

The Battle of Aerodynamics Lesson Plan

Michigan Curriculum Connections

SCI.I.1.E.1 – Generate questions about the world based on observation.

SCI.I.1.E.2 – Develop solutions to problems through reasoning, observations, and investigations.

SCI.I.1.E.3 – Manipulate simple devices to make measurements or scientific investigations.

SCI.I.1.E.5 – Develop strategies and skills for information gathering and problem solving.

SCI.I.1.E.6 – Construct charts and graphs and prepare summaries of observations.

SCI.I.1.MS.1 – Generate scientific questions about the world based on observation.

SCI.I.1.MS.2 – Design and conduct science investigations.

SCI.I.1.M.5 – Use sources of information in support of scientific investigations.

SCI.II.1.E.1 – Develop an awareness of the need for evidence in making decisions scientifically.

SCI.II.1.MS.1 – Evaluate the strengths and weaknesses of claims, arguments, or data.

SCI.II.1.MS.2 – Describe limitations in personal knowledge.

SCI.II.1.MS.5 – Develop an awareness of and sensitivity to the natural world.

SCI.IV.3.E.1 – Describe or compare motions of common objects in terms of speed or direction.

SCI.IV.3.E.2 – Explain how forces (pushes or pulls) are needed to speed, slow down, stop, or change the direction of a moving object.

SCI.IV.3.MS.1 – Qualitatively describe and compare motion in two dimensions.

SCI.IV.3.MS.2 – Relate motion of objects to unbalanced forces in two dimensions.

SCI.IV.3.MS.3 – Describe how the non-contact forces exerted by gravity.

Time required

Two 45-minute to 1-hour class sessions

Class materials

(Class working in teams of three)

- Pilot Logs
- Pencils
- 1 quarter per team
- 1 pair of scissors per team
- Several sheets of different types of paper: tissue, rice, 20#, cardstock
- Worksheet for Battle of Aerodynamics

Intrigue

- Prior to visiting the Air Zoo, visit www.airzoo.org with the students to preview the exhibits. Review with them what expectations will be while visiting the museum.
- Distribute pilot logs and pencils to students, and instruct the children to use them for taking notes and creating drawings and diagrams during the visit.
- Discuss gravity with students and have them explore it with the lesson *What Goes Up Must Come Down?*

Gravity is a force that pulls objects with mass toward the center of the Earth.

- Ask students if they can think of a way to make a quarter and paper smaller than the quarter that hit the ground at the same time here on Earth. Facilitate their ideas and list them for the entire class to view.

Illustrate

- Taking ideas from the list created by the students, divide the class into groups of three. Have each group try one idea. Assign members of each group to jobs: recorder, observer, experiments, etc. Tell the groups they have 15 minutes to try their idea a minimum of 5 times and gather results into a brief summary to share with their classmates.

- It's rare that teams cannot make the quarter and slip of paper hit the ground simultaneously. If a team succeeds, give them credit and then demonstrate to entire class how it can be done, using vocabulary like *gravity*, *weight*, *friction*, and *drag* to reinforce the lesson. If they do not find a way, simply demonstrate for them using correct vocabulary.
- To do this, put the paper on top of the quarter making sure that no corners of the paper are sticking out over the edges. Press the paper down on the quarter, so there is as much contact between the two surfaces as possible. The idea is to keep air from moving under the paper and lifting it from the quarter. Drop the quarter and paper together, making sure the coin remains horizontal as it falls.
- Putting paper under the coin generally works too because the coin presses down on the paper as both fall to the ground. This approach is more difficult to set up. The fingers must be removed from the paper quickly so the drop can occur without shifting.

Finalize

- Air exerts friction on objects moving through it. The amount of air resistance, or *drag*, depends on the shape of an object and the object's speed. Streamlining and smoothing surfaces reduces drag. A slip of paper flutters to the ground slowly because drag acts against gravity. Drag also affects a falling coin, but the weight of the coin counteracts the drag. If the paper is placed properly on top of the coin, the coin will shield the paper from the effects of motion through the air. The paper and coin reach the ground at the same time. If there were no air, all objects dropped from the same height would reach the ground at the same time.
- Ask students to return to their Pilot Logs and find an example of drag and the effect of surfaces found in the museum.

Assess

- Tell students that *thrust* is the force that gives a bird or airplane forward motion and gets air moving over a wing. Air constantly rubbing

against the surface of the wing causes air resistance or drag. Drag is the force that slows a flyer down. Ask students to watch the following demonstration and answer the questions including diagrams.

- Ask one member of the student teams to hold a piece of construction paper vertically between their hands so the thumbs point toward the ceiling. Have them hold their arms out straight and start to spin to the left. Spinning in this manner provides thrust and gets the construction paper moving. After the children are spinning, have them drop their left hand from the vertical position on the paper. Ask the students why the paper does not fall. What is holding it to their hand? Have them predict and explain what would happen if they stopped spinning. Ask them if they could spin faster without the paper. Why? Why not?

References

- Science Is...A Sourcebook of Fascinating Facts, Projects and Activities, Susan V. Bosak
- The Wright Brothers for Kids: How They Invented the Airplane with 21 Activities for Exploring the Science and History of Flight, Mary K. Carson and Laura D'Argo