# Coin drop experiment

You will be given a set of "coins"; disks of different diameters, materials, and thickness. The coins are grouped and labeled and there are many of each size. You should do the following

1. Set the coin just below the surface of the water with the red side up. Pick a position and try to drop all coins in one set from the same location. This is impossible to do precisely by hand, but try to keep the person dropping fixed.
2. Try to hold the coin as level as possible and release without giving the coin any spin. Release the coin slowly as not to give it any initial motion.
3. Observe and record the basic regime of falling shown below A) steady B) Fluttering C) Chaotic D) Tumbling. In some cases it may not be totally clear which regime it is, use your best judgment. In fluttering, the coin typically does not flip over while falling. In tumbling, the coin will take off in one direction.
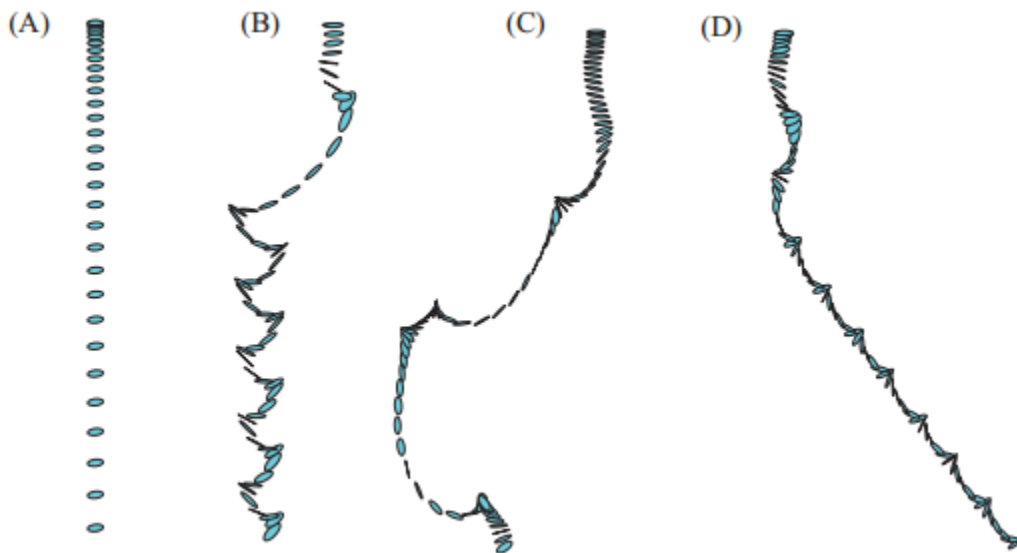
4. Let the coin fall to the bottom of the pool. Someone in the group should record whether the coin landed up or down for each coin. If the coin flips after hitting the ground, record the orientation just before impact (if you can tell).
5. Release the remaining coins in the set, recording the orientation and waiting until the coin hits bottom before releasing another.
6. **After all the coins are dropped, take a picture from the surface of the water looking down at the collected coins. Hold your phone camera about 1 foot from the surface and try to hold the camera directly over the center of the collected coins. Make sure you know what pictures correspond to what set of coins.**

7. Some of the coins are curved. If your set is, you may want to repeat the experiment for the other side being one facing up when released, just to check if the curvature matters.
8. Record your data in the spread sheet. Record the probability in your set that coin will land "heads-up" in its released orientation. (the number of coins that landed in the released orientation divided by the number of coins in the set). Place your picture in the common directory with the file name, A_1.jpg, for example. The "A" is for coin set A and the _1 is for trial 1. Another experiment with the same set of coins would be A_2, for example.

Once we are done, your task is to try and make sense of all the experimental data from the class. Propose two dimensionless numbers that can describe the basic falling regime. Try to develop a phase diagram that plots the regime in a two-dimensional space of the dimensionless numbers. Look at the probabilities of what orientation the coin lands and the photos in light of your dimensionless numbers. Our data will be limited so there are likely multiple plausible answers at this point in time. Propose a next set of experiments that you would try to confirm or refute your hypothesis. If there are dimensionless numbers that you neglected as being unimportant, explain why you neglected and what experiment you could try to confirm or refute your assumption.

Note that this is an experiment. There is not necessarily a "right answer" I am looking for. I want you to use dimensional analysis to try and make some sense of a simple, but real experiment. Even though the concept of the experiment is simple, the results are quite complex.

Your results for this exercise will be part of the homework due on Sept 19.