Energy Explorations Outline

Station 7

**Balanced Forces Station**

**Materials:**

balance bird craft sticks wooden cubes

ruler clothes pin cups

**Introduction to Forces:**

* A force is a push or pull in a certain direction. Gravity, magnetism and friction are examples of forces.
* Forces that are equal in strength but in opposite direction are balanced or at equilibrium.
* When forces are balanced:
  + there will be no motion (or change in position) OR
  + there will be no change in speed or direction.
* Unbalanced forces cause a change in position or motion.

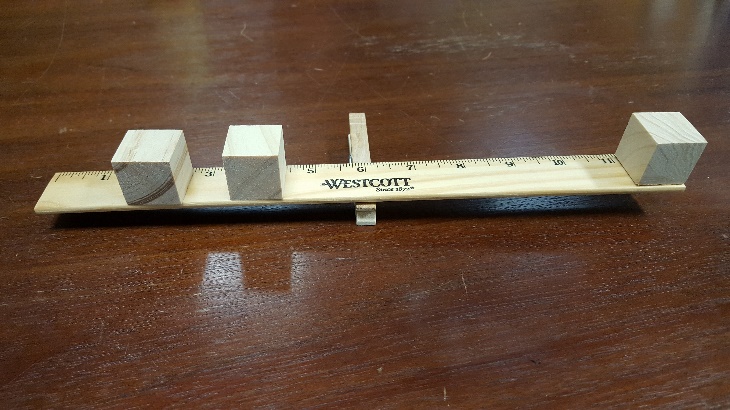
**Activity #1: Balancing Act**

* Find a partner. One partner is going to balance on one foot. Why are you in balance? *All the forces acting on your body are equal and opposite. You are pushing on the floor and the floor is pushing back on you.*
* USING ONLY ONE FINGER, your partner will **gently** push on your shoulder. What happens? *You lose balance. You may have put your foot down or caught yourself on the table. If the force was great enough you may have fallen down.* ***The outside force of the push, caused you to be unbalanced and you had to move.***

**Activity #2: Pencil & Balance Bird**

* Take out your pencil. Try to balance it on one finger. Great job! Where did you need to have your finger to make the pencil balance? *Almost in the middle.* What you just found was the Center of Gravity of your pencil. The Center of Gravity is the point where the object is perfectly balanced. Why wasn’t it EXACTLY in the middle of the pencil? *The eraser has a little bit more mass than the sharpened end.* If an object has a uniform shape then the center of mass is easy to determine. It's in the center of the object.
* For objects with non-uniform shapes, like this bird, the center of gravity is unknown without trial and error. You must try balancing the object on different points until you find the point where the object is perfectly balanced. Tell me some observations about this toy*. Answers may include: made of plastic, wings are extended, has a weight in the body.* Try to balance the bird on one finger. What part of the bird must be on your finger? *Its* *beak.* *The balancing bird has its center of gravity located at the tip of the beak.*

**Activity #3: Balancing Blocks**

* Set up a ruler with a wooden close pin in the middle like a see saw. One end has a wooden block glued to it.
* Give the students a block to put on the other side so the ruler is balanced.
* Give the students a 2nd block. Challenge the students to come up with a way to balance two blocks on the side opposite of the block glued to the ruler.
* If time allows, challenge them to come up with a second way to balance two blocks on one side. *The force depends on the mass (weight) and the distance to the fulcrum (balance point). There is no movement in the system because the forces are equal and opposite.*

**Activity #4: Design Challenge**

Now we’re going to put your knowledge of forces and balance to the test! I’m going to give each group a set of cubes, cups and sticks. Your challenge is to work as a group to build a structure.

*Note to Student Leaders: Divide your students into partners or groups of 3.*

**Challenge 1:** Build a structure using only cube or cup as the base.

* Structures must be built on a cookie sheet.
* Give students one minute to build.
* Share students’ creations and point out points of balance.

**Challenge 2: Feats of Balance.  Make something on your structure stick out in an impressive way.**

* **You may need to give groups a little more time for this structure.**
* **If it is not time to rotate, give them additional time to build.**

**Complete Student Worksheet Questions:**

1. A **FORCE** is a push or pull in a direction.
2. When forces are **BALANCED OR EQUAL**, there is no motion or change in speed or direction.