

# RAFT IDEAS

**Topics:** Measurement,  
Physical Properties, Mass

## Materials List

- ✓ (For one scale)
- ✓ 2 Cups paper/foam
- ✓ 1 Wooden stir stick
- ✓ 1 Drinking straw
- ✓ 1 Paperclip, smooth finish
- ✓ 2 Spoons, plastic
- ✓ 1 stir straw
- ✓ 1 straw with a diameter larger than a drinking straw
- ✓ Tape or return address labels
- ✓ (Portion cup addition)
- ✓ 12 paper clips
- ✓ 2 Portion cups, 2 oz. size or equal
- ✓ Objects to measure
- ✓ Measurement units (gm unit, pennies, cm cubes, paperclips)
- ✓ Pencil or equal

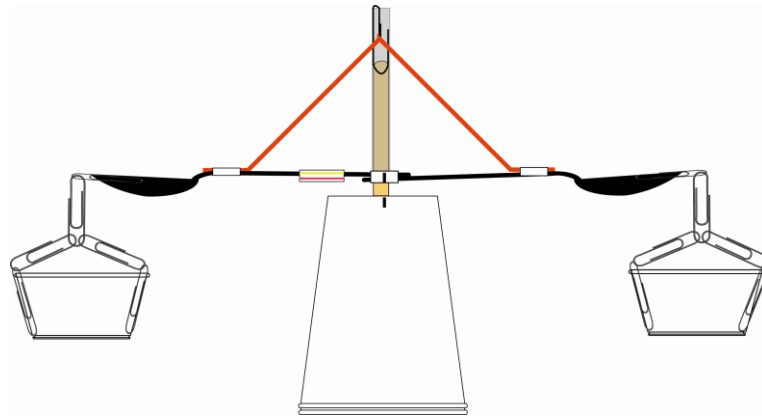
This activity can be used to teach:

- Science & Engineering Practices (Next Generation Science Standards: Grades 2-12)



## Spoon Scales

### Balancing with Cups and Spoons



These balances are simple to make and sensitive enough to be used for a variety of investigations using standard or non-standard measurement units.

### Assembly

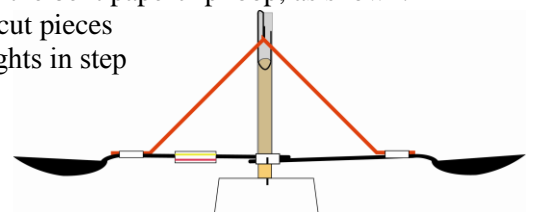
#### Base

1. Invert a cup and poke a hole in the bottom, very near the edge.
2. Insert a wooden stir stick about halfway into the hole and stack the cup over a second cup, sandwiching the stir stick between the sides of the two cups.
3. Cut a drinking straw to make a 6 cm (2-1/2") section and slip over the stir stick.
4. Bend a smooth finish paperclip so that the 2 loops form a "V" shape. Widen the narrower loop and insert between the stir stick and straw.
5. Twist the other loop of the paperclip as shown in the illustration below.



#### Spoon balance arm

1. Overlap the handles of two spoons, both bowls upward, for about 3 cm (1 1/2").
2. Wrap the overlapped section with tape or an adhesive return address label.
3. Bend a stir straw in 1/2 downward. Bend up a ~1 cm (3/8") section at each end.
4. Using tape, or labels, attach the stir straw to the spoon handles so that the middle bend is over the center of the joined spoons and the bent ends are attached near, but not over the bowls of the spoons.
5. Hook the bent middle of the stir straw onto the bent paperclip loop, as shown.
6. Slit a large diameter straw lengthwise and cut pieces about ~2.5 cm (1") long to use as trim weights in step 2 of **To Do and Notice**.

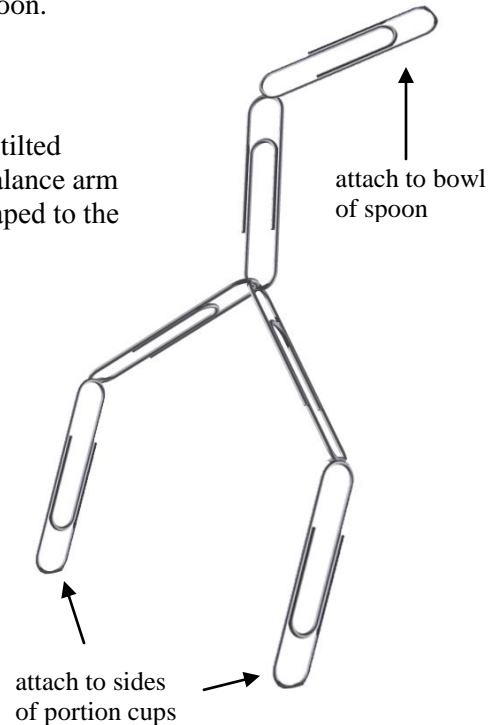


**Portion cup addition** (useful for larger items or ones that might fall off the spoons)

1. Connect six paperclips together in pairs. Hook two of the pairs to the end of a third pair. Hook the loose ends of the first two pairs to the opposite sides of a portion cup. Hook the loose end of the third pair to the bowl of a spoon.
2. Repeat the previous step with six more paperclips for the second spoon.

**To Do and Notice**

1. Place the Spoon Scale's cup base on a level surface.
2. Place the slit straw section over the spoon handle on the side that is tilted upward. Move the section (or add more sections) until the spoon balance arm (the joined spoons) is level ("zeroed"). The straw sections can be taped to the handles to prevent movement or loss.
3. Place a mark on the spoon balance arm on the side at the mid-point. Move the stir stick and/or the drinking straw section up or down, or increase the bend in the paperclip, to position the mark about 1 cm (3/8") above the edge of the cup. Mark the cup at a point directly below the mark on the balance arm. (See illustrations on previous page.)
4. Place an object to be measured in the bowl of a spoon (or in a portion cup).
5. To determine the object's mass, add units to the second spoon (or second cup) until the balance arm is level. (See the materials list on page 1 for suggested measurement units.)



**The Science Behind the Activity**

Mass measures the amount of matter in an object. The Metric unit of mass is the gram (g), defined as the mass of one cubic centimeter of water at 4°C. A large ("jumbo") paperclip has the mass of about 1 g and makes a suitable substitute for standard gram units. An object's mass is the same anywhere in the universe. An object's weight, however, depends on the strength of the gravitational field at the object's location. For example, an apple's mass does not change, but the apple's weight on the Moon would be 1/6th of the apple's weight on Earth, because the Moon has a weaker gravitational field. The Metric unit of weight is the Newton (N). An object's weight at Earth's sea level is equal to the mass in kg times 9.8 N/kg. Thus, on Earth, a person's weight in Newtons is about 10 times their mass in kilograms (or less than 5 times their weight in pounds).

**Web Resources** (Visit [www.raft.net/raft-idea?isid=565](http://www.raft.net/raft-idea?isid=565) for more resources!)

- Measuring mass in space - <http://www-istp.gsfc.nasa.gov/stargaze/Smass.htm>