

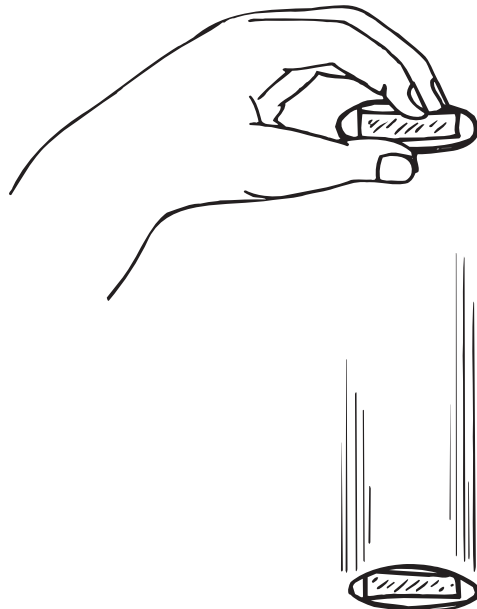
# AERODYNAMIC DRAG RACE

If you understand aerodynamic principles, it's no problem at all to meet the challenge of making a slip of paper and a coin hit the ground at the same time.

**MATERIALS:** Quarter; paper.

## DOING IT:

1. Cut or tear a slip of paper so that it's slightly smaller than a quarter (when placed on top of the coin, no corners of the paper should stick out).
2. The challenge is to drop the coin and the slip of paper from the same height, at the same time, and have the paper and coin reach the ground at the same instant. Can anyone do it?
3. The trick: Put the paper on top of the coin (make sure that there aren't any corners of the paper sticking out over the edge of the coin). Press the paper down on the coin, so that 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 coin. Drop the coin and paper together, ensuring that the coin remains horizontal as it falls.
4. *Variation:* Putting the paper under the coin should also work because the coin presses down on the paper as both fall to the ground. The paper-under-coin approach is a little harder to set up. You must quickly remove your finger from the paper, and drop the paper and coin without shifting the paper's position under the coin.



Air exerts friction on objects moving through it. The amount of this air resistance, or drag, depends on the shape of an object and its speed. Streamlining and smoothing surfaces reduces drag. A slip of paper flutters to the ground slowly because drag acts against the force of gravity. Drag also affects a falling coin, but the coin's weight counteracts the drag. If the slip of paper is placed properly on top of the coin, the coin shields the paper from the effects of motion through the air. The paper and coin then reach the ground at the same time. If there were no air (e.g. as on the moon), all objects dropped from the same height would reach the ground at the same time.

**Topics:** Problem-Solving; Flight; Air; Forces.

Drop a playing card, thin edge downward. Can you make it fall perfectly straight? Now try holding the card flat and dropping it. In the first case, the thin edge slices through the air and is easily pushed off course by slight differences in the air resistance met by the two sides of the card. In the second case, air strikes the bottom face of the card, but not the top face. The fall is slower, more balanced, and therefore straighter.

