

### Visible Elements in Photo



- Two chrysalises (pupae) attached to a hard surface—one tan/translucent, one bright green with yellow spots
- Concrete or stone wall/foundation as the attachment surface
- Rusted metal beam or gutter above, showing weathering and oxidation
- Narrow crevice between wall and beam where chrysalises are sheltered
- Outdoor, exposed environment with visible moisture and weathering

### Reasonable Inferences

1. From chrysalis placement in crevice ! The insects naturally seek tight, protected spaces during their vulnerable transformation stage; they need shelter from wind, predators, and extreme weather.
2. From weathered metal and concrete ! The environment is harsh (moisture, temperature swings, UV exposure); the chrysalises must be structurally protected yet allow gas exchange.
3. From two different chrysalis colors and positions ! Different species or life stages may require different shelter designs, suggesting a need for adaptability.

### Engineering Task

#### K-2 Challenge:

Make a cozy, small house where a caterpillar can hide and stay safe while it turns into a butterfly. Use natural materials like twigs, leaves, and soil. Your house should have a small opening so the caterpillar can go in and out, but be closed enough so bugs and wind cannot hurt it. Can you build it so it stays together for one week?

#### 3-5 Challenge:

Your task: Create a shelter structure that protects a chrysalis (modeled with a small clay or paper form) from wind, rain, and predators while allowing air to reach it. Your shelter must:

- Fit in a space no larger than 5 cm x 5 cm x 3 cm tall
- Stay attached to a vertical or angled surface without glue or nails
- Allow water to drain away (no pooling on top)
- Protect the chrysalis from a "predator probe" (a pencil poked gently from multiple angles)
- Be built from materials found outdoors (twigs, bark, leaves, soil, small stones)

Test your design by placing it outside or by a fan for 2 days. Does the chrysalis stay dry and secure? Redesign one element and test again.

### EDP Phase Targeted

Ask / Define Problem — This phase fits best because the photo shows a real problem in nature (how to protect a vulnerable life stage in a harsh environment) without prescribing a solution. Students must first observe and ask: "Why do chrysalises hide here? What threats do they face? What does good shelter look like?" This inquiry-driven start builds ownership and curiosity before they jump into building.

## Suggested Materials

- Twigs and small branches
- Bark pieces and dry leaves
- Small stones or pebbles
- Soil or sand
- Clay (for modeling chrysalis if needed)
- Tape (masking or painter's—minimal, for structure testing only)

## Estimated Time

3–5 hours across two sessions:

- Session 1 (45 min): Observation, outdoor material collection, and design sketching
- Session 2 (60–90 min): Construction and first testing
- Optional Session 3 (30 min): Redesign and outdoor placement (can extend over 2 days of monitoring)

## Why This Works for Teachers

This task directly addresses NGSS 3-5-ETS1-1 (Define a simple design problem) by asking students to identify the real need (protection during metamorphosis) from a natural system, then build a solution using constraints grounded in observable biology.