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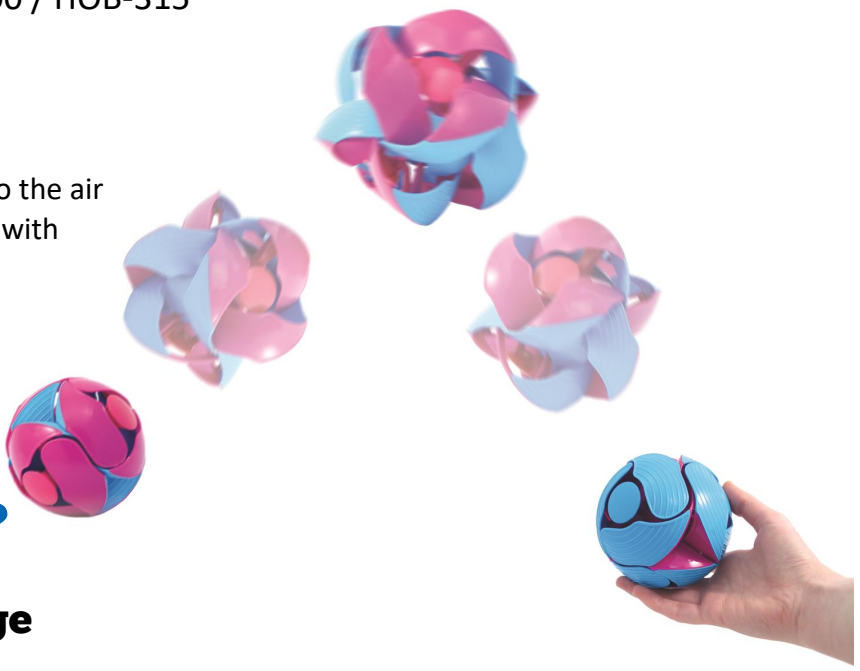
Hoberman Switch Pitch Ball

HOB-300 / HOB-315



How does it work?

It's simple! Gently toss a Switch Pitch Ball into the air without a spin and notice no change. Repeat with increasing energy until a change occurs.

What scientific concepts does it teach?

CONCEPT 1: Physical Change

Physical change refers to any event that causes an object to undergo a change that does not alter its chemical composition. It is still the same object… but its shape, size, color or other physical characteristic has changed.

This class activity is a great way to use the Hoberman Switch Pitch Ball to illustrate physical change:

1. Begin by tossing the Switch Pitch Ball up very gently so that it does not change shape. Ask the students to describe what is happening.

2. As they continue to watch, increase the amount of energy you are putting into the Switch Pitch Ball by tossing it somewhat harder and with a slight rotation. After the Switch Pitch changes colors, ask them to describe what happened.

3. Tell them that what they just saw was an example of a physical change. A physical change is what happens when an object undergoes a change that does not alter its chemical composition. It's still a Switch Pitch Ball; it's just a different color.

4. Invite a couple of students to try to make the Switch Pitch Ball undergo a physical change. Students should not force the ball—just give it a toss.

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Using the Switch Pitch Ball

5. Ask the students to come up with other examples of physical changes. Toss the Switch Pitch ball to one student. If the ball changes colors, they must give you an example of an object going through a physical change. Then they pass it to another student to give another example. If it does not change colors, they can pass it to another student without answering.

Some examples of objects going through a physical change:

- ✓ Crushing a can
- ✓ An ice cube melting
- ✓ Boiling water
- ✓ Mixing sand and water
- ✓ Breaking glass
- ✓ Dissolving sugar and water
- ✓ Shredding paper
- ✓ Chopping wood
- ✓ Dry ice going through sublimation
- ✓ Breaking a pencil in half

CONCEPT 2: Activation Energy

Activation Energy is a term coined in the late 1800's by the Swedish scientist Svante Arrhenius. Activation energy describes the absolute minimum amount of energy that must be available to a system with potential reactants in order to result in a physical or chemical change.

