**A Lateral Accelerometer**

**Step 1. Making the lateral accelerometer:**

Materials: You will need a largish jar with a watertight lid. Canning jars work as will any jar with a rubber gasket stuck to the lid. Big pickle jars are best. Avoid jars that use paper as a gasket to seal. When you have a jar that might work, fill it with water and turn it upside down. Does it leak? Try again. You will also need a piece of waterproof tape (Duct tape and strapping tape seem to work well, but not masking tape), some string or thread, (dental floss works) and a float. A Styrofoam peanut would work fine as a float, as would anything that floats in water, and is small so you can tie it on your string and put it in the jar.

Assembly: Tape one end of the string to the inside of the lid of your jar about in the center. Tie the other end of your string to your float. The length of the string should be about 3/4 to 2/3 the depth of your jar. Check this by putting the lid on your jar. Does the float dangle without touching the bottom? Now fill a bucket with water. (A sink will work too) Completely submerge the jar in water, being careful not to trap any air. With the jar under water, screw the lid onto the jar so the float is inside the jar and the string is not caught in the lid. When you take the accelerometer out of the water and turn it lid side down, the float should now hold the string taught, rising from the lid as far as the string will let it. This is the proper orientation of the jar for using it as an accelerometer.

**Step 2: Trying the thing out.**

The rule with the accelerometer is that the float will point in the direction of the acceleration. This is a lateral accelerometer, so it only really picks up on accelerations that are to the side, not up and down.

A) Hold the jar in your hand and speed up from rest. Which way does the float go? (**Draw a little diagram indicating the direction of acceleration, and which way the float went**)

B) Hold the jar in your hand, and slow down from some high speed. Which way does the float go? (**Draw a little diagram indicating which way you slowed down, and which way the float went**)

C) Why do you suppose the float does what it does? (Doesn't it seem a little backwards?) **Show this to your parents or guardians and see of they can explain it to you or vice versa**. (Use the idea of inertia - an object resisting a change in velocity - and Styrofoam floats)

**Step 3: Using the lateral accelerometer in a car.**

You can measure accelerations fairly accurately with your lateral accelerometer. When you have the jar held exactly level, if you measure the angle the string forms with the vertical, you can estimate the “g” s you are experiencing:

|  |  |
| --- | --- |
| Angle | “g” s of acceleration |
| 0o | 0 “g” s |
| 11o | 0.2 “g” s |
| 22o | 0.4 “g” s |
| 31o | 0.6 “g” s |
| 39o | 0.8 “g” s |
| 45o | 1.0 “g” s |

(1 "g" of lateral acceleration is 9.8 m/s/s or 32 f/s/s) It is rare that you will experience an acceleration that high in a car, unless you are in an accident. (Airbags use accelerometers to determine when to inflate)

Get someone to drive for you as you will be busy looking at your accelerometer. Find a nice big abandoned parking lot, and for the following actions, **draw a diagram of the car's motion**, and the **behavior of the accelerometer float**:

A) Speeding up from rest

B) Moving a constant speed in a straight line.

C) Moving at a constant low speed quickly in a tight circle.

D) Stopping as quickly as possible from a speed of 5 MPH (Hang on tightly to the accelerometer)

**Answer these questions, citing your data:**

E) Did you read any lateral accelerations greater that one g?

F) What was the biggest acceleration you measured?

G) What acceleration should an airbag chip be set to inflate at? Why?

Generally, cars can pull about one g of lateral acceleration tops unless they are in an accident, or somehow glue themselves to the road. (Like drag racers)

-------------------------------------------------Cut along dotted line (or don’t)---------------------------------------

**Get a parent to sign this and affix it to your lab.**

My child has demonstrated the accelerometer to me, and **we have theorized as to why it behaves as it does.**

 Date

Signature of parent or guardian

 Date

Signature of student

**Turn this in along with your diagrams and answers to 2A, B, C, and 3A-G**