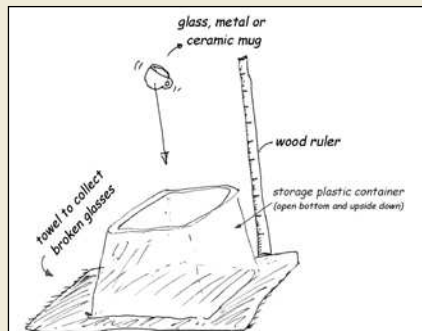


Strong Materials: Is it going to break?

Using a set of aluminum, plastic, ceramic, and glass mugs, assemble a travel-friendly setup as shown in the figure by placing a plastic container with the bottom cut off upside down on the floor. Place a towel under the container and affix a ruler to the container with duct tape. Then, simply drop the mugs into the container. The towel will help contain pieces of the glass and ceramic mugs that we know will break. The ruler is useful to check how high we are dropping the mugs before they break. The metal mug will not break, but it will bounce; the ruler can tell you how high.

Students should drop the mugs to break them themselves. Mugs are cheap—you can order a dozen online for less than \$20—and very fun to break. Students can drop mugs from any height they choose, as long as the mug drops inside the container. Remember, safety is a priority.

What they learn: Ceramics and glasses are brittle; metals and plastics are more ductile and can deform before breaking. A simple figure of atoms sliding upon impact and atoms being strongly bonded may be used to relate these properties to the atomic structure (but be careful—you're not trying to teach atomic physics or crystallography here, so a simple connection is typically enough). The height needed to break the brittle mugs or deform the ductile ones allows you to relate the potential energy of the height and the result. A good question at the end of the activity is: Do you want your car made of metal or ceramics?



What you will need

Ceramic, aluminum, and glass mugs; plastic storage container approximately 23 × 16 × 12 inches, 3-ft wooden ruler, safety goggles, duct tape, towel, knife to cut off container bottom.