

GUMDROP DOME

YOUR CHALLENGE

Build a dome out of gumdrops and toothpicks.

What's the Deal?

Domes have been built for almost 2,000 years because they are very stable structures. What's the secret? Triangles. Triangles are stable shapes, that means that they don't bend, twist, or collapse easily when you push on them.

Buckminster Who?

In the 1950s, an engineer named Buckminster Fuller developed a new dome design using all triangular sides. This kind of dome is called a geodesic dome. Its strength comes from all the triangles. Fuller looked at a dome (a very old structure) and saw a way to make it better. Future engineers like you could think of new ways to design old structures too!

MAGIC DISC

YOUR CHALLENGE

Spin two cups taped together and make a round disc magically appear!

What's the Deal?

When images are moving faster than your eyes and brain can process, your brain blends the images. When the magic disc spins, you “see” the center of the cup as one complete circle. This is called persistence of vision. It's also why a flip book, animation, and even motion pictures work.

Safe at Any Speed

Have you ever heard of flicker fusion frequency? It is the point at which one sees an increasingly rapid flashing light as a continuous beam. Birds have a much higher flicker fusion frequency than humans. A hawk flying at high speed can perceive an obstacle and veer away in a fraction of the time it would take a motorist to avoid an accident. If the hawk had the same flicker fusion frequency as a human, it would probably end up splattered against a tree trunk.

CUP TOWER

YOUR CHALLENGE

Build the highest tower you can using cups.

What's the Deal?

The main obstacle in building upward is the downward pull of gravity. Every time you add a new vertical layer, the total force on every point below that layer increases, so there has to be a large base at the bottom to support the weight of all the material above. This is how "cheerleader pyramids" work, and it's also how real pyramids and other stone buildings work.

Meet You at the Top

In the late 1800s, advances in producing iron and steel made modern skyscrapers possible (until that time, buildings couldn't be higher than 10 stories because the materials weighed too much). Narrow, relatively lightweight metal beams could support much more weight than the solid brick walls in older buildings, while taking up a fraction of the space, meaning taller buildings could be built using smaller plots of land.

MAKE A HARMONICA

YOUR CHALLENGE

Build your own harmonica and listen to your music!!

What's the Deal?

When you blow your harmonica, the rubber band vibrates and creates (invisible) sound waves that travel through the air to your ear. Your ear (and brain) translate those waves into sound. How high or low a note sounds (its pitch, or “frequency”) depends on how many times per second the rubber band vibrates. You can change the pitch by moving the sliders or blowing with varying speeds.

I'm at WKRP in Cincinnati

Sound waves aren't the only invisible waves traveling through the air. Ever wonder how devices like a radio, cordless phone, or your remote controlled toys work? Electromagnetic waves, also known as radio waves, have the capacity to transmit music, speech, and pictures invisibly through the air. When you go up or down the radio dial, each number on the dial is a different wave frequency. Each radio station uses a different frequency to transmit its music and shows through the air. If your radio is tuned to that station's frequency, you'll hear it!

DROPS ON A PENNY

YOUR CHALLENGE

Predict how many water drops you can fit on a penny and then test your prediction.

What's the Deal?

When you place water drops on a penny, the drops pile up into a small dome. Why? Water molecules are attracted to each other, making them “stick” together. However, molecules on the penny's surface only stick to molecules next to and above them. That's because there are none below them. This makes the surface act as if it has a thin “skin.” This is called “surface tension.” As you add more drops, the force of gravity eventually becomes stronger than the force of attraction among the water molecules and the water spills over the edge of the coin.

What Would the Magic Eight Ball Say?

Prediction is one of the steps of “The Scientific Method,” a process scientists use to design their research and hopefully give them confidence in the answers they find. The steps of the Scientific Method are: Observation/Research, Hypothesis, Prediction, Experimentation, and Conclusion.

LUNAR LANDING

YOUR CHALLENGE

Build a spacecraft that can land on the moon gently enough to keep your astronauts safe.

What's the Deal?

You are building a shock-absorbing system. When you jump off a high step, you bend your back and knees to absorb some of the energy to break your fall. Like your body, your lander creates energy while it's falling to the ground. This motion energy is called kinetic energy. When your lander hits the ground, the kinetic energy is changed into potential energy which gets stored in the shock absorbers.

Are We There Yet?

Cars on the highway go about 60 miles per hour, but a spacecraft goes about 18,000 miles per hour on its way to the moon. If you take a spacecraft to the moon, it'll take about 3.25 days to get there. If you could drive a car straight up, it would take about 182.5 days, or six months, to reach the moon (with no rest stops along the way!).