SCIENCE QUEST GAZETTE

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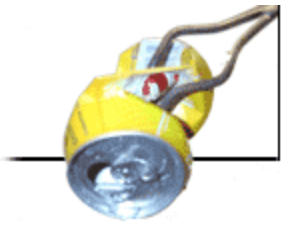
The Collapsing Can

We are so accustomed to the pressure of the air around us that we don't even notice it. However, the air pressure is large enough to crush a soda can. You can see the air crush a can in this experiment.



For this experiment you will need:

- **an empty aluminum soft-drink can**
- **a 2- or 3-liter (2- or 3-quart) saucepan**
- **a pair of kitchen tongs**

Fill the saucepan with cold water. Put 15 milliliters (1 tablespoon) of water into the empty soft-drink can. Heat the can on the kitchen stove to boil the water. When the water boils, a cloud of condensed vapor will escape from the opening in the can. Allow the water to boil for about 30 seconds. Using the tongs, grasp the can and quickly invert it and dip it into the water in the pan. The can will collapse almost instantaneously.

What caused the can to collapse? When you heated the can you caused the water in it to boil. The vapor from the boiling water pushed air out of the can. When the can was filled with water vapor, you cooled it suddenly by inverting it in water. Cooling the can caused the water vapor in the can to condense, creating a partial vacuum. The extremely low pressure of the partial vacuum inside the can made it possible for the pressure of the air outside the can to crush it.

A can is crushed when the pressure outside is greater than the pressure inside, and the pressure difference is greater than the can is able to withstand. You can crush an open aluminum can with your hand. When you squeeze on the can, the pressure outside becomes greater than the pressure inside. If you squeeze hard enough the can collapses. Usually, the air pressure inside an open can is the same as the pressure outside. However, in this experiment, the air was driven out of the can and replaced by water vapor. When the water vapor condensed, the pressure inside the can became much less than the air pressure outside. Then the air outside crushed the can.

When the water vapor inside the can condensed, the can was empty. You may have expected the water in the pan to fill the can through the hole in the can. Some water from the pan may do this. However, the water cannot flow into the can fast enough to fill the can before the air outside crushes it.

CAUTION: Do not heat the can over high heat or heat the can when it is empty. This may cause the ink on the can to burn or the aluminum to melt.

Bat House Plans: http://www.batcon.org/bhra/economyhouse.html

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THE AMAZING WORLD OF BATS

Are bats related to birds? Bats and birds both can fly, yet they developed this ability independently. They belong to different animal classes; birds are in a class called Aves while bats are in the class Mammalia. Bats are mammals, just like humans, which means that all bats are warm-blooded, have hair, bear live young, and feed their babies milk.

How do bats move around in the dark? All bats can see, but some use a special sonar system called echolocation. These bats make high frequency calls either out of their mouths or noses and then listen for echos to bounce from the objects in front of them. They are able to form pictures in their brains by listening to reflected sounds just like we form pictures in our brains by interpreting reflected light with our eyes. In this way, bats are able to comfortably move around at night, avoiding predators, maneuvering around obstacles, locating their food, and capturing insects in total darkness.

Why do bats hang upside down? Unlike the bodies of other animals, a bat's body is best adapted for hanging upside down. Its hind limbs have rotated 180 degrees so that its knees face backwards. This rotation aids in the bat's ability to navigate in flight and to hang by its feet. Bats actually have specialized tendons that hold their toes in place so that they are able to cling to their roosts without expending any energy. In fact, bats must flex their muscles in order to let go of the roosting surface. These adaptations are quite helpful for a flying mammal since bats only need to let go of the roost in order to drop into flight. Hanging upside down also provides bats with roosting space away from predators in safe places on the ceilings of caves, in trees, and buildings that few other animals can use because they have not evolved to hang upside down by their feet.

What do bats eat? There are more than 1,100 different species of bats in the world, living on every continent except Antarctica. Each one has developed special adaptations for how it lives and what it eats. For example, 70% of all the bats in the world eat insects and many of them use echolocation in order to find food and move around in the dark. Many small insectivorous bats can eat up to 2,000 mosquito-sized insect in one night. These bats are able to eat so much because they have high metabolisms and expend lots of energy in flight. Frugivorous bats living in tropical climates have very good eyesight and sense of smell for finding ripe fruit to eat. In the desert, there are nectar-feeding bats which have long noses and tongues for harvesting nectar from flowers, as well as special enzymes for digesting the high-protein pollen that accumulates on their faces. Carnivorous bats have sharp claws and teeth for catching small vertebrates such as fish, frogs, birds, or rodents. A few Latin American bats, the vampires, eat only blood.

How long do bats live? The oldest bat caught in the wild was a banded little brown bat (Myotis lucifugus) which was 34 years old at the time of recapture. To put this in perspective, a bat living longer than 30 years is equivalent to a human living longer than 100 years. Bats, for their size, are the world's longest-lived mammals. Yet unlike other mammals of their size, bats have very low reproductive rates, females of most species producing just one pup per year.

Where do bats live? Not all bats spend their days roosting in caves. Some roost in trees, abandoned mines, buildings, bridges....the list goes on and on. Actually, the variety of bat roosts reflects the amazing diversity of bat species. Bats are highly opportunistic and have adapted to their environments in creative ways in order to take advantage of the many shelters available to them. penny.

How large are bats? The largest bat living in the United States is the western mastiff bat (Eumops perotis), weighing approximately 2 ounces. It has a wing span of nearly 2 feet. However, other bats in the world can be much larger; one fruit-eating flying fox (Pteropus vampyrus) has a wingspan of six feet! The smallest bat lives in Thailand and is called the bumblebee bat (Craseonycteris thonglongyai). This insectivorous bat has a wingspan of only 6 inches and weighs less than a penny.