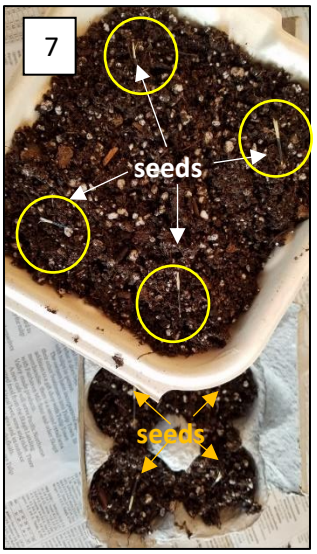
LET'S START NOW! SOW SOME SEEDS FOR A BETTER WORLD!
(THIS IS ALSO A GREENHOUSE EXPERIMENT)

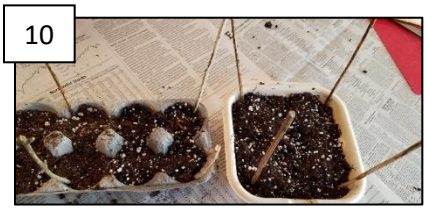
MATERIALS:

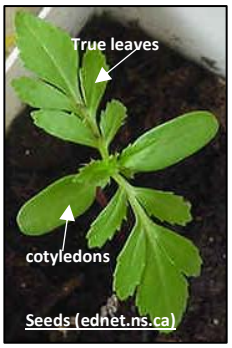
- "Take-out" or egg carton made out of paper pulp
- Nail or something to poke holes in the carton
- Four 5-inch sticks, toothpicks, chopsticks, or skewers
- Seeds (photographs are French marigolds, *Tagetes patula*)—odd looking seeds—like porcupine quills
- Seeds starting mix (This is fluffier than regular potting mix and easier for seeds to germinate—sprout.)
- Water
- Plastic produce bag from the grocery store, or other clear, lightweight plastic bag
- Twist tie, string, or yarn
- Spray bottle optional

DIRECTIONS: *Numbers on pictures match a direction.*

1. Cut the carton in half. (If you use egg carton, cut off the lid. You can only use the "dimple" side. (dimple = where eggs sit) If you use the take-out carton, you can use both halves.)
2. Poke a hole in 4 corners of the carton, or a hole in each dimple.
3. Place soil in an old container or bucket.
4. Add little bits of water to the soil and mix it up, until it feels like a damp sponge. If clumps in the soil don't squish apart, remove them. Remove small sticks too.
5. Place the soil into both sides of the take-out carton, or into the dimples of the egg carton.
6. GENTLY press down the soil and smooth it out.
7. Follow directions on the seed packet. For our marigolds lay 1 seed down on top of the soil, in the corners of each take-out carton—4 seeds total, or 1 seed into each dimple.
8. Sprinkle about 1/8-inch of soil over the seeds.
9. Squirt or gently drip water over the sprinkled soil. Feel the weight of the cartons. This will help you know when it's time to water later on.
10. **Now the experiment part**: Put sticks into the corners of ONE take out container. Or put sticks in the corner of the rectangle around 6 dimples.
11. Carefully cover the part of the carton with the sticks with the plastic to make a "greenhouse." If you poke holes in the bag, start over with another bag. Tie the end of the bag closed.
12. Place the cartons on a plate or cookie sheet (to catch water) and put them in a sunny, warm window.
13. The soil just needs to stay damp, so spray water *ON THE SOIL* or drip water *ON THE SOIL* several times a day on the NON-greenhouse side of the carton. (If you spray the leaves, they could grow mold/mildew.)
14. Spray or water the covered side whenever you don't see condensation (drips of water) on the plastic, or when the carton seems too light in weight.
15. Watch for the seedling's first "true leaves." These are NOT the first leaf-like things to poke through the soil. Those are called *cotyledons* or seed leaves. True leaves sprout AFTER the cotyledons and look very different. See the picture.

