On the Cutting Edge: Professional Development for Geoscience Faculty
Teaching Sedimentary Geology in the 21st Century

From Baseball, Beer, & Airplanes to Sedimentology: Teaching Students About Fluid Properties & Particle Transport

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Abstract

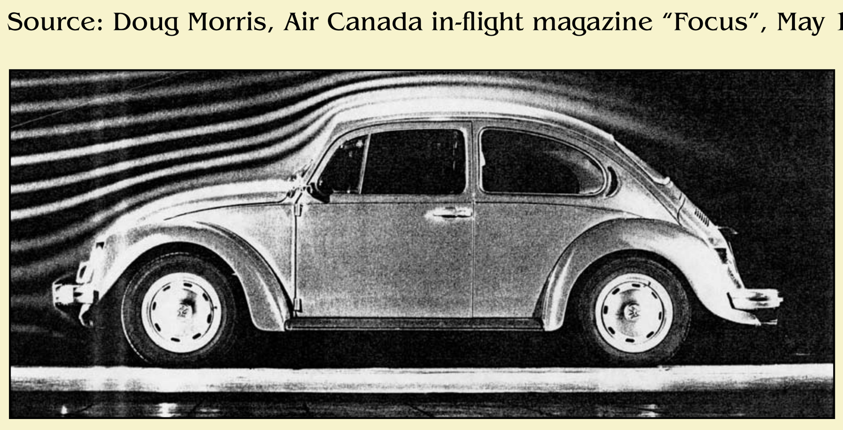
Fundamental principles of fluid properties and particle transport can be made more accessible for students by relating concepts and processes to common everyday events. For example, fluid viscosity can be related to the motion of bubbles in beer, fluid turbulence can be connected to baseball (specifically curve balls), and the entrainment of particles can be related to how planes take off. This poster includes a series of cartoons and short articles that can be used in any sedimentology classroom to teach these and other sediment transport concepts.

Laminar and Turbulent Flow

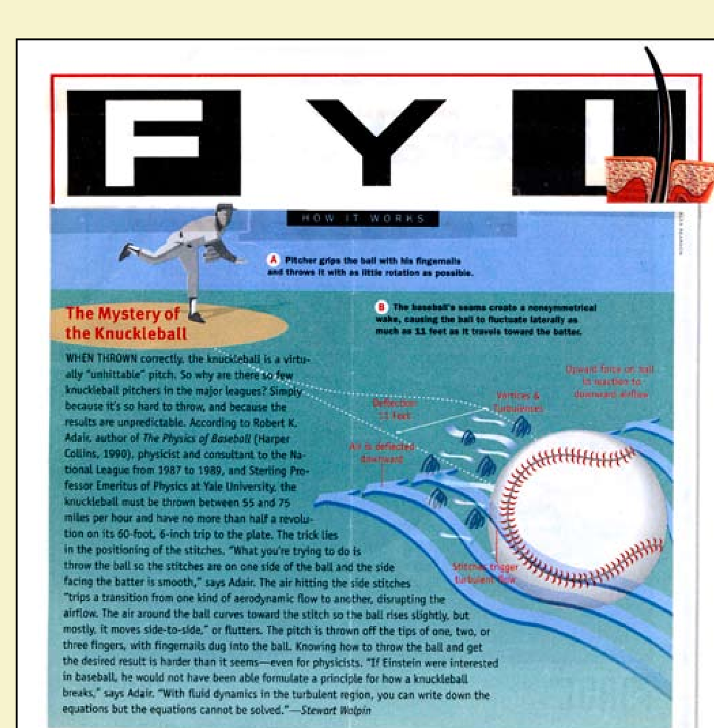
Source: "Hurtling Toward Chaos", Elizabeth Svoboda, The Physics of Waterslides, Discover, v.26, no.7, July 2005. Available online at: www.discover.com/issues/jul-05/departments/physics-of-waterslides/

The article from the in-flight magazine describes six different types of turbulence and includes diagrams showing wind currents. The Volkswagen Beetle in a wind tunnel illustrates how Cd (drag coefficient) is calculated and clearly shows streamlines converging over the 'beetle'. Both are used to help students learn about laminar and turbulent flow, the convergence of streamlines over an object resting on a bed, and the forces necessary to lift particles from the bed.

