

Visible Elements in Photo



- A dragonfly with four transparent, intricately patterned wings positioned horizontally on green plant stems
- Multiple green, elongated leaves (appear to be grass or sedge blades) supporting the insect
- Fine vein patterns visible across each dragonfly wing
- The dragonfly's small, segmented body positioned between its wings
- Yellow and pale coloring visible on some plant parts (aging or flowering structures)
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Reasonable Inferences

1. From wing structure (delicate veins + transparency): Dragonfly wings are designed to be lightweight yet strong enough to support fast, precise movement. The vein pattern distributes force across the wing without adding weight.
 2. From positioning on thin stems: The dragonfly's weight and wing span are proportional to the slender plant material available—suggesting a natural balance between an organism's size and the support systems in its environment.
 3. From transparent wing material: Wings that allow light through are stronger per unit mass than opaque alternatives, which relates to material efficiency in nature.
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Engineering Task

K-2 Challenge:

Design and build a pair of wings for a toy bug (or cardboard cutout) using thin, see-through materials. Your wings must:

- Be light enough that the bug can stay balanced on a pencil or stick
- Have lines or patterns on them (like real dragonfly wings)
- Be able to "flap" or move without tearing when you move the stick gently

Success check: Can your bug balance on the stick without tipping? Do the wings stay attached after 5 gentle wiggles?

3-5 Challenge:

Design a model wing (8–10 cm long) that mimics dragonfly wing efficiency. Your wing must:

- Be made using no more than 3 grams of material total
- Support a small load (3 washers or paper clips) hung from its center without bending more than 1 cm
- Include at least 3 internal support lines or "veins" that mirror the pattern visible in the photo
- Use transparent or translucent material for at least 50% of its surface

Success criteria:

- ' Total mass recorded and $\leq 3g$
- ' Load remains suspended without touching the ground
- ' Wing bends $\leq 1\text{ cm}$ when load is applied
- ' Vein pattern sketched and labeled before building

EDP Phase Targeted

Ask / Define Problem

This photo shows a real solution already in nature (the dragonfly's efficient wing design), so students should begin by observing and asking: What problem does the dragonfly wing solve? (lightweight, strong, fast-moving). This phase builds curiosity and biomimicry thinking before students move to planning their own designs. The visible structure invites questioning rather than prescribing a solution path.

Suggested Materials

- Cellophane or clear plastic wrap
 - Straws or thin wooden dowels (for veins/frame)
 - Tape (masking or clear)
 - String or fishing line (for hanging washers)
 - Washers, paper clips, or small metal weights
 - Markers or colored pencils (for vein patterns)
 - Scissors and rulers
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Estimated Time

K-2: 30–40 minutes (15 min. design, 15 min. build, 10 min. test & adjust)

3-5: Two 35–40 minute sessions (Session 1: observation, sketching, vein planning; Session 2: build, test, measure, revise)

Why This Works for Teachers

This task directly addresses NGSS 3-5-ETS1-1 (Define a simple design problem that can be solved by applying scientific ideas about how living organisms use materials to accomplish specific functions) by having students observe a real organism's structure and replicate its efficiency principles using classroom materials.