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Plant Germination

Grade Level	7th
Subject Areas	Plants, Scientific Method, Soil, Water
Skills	observation, classification, comparison, identification, communication, data analysis, scientific method, critical thinking, math skills
Duration	50 minutes
Setting	classroom
Vocabulary	Germination, cotyledon, hypocotyls, radicle
Standards Addressed	Standard 1: Benchmark 2 and 3: 2. select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from scientific investigations 3. review, communicate and defend results of investigations, including considering alternative explanations Standard 3: Benchmark 2: 2. explain how organisms and systems of organisms obtain and use energy resources to maintain stable conditions (e.g., food webs, photosynthesis, respiration)
Objectives	**Students will:** ● Students will germinate seeds on moist paper towel in a Petri dish so the process of germination can be observed, measured, and recorded effectively. By placing a ruler disk transparency in the cover of the germination Petri dish, students can make quantitative observations as the embryonic root and stem emerge and grow.
Materials	*Each pair will need:* • 1 Petri dish • Transparency-plastic Ruler • Ruler disc cut out • 5 seeds • paper towels • eye dropper • hand lens
Background	A seed contains a tiny, new plant (embryo). The outside of the seed is called the **seed coat**. During germination, the *radical* (embryonic root) and *hypocotyl* (embryonic stem) emerge from the seed. Two *seed leaves*, called **cotyledons**, unfold. The cotyledons

look different than the *true leaves* that will develop as the plant grows. Germination is the awakening of a seed from a resting state. This resting state represents a pause in growth of the embryo. The resumption of growth, or germination, involves the harnessing of energy stored within the seed. Germination requires at least water, oxygen, and a suitable temperature. For many seeds, water is the "on" switch that initiates germination. As the dry seed imbibes or takes up water, the seed's cells enlarge and the seed coat cracks. A radicle emerges and rapid development of the fine root hair cells vastly increases the surface area of the root, facilitating the uptake of more water. In Wisconsin Fast Plants and many other *dicots* (plant with two cotyledons), this uptake of water drives the elongation of the hypocotyl, which pushes the cotyledons upward through the soil.Not all plants germinate in such a fashion. Cotyledons from pea plants remain below the ground. The shoot tip is lifted out of the soil by the elongation of the *epicotyl* (the embryonic tem above the cotyledons). *Monocots* (plants with a single cotyledon), such as grasses, push the *coleoptile* (a protective sheath) from the seed upward through the soil. The shoot tip then extends through the coleoptile and out of the soil. At this point the plant begins to photosynthesize and becomes independent of its stored reserves
and dependent on the energy of light.

Procedure

1. From a paper towel or a piece of filter paper, cut a circle 8.5 cm in diameter to fit in the cover (larger half) of a Petri dish. With a pencil, label the bottom of the paper circle with your name, the date and the time.
2. Place a transparency-plastic ruler disk in the cover of the germination Petri dish; place the paper circle on top. (The ruler will show through the paper circle once it is wet.)
3. Moisten the paper circle in the Petri dish with an eyedropper.
4. Place five seeds on the paper circle along the middle dark line on the ruler and cover with the bottom (smaller half) of the Petri dish.
5. Place the Petri dish at a steep angle (80˚– 90˚) in shallow water in a tray so that the bottom two centimeters of the paper is below the water's surface.
6. Set the experiment in a warm location (optimum temperature: 65–80˚F). Check the water level each day to be sure the paper circle stays wet.
7. On your individual data sheet record the day, time, and initial environmental conditions for the experiment.
8. Over the next 5-12 days observe the germinating seed and seedlings using a magnifying lens.

	9. Measure and record the growth of the roots and shoots. Sketch the germinating seeds and young plants using a hand lens/magnifying glass. Record all data in a data chart. 10. Graph the combined length of the Wisconsin Fast Plants™ roots and hypocotyl (dependent variable = y-axis) over time (independent variable = x-axis), and look for patterns in your and your class' results.
Assessment	Compile a class data set to determine if sample size affects conclusions. Lab report using the scientific method
Extension	This was the start of a month long unit where students monitored growth at all life stages and experimented with different growth conditions
Resources	Fast Plants website