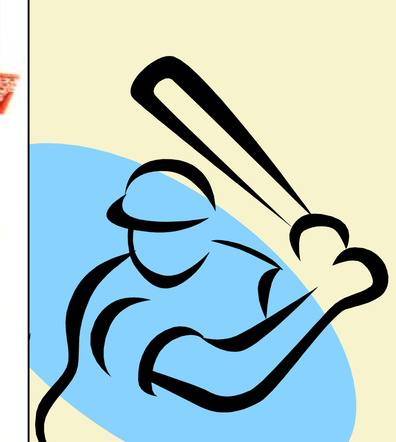
Source: Doug Morris, Air Canada in-flight magazine "Focus", May 1998, p.91-93.



Source: Volkswagen.



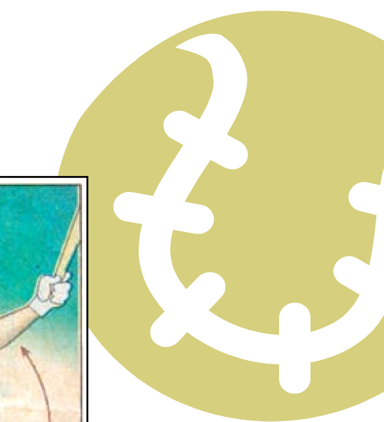
Source: FYI, Popular Science, April 1997, p.74.

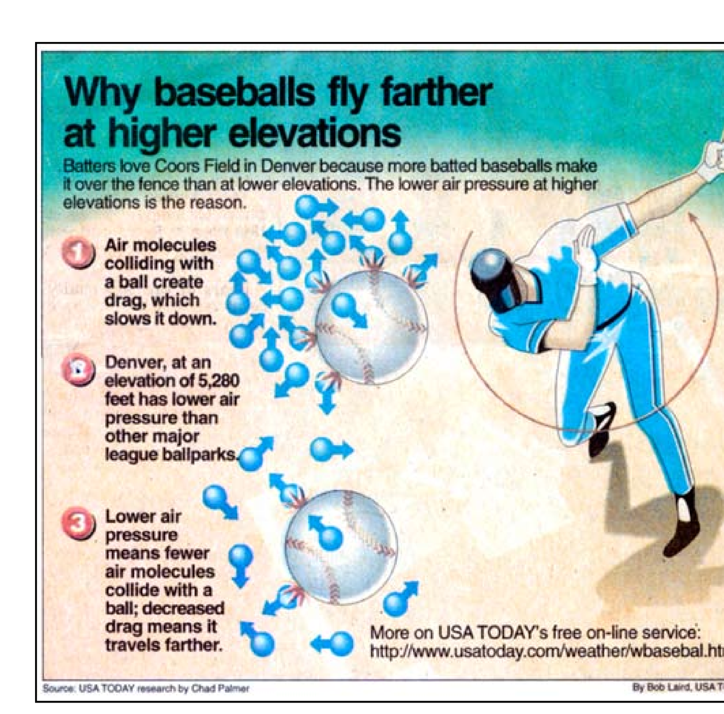


Viscosity of Fluids

The newspaper article describes the behavior of bubbles in a pint of Guinness and the role of viscosity and drag effect of fluids. Using humor, this article does convey that the solution to this question required research by a computational engineer (and several visits to pubs to carry out field research). A related link that helps students learn more about air density and its effects can be found at: www.usatoday.com/weather/wdensity.htm.

