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Drinking Bird Demonstration

DB-100

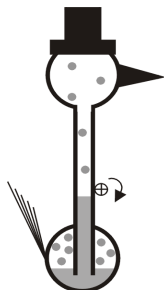
This amazing science toy can be linked to physical science, earth science, chemistry and more. It's an effective demo for students of all ages. When the felt on the head of the sealed glass bird is wet with water, the bird pivots back and forth into a glass of water, making it seem the bird is drinking!

Instructions:

Wet the head of the Drinking Bird, and place a full glass of water near it so that when the head tips forward, only the beak comes in contact with the water. Most Drinking Birds work without adjustment, but sometimes a small tweak to the pivot point of the bird is needed to make sure the bird is at equilibrium. Carefully move the metal clip up or down the glass tube, (ca. one millimeter), until the Drinking Bird just balances in a vertical position.

Explanation:

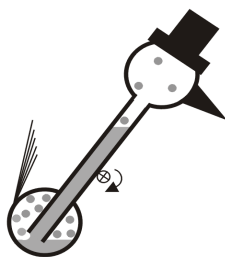
Step 1:



Water requires heat to evaporate. In this demonstration, water from the wet felt on the outside of the head evaporates, causing the vapor inside the head of the bird to cool. This reduces the pressure of the vapor at the top, allowing the higher pressure in the lower bulb to push up the column of liquid. The pressure of the vapor in the top bulb decreases for two reasons:

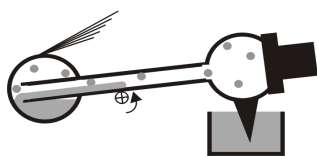
- As the vapor cools, the vapor contracts. Notice the top volume of gas decreasing, and
- As the rising liquid near the top cools, less liquid evaporates into the head and more vapor returns to the liquid state. Since this demonstration only works with a sealed liquid that has a high vapor pressure, this is a major factor.

Step 2:



As the head cools further and more liquid rises inside the bird, the center of gravity of the bird rises, causing the bird to become unstable and tip forward.

Step 3:



Eventually, the beak of the bird tips forward enough to rewet its head. When this happens, the bottom end of the glass tube in the lower bulb is above the remaining liquid. Vapor from the bottom travels to the top until the pressure is equalized. At the same time, liquid in the column flows to the bottom. As the center of gravity of the bird is lowered, the bird tips vertical and the cycle starts over.

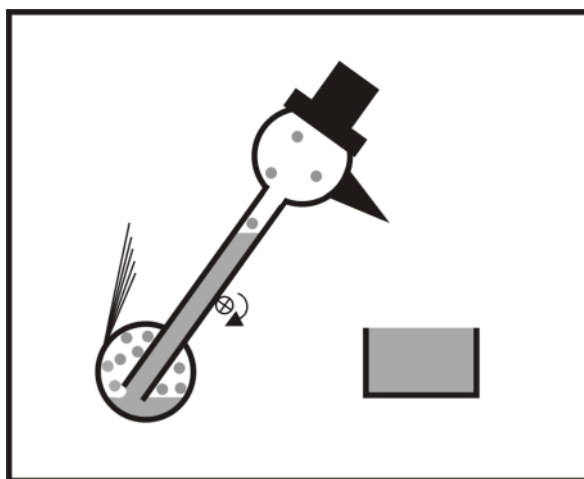
Suggested Classroom Activities

Classroom Discussion

- Q: Is this an example of perpetual motion?
A: *No. The cycle repeats itself only as long as the water evaporates from the head.*
- Q: What is needed in order for the Drinking Bird to work?
A: *A difference in temperature between the head and body.*

Student Challenges

1. Observe the operation of the Drinking Bird and explain how it works.
2. Discover a way to make the Drinking Bird cycle faster.
3. Predict what will happen if a fan blows air toward the Drinking Bird. Does it make a difference which direction the air blows?
4. Predict the result of using warmer or cooler water in the glass.
5. How long will the bird cycle without needing a refill of the water in the open container? Can you find a way of causing the bird to cycle longer?
6. Is there a difference in the cycle rate on a humid day vs. a dry day? Can the bird be used to determine the relative humidity in the air?
7. Predict the result of placing a small inverted aquarium over the bird. Does this cause the bird to cycle more or less? (*Note: as soon as the water in this closed system reaches its vapor pressure, water from the felt can no longer evaporate and the bird stops.*)



8. Can you attach a thread to the bird so that it does useful work, e.g. lifting a small paper clip?

Suggested Classroom Activities

continued

Activities Correlated to the NGSS

K-ESS2-1

The speed of the bird's dipping cycle changes due to the humidity in the air. If the students watch and collect data, over time in different weather conditions they will see a correlation. Students can use the Drinking Bird Demonstration to use and share observations of local weather conditions and describe patterns over time.

