Life Cycle Stage of Monarch Butterfly

Engineering Challenge

Life Science | Engineering Design Process

Visible Elements in Photo

- A monarch butterfly caterpillar with distinctive yellow, white, and black banded segments
- A shed skin or chrysalis shell (pale, translucent) nearby on the same surface
- Rough concrete or stone surface serving as substrate
- Two thin, dark antenna-like structures at the caterpillar's head end

Reasonable Inferences

- From the shed skin + active caterpillar: This organism undergoes rapid growth and must repeatedly replace its outer covering; this suggests a need for protection during vulnerable transition periods.
- From the concrete surface + caterpillar placement: The creature is exposed to environmental hazards (weather, predators, vibrations) while clinging to a hard, exposed surface; it requires shelter or anchoring mechanisms.
- From the banded coloration: The bold striping likely serves a defensive or warning function, suggesting the caterpillar is palatable to predators and relies on visibility or toxicity rather than camouflage.

Engineering Task

K-2 Challenge:

"Build a Safe House for a Caterpillar"

Your job is to design a cozy shelter where a caterpillar can rest while it grows and changes. Your shelter should:
- Keep the caterpillar safe from rain and wind
- Let the caterpillar hold on with its feet
- Use only materials you find or have in class

Build your shelter and test it by gently blowing on it or sprinkling water on it. Does it protect what's inside?

3-5 Challenge:

"Design a Protective Chrysalis Structure for Metamorphosis"

Monarch caterpillars are vulnerable during their transformation into butterflies. Your task is to engineer a protective structure that:
- Provides shelter from wind, rain, and direct sunlight
- Allows the caterpillar to attach securely (using silk or adhesive)
- Maintains airflow so the caterpillar doesn't suffocate
- Uses only natural or recycled materials
- Can support the weight of a small object (50 grams) without collapsing

Success criteria: Your structure must keep a sponge dry when sprayed with water from 15 cm away for 30 seconds, and the object must not fall for 2 minutes of gentle shaking.

EDP Phase Targeted

Ask / Define Problem

This phase fits because the photo reveals a real organism in a real environment facing genuine biological challenges (shedding, exposure, vulnerability). Students can observe the caterpillar and its shed skin, then identify what problems it faces—a natural entry point to the EDP. They're not solving a pre-designed puzzle; they're responding to an actual need visible in nature.

Suggested Materials

- Paper cups or rolled paper (for structure frames)
- Tissue paper or coffee filters (for breathable covering)
- Twigs or popsicle sticks (for support and attachment points)
- Tape or glue (to assemble)
- Small sponges or cotton balls (as test objects for weight and water resistance)

Estimated Time

60–90 minutes (two 30–45 minute sessions)
- Session 1 (20 min): Observe the caterpillar photo, discuss the problem, sketch designs.
- Session 2 (40–45 min): Build, test with water and weight, iterate.

Why This Works for Teachers

This task directly addresses NGSS K-LS1-1 / 2-LS2-1 (understanding life cycles and organism needs) while anchoring ETS1.A (defining engineering problems based on real-world constraints), making it a natural bridge between life science and engineering thinking.