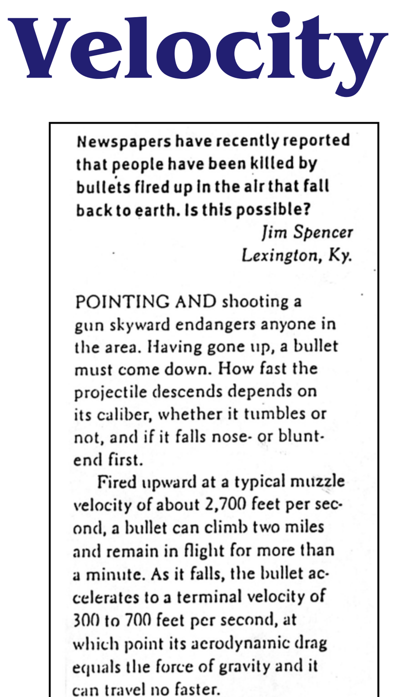
Source: "Mystery of Guinness bubbles is solved", Carolyn Byrne, AP carried in, The Buffalo News, March 17, 2000.





Source: "Why baseballs fly farther at high elevations", USA Today, Feb 20, 1997, available online at: www.usatoday.com/weather/tg/wbasebal/wbasebal.htm.

Terminal Velocity

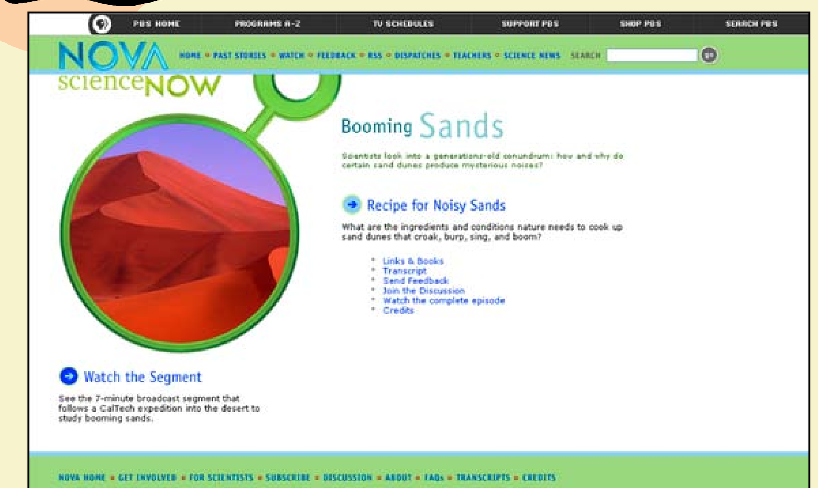


Source: FYI column, Popular Science, Jan 1996, p. 76.

This short column reinforces the concept of terminal velocity when $F_d = F_g$, the conditions for applying Stokes Law of Particle Settling. While there are limitations in the application of Stokes Law, it is the equation commonly used to determine the settling rate for particles smaller than medium sand (~2 phi) and low Reynolds numbers.

Shape & Sorting of Sand

Sources: "Here's the Dirt", Allison Cook, dig it column, House & Garden, Oct 1999, p. 105; ScienceNOW, NOVA, www.pbs.org/wgbh/nova/sciencenow/3204/04.html; "The Mystery of the Singing Sand", The Science Page, The Buffalo News, Nov 7, 2004.



The 7-minute video segment shows how a research group from CalTech are studying desert dunes to learn more about the acoustics of booming sands and why and how certain dunes sing and boom. The newspaper article (from NationalGeographic.com News) carried in The Buffalo News complements the NOVA segment and provides more detail about how geophones were used to determine the frequency of the sound produced by the dunes and GPR used to confirm the presence of a wet, hard sand layer ~2 meters below the dune surface (allowing dry, loose surface sand to avalanche down the dune surface). It also explains how this research is tied to understanding flow of sand and debris flows. The one-page article from House & Garden describes the varying texture and composition of sands and soils. The NOVA ScienceNOW video clip and short articles are part of an assignment where students sieve beach sands and learn about texture (particularly size and sorting). The students also examine and describe a sample of squeaky sand from Seaside, Florida. A writing assignment helps the students tie this activity together.