

# Einstein's Drinking Duck

323.ETE

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## Setting up the Drinking Duck:

Dip the head of the Drinking Duck into a glass of water to thoroughly moisten the flock coating. Then fit the axle through the eyelets in the stand, so that the duck can freely swing back and forth. Fill the plastic cup or a vessel of similar height with water and put it in front of the duck so that its beak can dip into it. This way the head is re-moistened each time the duck swings fully forwards.

**TIP:** Hard water can lead to limescale deposit on the duck's head, which can impair its function. It is best to use rain water or distilled water for your Drinking Duck.

## What is happening?

When the duck is swinging back and forth, its arc increases constantly until at one point the beak touches the water surface. It stops for a moment, then rights itself and starts swinging again until it touches the water the next time. This process will carry on as long as there is water in the cup, possibly for years, without interruption.

## Who invented the Drinking Duck?

The Drinking Duck was invented by the American inventor Miles Sullivan in 1946 and became a worldwide hit. Its filling originally consisted of ether, Dichloromethane (a poisonous solvent), or later of ozone-depleting refrigerants. When the EU banned these dangerous substances, the Drinking Duck vanished from the shop shelves. Now AstroMedia has brought back this wonderful toy, using a new, non-poisonous, fire-proof, and ozone-friendly filling called Ecovulon™.

## What is the connection with Einstein?

In 1964 Dr Thomas Lee Bucky, who had close connections to Einstein's family when he was a child, wrote that he gave a Drinking Duck to

Albert, who for a long time unavailingly tried to discover the secret of its seemingly perpetual motion. The duck was standing on Albert's breakfast table and he liked to stroke its head with a wet finger.

## How does Einstein's Drinking Duck work?

At first glance, the Drinking Duck seems to be a perpetual motion machine because it constantly moves without apparent energy input. The secret lies in its filling of Ecovulon™, which has a very low boiling point and which fills the body of the duck completely, partly as liquid, partly as gas. As long as the head of the duck is moist and moves back and forth, it is cooled down by the evaporation of the water. This makes some the gaseous Ecovulon™ inside the head condense into its liquid state, which lowers the pressure. The lower pressure in the head makes the liquid from the body rise up through the neck so that the duck becomes more and more top-heavy. This increases the arc of the duck's swing until it leans forward nearly horizontally and its beak touches the water surface. At that moment gaseous Ecovulon™ bubbles through the neck into the head, so that liquid can flow back into the body. Now the duck rights itself and the process begins all over again. The energy that keeps the duck moving comes from the air: it cools down when the water evaporates and at the same time cools down the head of the duck. Ultimately the energy that runs your Drinking Duck is provided by the Sun that warms up the surrounding air: The Drinking Duck is a very ingenious solar thermal engine.

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