

### Visible Elements in Photo



- A young seedling with bright green oval-shaped leaves
- Dark wood chips or mulch surrounding the plant
- Weathered wood fragments of varying sizes mixed into the mulch
- Moist soil visible around the plant base
- A healthy, upright stem supporting multiple leaves

### Reasonable Inferences

- From seedling in mulch bed: The plant is in early growth stages and relies on the mulch layer for moisture retention, temperature regulation, and protection from direct soil contact.
- From wood chip composition: Decomposing wood chips create a barrier that shields delicate roots from extreme conditions while providing organic matter as the plant matures.
- From plant health despite harsh surroundings: The mulch system is effectively protecting this seedling, suggesting engineered growing conditions work better than bare soil exposure.

### Engineering Task

#### K-2 Challenge:

Build a protective bed for a seedling using wood chips, bark pieces, and shredded paper. Your job: create a "blanket" around a small plant pot that keeps the soil moist, blocks weeds, and keeps the plant safe. Test it by watering your plant and checking if the soil stays wet longer than a plant without your design.

#### 3-5 Challenge:

Design a mulch layer (using wood chips, straw, shredded paper, and bark) that:

- Maintains soil moisture for at least 5 days after watering (measured by soil moisture probe or simple visual check)
- Prevents weeds from competing for space (layer thickness: 2–4 cm)
- Keeps soil temperature stable (measure morning and afternoon temps with a thermometer)
- Breaks down slowly enough to last an entire growing season (8–12 weeks)

Test three different mulch combinations (e.g., chips only, chips + straw, chips + shredded paper) on identical seedlings. Measure and compare moisture retention, temperature fluctuation, and weed growth weekly.

### EDP Phase Targeted

#### Ask / Define Problem

This photo shows a real-world growing system in action. Students should start by observing and asking: Why is mulch around seedlings? What problems does it solve? This grounds the engineering task in authentic plant biology rather than jumping to "build something." Observing how nature solves the seedling protection problem naturally leads to designing and testing improvements.

### Suggested Materials

- Wood chips (mulch from garden centers or landscaping suppliers)
- Straw or shredded paper
- Bark pieces or wood fragments
- Small seedlings or seeds (fast-growing: radish, bean, lettuce)
- Soil, pots, and watering containers
- Thermometer and moisture meter (or visual checks)
- Measuring tape or ruler

### Estimated Time

Two to three 40-minute sessions (or 1–2 weeks if measuring long-term moisture and temperature):

- Session 1: Observe the photo, ask questions, design mulch combinations (40 min)
- Session 2: Plant seedlings with different mulch layers, take initial measurements (40 min)
- Sessions 3+: Weekly observations, data collection, analysis, and redesign (3–5 min per day + 30 min weekly review)

### Why This Works for Teachers

This task directly addresses NGSS ETS1.B: Developing Possible Solutions, as students must design and test multiple solutions to the real problem of seedling protection, collecting evidence to determine which engineering approach works best for plant survival.