

Atmospheric Pressure Verses the Weight of Water

Equipment Required

1. Plastic cups
2. Plastic dish
3. Flat plastic disks from food/nut cans
4. Paper Towels

Procedure

1. Assemble materials
2. Cut bottom disk from dish
3. Fill plastic cup with water.
4. Weigh cup & water. (or calculate weight)
5. Using your finger, wet the cup lip with water.
6. Place flat disk on top of cup.
7. With one hand hold disk on top of cup.
8. With other hand grasp bottom of cup.
9. While gently holding cup, turn upside down.
10. Remove your hand from disk.
11. The disk should not drop off.
12. If you see air bubbles in the water, the disk may drop off.
12. Practice over a sink.



Fill & Cap



Flip Over



Hands off



The Science Involved

Atmospheric pressure is at work.

When you fill the cup with water and flip it over, the force pushing down against the flat plastic is the weight of the water divided by the area of the top of the cup.

Example:

Water in cup = 6 oz. Top of cup = 3" Dia.

Cup top area = $3.14 \times (1.5)^2 = 3.14 \times 2.25 = 7.07 \text{ in}^2$

Weight of water = 6 oz \times 0.065 lbs/oz = 0.39 lbs.

Water pressure on disk = $0.39 \text{ lbs} / 7.07 \text{ in}^2 = 0.055 \text{ PSI}$

Atmosphere pressure on disk = 14.7 PSI

Winner : Atmospheric Pressure – disk stays put.

Water molecules are at work.

The water molecules are polar, that is they have a positive charge end and a negative charge end. Thus the molecules form an attraction to other water molecules. This is called *surface tension*.

The water molecules form a weak attraction to the cup lip and flat disk as well.

This is called *adhesion*. The water acts like a weak glue holding the disc and cup lip in place. *Winner: disk doesn't slid off.*

Additional information:

Pressure = force/area

Atmospheric pressure = 14.7 pounds per square inch

1 gallon of water weighs 8.32 lbs

Water = $8.32 \text{ lbs} / 128 \text{ oz} = 0.065 \text{ lbs/ oz}$

Area formula $A = \pi R^2$