Although activation energy is typically discussed primarily as a chemical change, you can use the Switch Pitch Ball as the perfect visual to better understand this concept.

In order for chemical reactions to occur, stable atoms must break their bonds to create new bonds with other atoms. That "breakup" is where the molecules need a catalyst or some form of assistance to speed up the process. Breaking those bonds takes a significant amount of energy. Your body uses enzymes to do this.

In your demonstration with the Switch Pitch Ball, the force of your hand applied to the ball will act as the catalyst. Giving the ball that push it needs to change is much like the enzymes in your body that destabilize the bonds to a point at which the atoms are ready to break. As the ball begins to spread apart, it is nearing the amount of energy needed to change. The amount of force given to the ball to where it has enough to fully change would be demonstrating "activation energy."

CONCEPT 3: Transitional vs. Rational Energy

Transitional Energy is motion where an object is sliding on a plane: left, right, up, down. For example, you can:

…slide the Switch Pitch Ball along a table in any direction.

…toss the Switch Pitch Ball straight up in the air.

…spin the Switch Pitch Ball in one place on a table (to demonstrate that an object can still be moving even if it is just sitting at an x, y, or z coordinate.)

Rotational Energy is motion where an object rotates on an axis in a continuous manner. For example, you can:

…spin the Switch Pitch Ball in one place on a table again

When moving from translational motion to rotational motion, many of the basic concepts don't change. You are simply changing translational quantities with rotational ones. For instance:

…Gently toss the ball up WITHOUT allowing the ball to rotate while in the air.

…Gently add a slight rotation by spinning the Switch Pitch ball as you toss it.

As you add rotational energy to the translational movement, the ball should more easily change color.

Newton's 1st law states that an object at rest will remain at rest and an object in motion will remain in motion unless acted upon by an unbalanced FORCE. This law is true for rotation as well, but instead of a linear force, we have a rotational torque. (Torque is simply a force that acts of-center and causes an object to spin.)

Newton's law can actually be true by saying: A spinning body will remain spinning, and a non-spinning object won't spin unless acted upon by an unbalanced TORQUE. Practically every quantity in translational motion has a rotational equivalent.

Translational Quantity	Rotational Quantity
Linear Acceleration	Angular Acceleration
Force	Torque
Momentum	Angular Momentum
Velocity	Angular Velocity

