



Classroom Activity: Student Guide: How Does Gravity Affect Root Growth?

How do plants respond to gravity? See how gravity affects the growth of plant roots using some seeds, plastic bags, paper towels, and a large cardboard box or dark closet.

Useful Vocabulary

- **Gravity:** A force that pulls everything on Earth toward the center of the planet. All physical objects have gravity, and heavier objects have a greater gravitational force.
- **Gravitropism:** When the direction that an organism grows in is in response to gravity. This is also called geotropism.
- **Statocytes:** Special cells in the roots of plants that tell the rest of the root the direction of gravity.
- **Statoliths:** Small bodies in the statocyte cells that tell the statocytes the direction of gravity. The statoliths sink to the bottom of the cells in response to gravity. By sensing where the statoliths touch them, the cells "know" which way is down.

Materials

To do this activity you will need:

- Plastic ziplock sandwich bags with damp paper towels inside (3)
- Radish, tomato, basil, or thyme seeds (15)
- Push pins (3) or strong tape
- Permanent pen (1) or a pen and tape
- Large lightproof cardboard box or closet

Directions

Day 1

1. Open each plastic ziplock sandwich bag and carefully open the damp paper towels inside the bag so that two layers of paper towel are on either side of the bag. Open the damp paper towels a little more than halfway.
2. Put five seeds near the middle of each open bag. Evenly space the seeds from each other and do not put any seeds close to the sides of the bag. Why do you think it is important that the seeds are not close to the sides of the bag?



Figure 1. Put five seeds in the middle of each bag. The seeds should be evenly spaced from each other and not close to the sides of the bag.

3. Carefully zip each bag closed. Leave a little air in each bag or gently blow a little air in each bag before closing it.
4. Hold each bag up to a light. Look at the middle of the bag and make sure the seeds are still there.
5. Carefully use the strong tape or push pins to attach two of the seed bags to a vertical empty wall in a dark closet or a vertical side in a lightproof cardboard box. To secure the bags, use the area above each bag's zipper. Make sure the "Up" label is at the top.
6. Take the third seed bag and find a flat surface in the closet or cardboard box and lay it flat there. Use push pins or tape to secure it in place.
7. With the marker (or a pen and tape), label the bags. Write a "V" on one of the vertical bags for "vertical." Write an "R" on the other vertical bag for "rotate." On the bag that is lying flat, write an "H" for "horizontal." What direction do you think the roots will grow in in the "V" bag? What about in the "H" bag?



Figure 2. Carefully secure two bags on a vertical surface and the third bag on a horizontal surface, all either in a lightproof cardboard box or in a dark closet. Make sure "Up" is at the top. Label one vertical bag "V" and one "R" (for rotate), and label the horizontal bag "H."

8. Close the box or closet and make sure that no light can get in.
9. You will be rotating the "R" bag 90 degrees clockwise every two days, starting on day 3. How do you think this will affect the direction the roots grow in?

Day 3 and 5

10. Two days after you put the seeds in the bags (day 3), and then four days after (day 5), carefully remove each bag from the box or closet, one at a time. Do not rip tape off the bags, as it might tear them.
11. Briefly hold the bags up to a light to look at the seeds. For each bag, write down your observations. How many seeds sprouted in each bag? In what direction are the roots growing in each bag?
12. If you see excess water at the bottom of the bag, carefully open it and pour out the water out.
13. Make sure each bag has some air in it and then zip it closed.
14. Put each bag back in its original location. Use new tape to secure the bags, if needed. When putting the "R" bag back, rotate it 90 degrees clockwise. (For example, if the "Up" label was previously at the top, rotate it so that the "Up" label is now on the right and the "Left" label is now at the top.)

Day 7

15. Six days after you put the seeds in the bags, carefully remove each bag from the box or closet.
16. Hold the bags up to a light to look at the seedlings. For each bag, write down your observations. Did the direction of the roots change since the previous days?
17. Carefully open each bag and take out the paper towel with the seeds in it. Make sure to keep the paper towel oriented the same as it was inside the bag.
18. Gently open the paper towels to expose the sprouted seeds. Try not to break the fragile roots or stems.
19. For each bag, write down your observations. What direction, or directions, are the roots growing in each bag? Did the roots of the seedlings in the rotated bag grow in the direction of gravity as it changed? Did the roots of the seedlings in the horizontal bag grow slower than the ones that could grow down in the vertical bag?

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