**Constant Velocity Apparatus**

by Don Rose

(Modified from apparatus originally published by Rex Rice)

**Supplies (per set-up; all from Lowe’s)**

1. 1”x2”x 6 ft pine strip
2. 3/8” od x 1/4” id vinyl tubing (comes in 20 ft rolls, enough for 4 set-ups)
3. #0 cork (3/8 x 9/32)—rubber stoppers would work better but that small size doesn’t exist
4. 3/8” screw protector (these are rubber caps for screws)
5. 3/8” cable clamps
6. #6 x 3/4 particle board screws (same as sheetrock screws but sheetrock screws are hard to find this short)
7. BB
8. Electrical tape
9. 3/4 in masking tape
10. magnet

**Assembly**

1. Suck water into the tube to fill it.
2. With one end sealed with a finger, cork the other end.
3. Let the bubbles rise and fill the tube full with water.
4. Drop in BB.
5. Submerge the screw protector in water to get rid of air bubbles and push onto the tubing (use the screw protector since the BB will rust and next year you will need an easy way to get the cap off and replace the BB).
6. Check for air bubbles and wipe down the tubing.
7. Wrap electrical tape around the cork and tubing (10-15 wraps) and again about 1” from the screw protector end.
8. Using two cable clamps (pointing in opposite directions so the screw holes are on opposite sides), clamp down one end with the tape up against the first clamp and the second clamp up against the first (this keeps it straight).
9. Using two more clamps, slightly stretch the tubing and clamp down (the electrical tape is acting as a stop against the clamps on either end).
10. Put two more clamps distributed along the middle at 1/3 intervals.

**Use**

1. Put masking tape along the side of the wood for marking.
2. Have the students hold the wood at an angle and use the magnet to put the BB at position zero.
3. Pulling away the magnet, the students mark different positions at different clock readings and then measure distances and plot. They can use different color pen for different angles or trials.
From left to right
Screw protector, electrical tape (orange), cable clamps (2) and BB

Top view

Corked end showing 2 clamps, and tape over cork
Date: Tue, 21 Sep 2010
Subject: Re: constant velocity apparatus document
To: <jane.jackson@asu.edu>
From: Rex Rice <RiceR@clayton.k12.mo.us>

Jane,

I think this is a good modification of my apparatus. The only problem I see with the flexible tubing is getting it straightened out.

I have recently made similar modifications to the version on the website by replacing the glass tube with a stiff clear plastic tube. Unfortunately, I haven't found a good source for the plastic tube in small quantities. Don's version using the flexible tubing has the advantage of having the tubing readily available. I'm wondering where he finds the screw protectors? I also think that a small section of the appropriate diameter dowel rod might make a good substitute for the small cork that Don suggests if the corks are unavailable.

I would also suggest that you could eliminate the need for all of the clamps if you were to rout a groove down the center of the support board the same width as the outside diameter of the tubing.

We use this apparatus/experiment for all of our freshman classes. It is good for any introductory physics class. We do this in addition to a video analysis experiment of an air glider on a level surface and the toy car experiment. This give the freshmen three different uniform motion experiments that are all based on the same basic descriptive model. However when one gets to forces, it is useful to refer back to the three experiments and relate the causal force models to the different situations to understand how we arrived at uniform motion in such different ways. Not to mention the practice freshman students get with making, interpreting, and analyzing linear graphs before the models become more complex.

So, yes, this experiment is a good alternative/addition to the "constant velocity particle model" unit, and Don's version of the apparatus seems "doable" with simple tools assuming the parts he describes can be acquired.