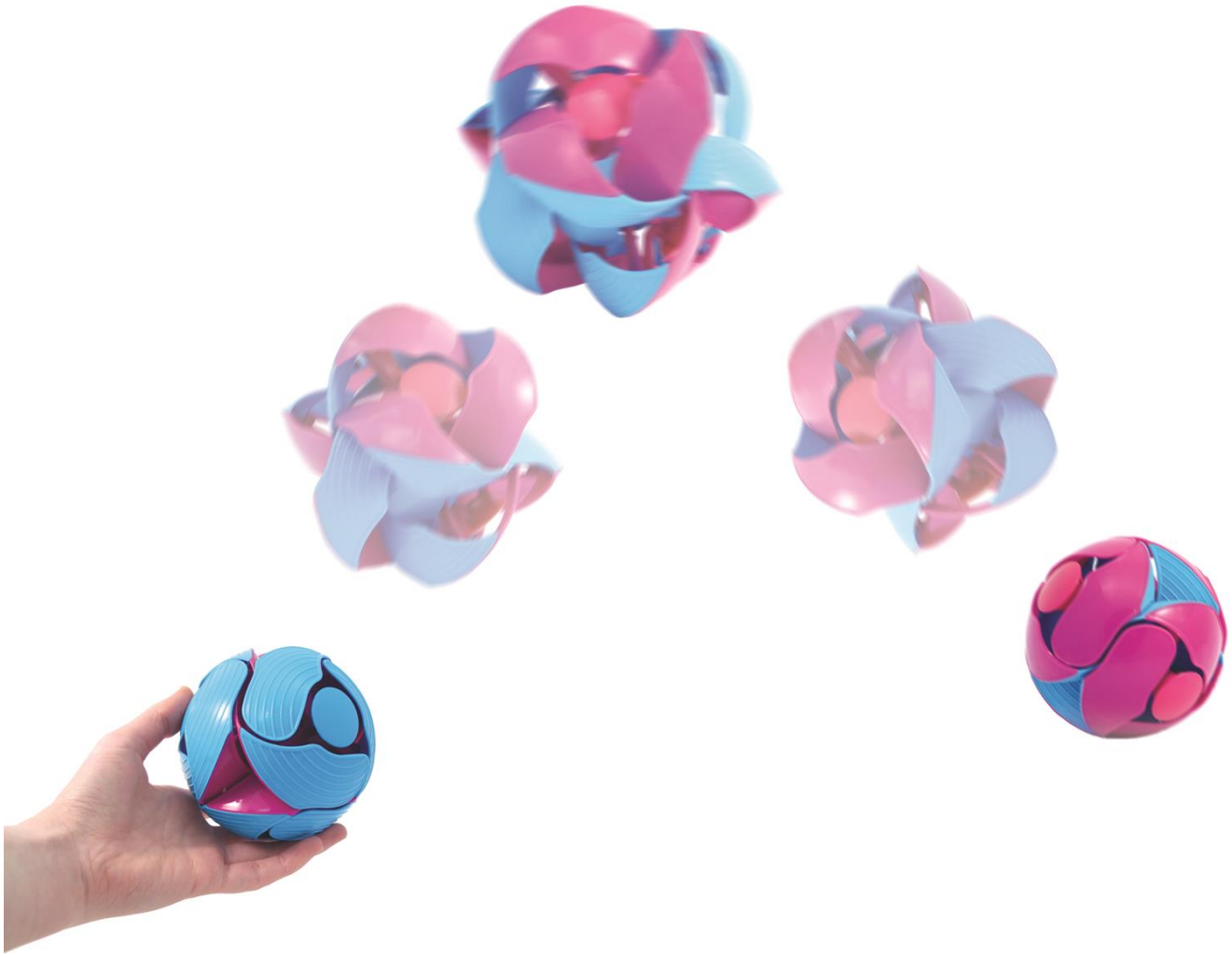
CONCEPT 4: Isomerization

Isomerization is the process by which one molecule is transformed into another molecule which has exactly the same atoms, but the atoms have a different arrangement.

As you toss and spin the Switch Pitch Ball into the air, it is transforming right before your eyes. The pieces rotate, spin, and turn which completely change their original arrangement.

The changing of colors symbolizes the changing from one molecule to another as the exact same atoms are used to construct the molecule.

You never add to or take away from the Switch Pitch Ball, yet the arrangement of visible sides changes the appearance.



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Magnetic Water Molecule Kit (MOD-200)

There's no better way to teach water concepts than with our hands-on magnetic water molecule modeling kit. Embedded magnets accurately reflect positive and negative charges, allowing your students to feel the various strengths of hydrogen, covalent and ionic bonds. Using these magnetic water molecules, your students can discover hydrogen bonding, make ice, dissolve salt, evaporate water, explore transpiration, create ethanol, and much more.

Polymer Bead Demonstration (MER-100)

This amazing demo starts when an end of a 50-ft length of beaded chain is pulled over the edge of its container. As the end falls and accelerates, the chain rises higher than the rim and seems suspended in the air. Students see this as a discrepant event. They will ask to see it again and again. This demo is great for explaining self-siphoning polymers.

Goldenrod Color-Changing Paper (SM-925)

True goldenrod paper is made from a dye which is an acid-base indicator. This paper turns bright red in bases such as ammonia, baking soda or washing soda and returns to bright yellow in acids such as vinegar or lemon juice. Make your own indicator paper or use to preserve fingerprints.