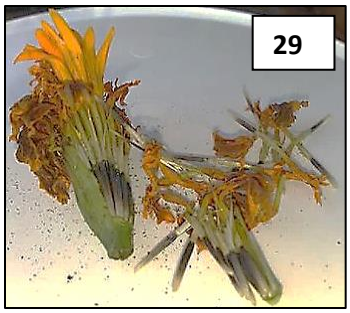






16. Rotate (turn) the carton every day, so that seedlings don't lean toward the light. You want your seedlings to be tall and straight. This leaning is called *phototropism,* a very cool phenomenon!!!
17. When seedlings get tall enough to touch the plastic, remove the bag.
18. **Back to the Experiment**: Have you noticed any difference between the seedlings in the "greenhouse" and the ones exposed to air? If there is, can you think of a reason why? What would happen if you left the bagged carton in the hot sun? Hmmm? Would the bag create its own **greenhouse effect**, hot enough to harm the plant?
19. Check this website to find out when your city can expect to have frost-free weather (weather above 32°F). Washington Interactive Average Last Frost Date Map (plantmaps.com) Woodinville's average last frost date is between April 11th and 20th. Most annual flowers don't like cold weather, or cold soil, though, so plan to plant them outside probably sometime in May. Lot's of people think Mother's Day is just right.
20. When your seedlings reach 3-inches tall, AND have 3 sets of true leaves, AND when weather warms up and danger of frost has passed, you can plant your seedlings outside.
21. But first get them used to Sun—toughened up. Gardeners call this "harden-off." Take your cartons outside into the sun a little bit each day for week. Start with an hour the 1st day, and add one hour on each of the following days, so that at the end of the week, they will be ready to be planted. Remember to water, water, water!

22. While hardening off seedling, prepare the soil in the ground or pot by loosening it up. Dig down 4 inches and 4 inches wide for each seedling. Break up dirt clods, remove sticks and rocks.
23. When it's time to plant, dig a hole in the soil you loosened up. Set the dirt you dig off to the side. You will use it in step 25.
24. After the soil is loosened and hole is dug, use a spoon to gently lift the seedling out of the carton, being careful not to tear the roots.
25. Place the seedling's root ball into the hole (roots surrounded with dirt). Make sure the leafy part is above the ground. Cover the root ball with soil to the same level as it was in the carton, and pat it into place.
26. Gently water the soil near the plant until it is moist but not flooded. Check on your seedlings often to protect from slugs and bunnies. See hortsense.cahnrs.wsu.edu/Search/MainMenuWithFactSheet.aspx?CategoryId=5&PlantDefId=56&ProblemId=294



27. Continue to water the soil gently every day until the plant is sturdy and growing new leaves, especially if it is hot. After a while you can water less because marigolds don't require lots of water, but don't let the plant wilt.
28. After your plant starts to flower, snip off the wilted flowers. Doing this tells the plant to make more flowers.
29. If you want to "harvest" (collect) seeds, you can use the snipped off wilted flowers (marigolds shown). Just peel open the bottom "shell" beneath the petals to expose the small thin, pointy seeds. Scatter these on paper towel indoors to dry. Once dry, put the seeds into an envelope or glass jar and keep them in a cool dry place, like a refrigerator, until next spring, when you can plant them.

NEXT GENERATION SCIENCE STANDARDS TOUCHED ON IN THIS LESSON (NGSS)

Disciplinary Core Ideas

LS1.A: Plants have internal and external structures that serve various functions in growth, survival, and reproduction.
LS1.C: Plants acquire their material for growth chiefly from air and water.
LS2.A: Organisms can survive only in environments in which their particular needs are met.
LS2.B: Matter cycles between the air and soil and among plants, animals as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid or solid) back into the environment.
LS2.C: When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment and some die.
PS1.A: Matter of any type can be subdivided into particles that are too small to see, but even then matter still exists and can be detected by other means. A model shows that gases are made from matter particles that are too small to see. Observations include the inflation and shape of a balloon.
PS1.B: When two or more different substances are mixed, a new substance with different properties may be formed.
PS3.B: Energy is present whenever there are moving objects, sound, light, or heat. Some energy is transferred to the surrounding air, as air gets heated.
ESS1.C: Local, regional, and global patterns of rock formations reveal changes over time due to Earth's forces. The presence and location of certain fossil types indicate the order in which rock layers were formed.
ESS2. A: Earth's major systems are the geosphere (rock), the hydrosphere (water/ice), the atmosphere (air), and the biosphere (living things). These systems interact in multiple ways to affect Earth's surface materials and processes. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
ESS2.D: Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.
ETS1.B: Designs can be conveyed through sketches, drawings, or physical models. These are useful in communicating ideas.

Crosscutting Concepts

*Similarities and differences in patterns can be used to analyze simple rates of change for natural phenomena.
*Patterns can be used as evidence to support an explanation.
*Cause and effect relationships are routinely identified, tested, and used to explain change.
*Standard units are used to measure and describe physical quantities such as weight, time, temperature, distance, and volume.
*A system is a group of related parts that make up a whole.
*Matter is made of particles.
*Matter flows and cycles; can be tracked.
*Change is measured in terms of differences over time.