3-PS2-2

Students can use the Drinking Bird Demonstration to make observations and investigate motion. Have the students change the temperature of water and make predictions about the speed of the dipping cycle.

4-PS3-2

MS-PS3-3

HS-PS3-3

HS-PS3-4

Water requires heat to evaporate. In this Drinking Bird Demonstration, water from the wet felt on the outside of the head evaporates, as the vapor in the head cools, the vapor contracts. This causes higher pressure in the lower bulb, allowing liquid to raise up the neck, the center of gravity rises, resulting in the bird to become unstable and tip forward. When the head gets wet, the cycle repeats itself.

MS-PS2-4

HS-PS2-4

Students can use the Drinking Bird Demonstration in an investigation to understand Center of Mass as pressure inside bird changes, so does the fluid moving up the tube.



Check out our blogs on the drinking bird!

Why Is a Drinking Bird like a Dog on a Hot Day?

<http://blog.teachersource.com/2015/09/11/drinking-bird-science-fun/>

The Flock Clock

<http://blog.teachersource.com/2011/02/06/the-flock-clock/>

NGSS Correlations

Our Drinking Bird Demonstration and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

K-ESS2-1

Students can use the Drinking Bird Demonstration to use and share observations of local weather conditions and describe patterns over time.

3-PS2-2

Students can use the Drinking Bird Demonstration to make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4-PS3-2

Students can use the Drinking Bird Demonstration to make observations to provide evidence that energy can be transferred from place to place by heat.

4-PS3-4

Students can use the Drinking Bird Demonstration to design, test, and refine a device that converts energy from one form to another.

Middle School

MS-PS2-2

Students can use the Drinking Bird Demonstration in the plan of an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-4

Students can use the Drinking Bird Demonstration in an investigation to construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS3-2

Students can use the Drinking Bird Demonstration to develop a model to describe that when the arrangement of objects interacting changes, different amounts of potential energy are stored in the system.

MS-PS3-3

Students can use the Drinking Bird Demonstration to test what either minimizes or maximizes thermal energy transfer.

High School

HS-PS2-4

Students can use the Drinking Bird Demonstration as an introduction to an investigation to use mathematical representations of Newton's Law of Gravitation to predict the gravitational forces between objects.

HS-PS3-3

Students can use the Drinking Bird Demonstration to refine a device that works with given constraints to convert one form of energy into another form of energy.

HS-PS3-4

Students can use the Drinking Bird Demonstration to conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system.

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, “*Teachers Serving Teachers*” isn’t just a slogan—it’s our promise to you!

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TeacherSource.com/lessons

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teaching plans on dozens of topics:

<http://blog.TeacherSource.com>

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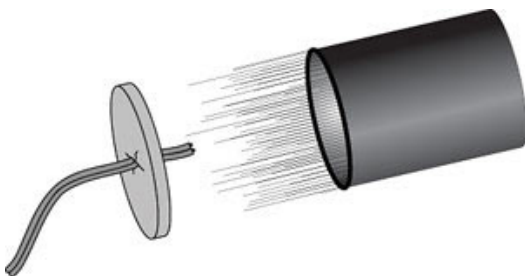


Handboiler (HB-100)

Great vapor pressure demonstration! When the handboiler is held in your hand, liquid quickly travels from the bottom bulb to the top along with numerous bubbles, giving the appearance of boiling. These new and improved hand-boilers are from a thicker glass and less likely to break.

Radiometer (RAD-105)

Originally, designed by William Crooke in the 1860's, the radiometer still fascinates both young and old. Whenever light shines on the four diamond shaped vanes the paddle wheel spins at up to 3,000 rpm. Great for illustrating the conversion of light energy into mechanical energy. Each vane is black on one side and white on the other. Because the black surface absorbs energy better than the white reflective side, the molecules of air move faster near the black surface. Molecules of heated air moving faster on one side of the vane than the other cause it to spin.



Piezo Popper Kit (HS-2A)

These amazing piezoelectric devices generate a few thousand volt sparks at the touch of a button. No batteries required. The discharge is created when a small hammer inside the device strikes a quartz crystal. It can be used as a safety lesson to demonstrate the flammability of alcohol or perfume. Igniting two drops of alcohol in a film canister will cause the canister to fly more than 20 feet into the air!