
Water for dilutions and moistening the paper towels and seeds
16-ounce plastic cups (1 per chemical being tested)
Safety goggles (1 per student)
Laboratory aprons (1 per student)

Advance Preparation:

1. Once groups have selected the household chemicals they plan to test, collect or purchase the needed supplies. Dilute each chemical to a 1:2 ratio by

adding 50 mL of the chemical to 100 mL of water. Place the diluted chemical in clearly labeled 10-ounce plastic cups.

2. The items listed in the materials list should be available to students as they design their plans for testing the chemicals.

Note: Do not allow students to bring chemicals from home.

SAFETY: The teacher needs to control the types of chemicals used and the containers in which they are stored/transported. Do not allow students to mix any of the chemicals with anything but water! Common household chemicals, including bleach and ammonia, can become deadly when mixed. Students must wear safety goggles and lab aprons throughout this activity.

Procedures:

1. Ask students the following questions about common household chemicals (including kitchen, laundry, and gardening supplies) we use in our daily lives and dispose of in our municipal/city/well water systems.

   - Why do we use these items?
   - What are the benefits we gain from their use?
   - What disadvantages would we encounter if we stopped using them?
   - How do we dispose of them once they have been used?
   - What impact, if any, do you think these common household chemicals have on the environment?
   - What impact, if any, do you think these common household chemicals have on plant germination?
   - How might plants come into contact with these chemicals?

Note: Some students may be unaware that items commonly found in the home are chemicals. *Chemical* tends to be a word students reserve for items in a classroom laboratory, not those encountered in their daily lives.

2. Student groups select the household chemical(s) to test for impact on plant germination and get the chemical approved by the teacher and placed on the supply list. At least two groups should test each chemical to enhance reliability.

Note: You can allow groups to test more than one chemical. Let student interest be the guide.

3. Allow groups sufficient time to decide how they want to set up seed germination. Seeds wrapped in moist paper towels and placed inside the plastic zipper bags might be one way to set up the initial stage of seed germination.

4. Groups design their plan for testing the impact of the chemicals on germination rates and a data table for recording their results. Each group receives 40 pinto bean seeds to use. Groups should predict and record the number of bean seeds that will germinate for each test. Remind students of appropriate experimental requirements such as clear labels on containers, the need for controlled variables, and detailed data collection and recording. Remind students that mixing two chemicals results in two manipulated variables and invalidates the results. Mixing chemicals can also be dangerous. Continue to remind any groups that forget about the value of a control during scientific research.

Note: Be sure students understand they are using bean seeds as a model for other plants that can be found in various natural environments.

5. Have groups construct and then discuss a graph of their predictions for germination. Which chemical did they expect to have the least effect? Why? Which was expected to have the greatest effect? Why?

6. Groups collect and record data on the appearance and number of seeds that germinate over a set period of time, such as five days. Groups should graph their individual results.

Note: If students construct a graph of actual numbers of seeds germinated, ask them if the graph allows for a meaningful comparison of the results. For example, if one test had 5 of 10 seeds germinate and another had 15 of 30 seeds germinate then these results represent the same ratio, although the actual number of germinated seeds may be different.

7. The class should construct a graph displaying all the groups' results. The graph should show the percentage of seeds that germinated for each chemical tested and for the controls.

8. As a class, discuss each group's investigation based on the following questions and using the graph with the compiled class data.

    - How did the predictions for germination compare to the actual results? [*Answers will vary.*]

    - Under what conditions did the seeds show the greatest amount of germination? [*Answers will vary.*]

    - Explain why groups testing the same chemical may have gotten different results. [*Some seeds might not be viable; some groups kept their seeds in different places; some groups moistened the paper towels differently than others did, etc.*]

    - Compare the results for the control seeds with two other groups' control data. Are the results the same? If so, why? If not, why not? [*Results are probably not the same because of variations in growth conditions or initial condition of the seeds.*]

- Were there any surprises in your results? What were they? Why was this a surprise for you? [*Answers will vary*.]

- How are the chemicals we tested normally disposed of after use in a home? [*They go down the drain and eventually end up at the water treatment plants; they can also get into the water treatment system as runoff from yards and driveways*.]

- What are the implications for us if we do not want these chemicals to become a problem? [*We need to dispose of chemicals in a responsible manner; water treatment must remove or neutralize any chemicals in the water system; we must not use chemicals that the water treatment plant cannot remove or neutralize; we need to control/limit the amount of chemicals, such as fertilizers, that we use.*]

- Do you think this concern is being addressed? Why? What is your evidence to support your answer? [*Answers will vary*.]

- Why is it important to protect plants living in or near water from pollution? [*So they can complete their life cycle in a normal pattern so they will not die, be damaged, or mutate.*]