Activity 1: Pea Seed Growth Preparation

In Activity 1, students will “plant” pea seeds in a system where they can observe seed germination and the growth of the seedlings. This setup enables students to observe the growth of the young seedling in a way that is not possible for seeds planted in soil. For example, students can see that the root emerges from the seed first and grows downward, and that the stem emerges later, grows upward and is green. In Activity 2, students have the opportunity to make close observations of the roots of a seedling using a hand lens. However, handling the seedlings damages them and they will not continue growing. The two activities compliment each other—in Activity 1, students can easily see continuing growth and in Activity 2, students can observe in close-up detail.
Each student will prepare a cup with 2-3 pea seeds.
Familiarize yourself with the following procedure before beginning this activity. To grow the seeds,

1. Roll up a paper towel and insert into a clear plastic cup (or glass). A cup that has fairly straight sides (not too much flare at the top) is best. Tri-fold paper towels (the kind in many dispensers) work well for this, but any paper towel can be used. If using paper towels off a roll, fold them in half so they are a bit thicker and stiffer than a single layer and so they don’t extend too far up above the rim of the cup.

2. After inserting the rolled-up paper towel into the cup, let it expand so that it lies against the walls of the cup. Use a spray bottle to moisten the paper towel.

3. Students can insert 2 or 3 pea seeds between the paper towel and wall of the cup. The seeds should be placed evenly around the cup. The seeds should be about 1/3 of the way from the bottom of the cup. It may be helpful to use the eraser end of a pencil to push the seeds down to the correct position. The moistened paper towel will hold the seeds in place.

4. After the seeds are in place, add water to the cup. The seeds should not be submerged in water—the paper towel will wick water to keep the seeds moist.

5. You will need to add water periodically so that the paper towel and seeds do not dry out.

Use your judgment as to the most appropriate way to involve your students in this setup. If you feel that it would take an excessive amount of class time for each student to do all of the set up, you can put the paper towels in the cups and moisten the paper towels ahead of time. Then students can add the seeds themselves.
**Activity 2:**

**Seedling Preparation**

In Step 4, students are asked to observe the root systems of young seedlings. For this activity, any type of seeds may be used so long as the roots have grown about 1 or 2 cm. Peas are easy to obtain and work well. Pinto beans are also a good choice. To germinate the seeds, place several seeds in a row along one side of a paper towel as shown in the photos that follow. Carefully roll up the paper towel from the bottom to top. Place the rolled paper towel into a glass of water so that the seeds are at the top and out of the water glass. Water will wick up through the paper towel and keep the seeds moist. Prepare enough seedlings so that each group of four students will have a seed to observe. Assume that just half of the seeds you prepare will germinate. Set the glasses of seedlings in a location where they will not be disturbed. The seeds will need approximately four to six days for the roots to grow enough for observation. During the germination period, be careful to replace any water that is lost through evaporation.
Preparation

a. Seeds are rolled up in a paper towel.

b. Seeds are placed into a glass of water.
ACTIVITY 3:
CELERY INVESTIGATION

Use a sharp knife to cut celery stalks into pieces approximately two inches long. Make sure that the cut surfaces are flat and will allow the celery to rest upright when placed into the paper cups. Pour food coloring into the cups to minimize the amount of food coloring that students have to handle.

NOTE TO TEACHERS: The celery demonstration described in this section is designed to show how water is transported quickly. For a more impressive demonstration, you can have carnations take up colored water and see the edges of the petals take on the color of the dye. While more dramatic than the celery demonstration, it takes much longer to see the effect; about two to three hours, as compared with 15 to 20 minutes for the celery demonstration.
OPTIONAL EXTENSION ACTIVITY:
CARNATION DEMONSTRATION

1. Obtain a white carnation and cut the stem diagonally so that the stem is about 6 inches long.
2. Add about 2 inches of water to a paper cup.
3. Add 6 drops of food coloring (blue works well) to the water and mix.
4. Place the carnation into the colored water.
5. Within 2 hours, small colored areas will appear at the edges of the petals.

a. Demonstration with celery  
b. Demonstration with carnation