

Uncertainties Graphing Experiment

Title Marbles and Cups

Apparatus A4 card, A3 paper, masking tape, ruler with groove, marble, plastic cups, sharp pencil.

Instructions

- Draw graph axes on the A3 paper. The space left below the x-axis should be slightly greater than the diameter of a cup, see Figure 1.

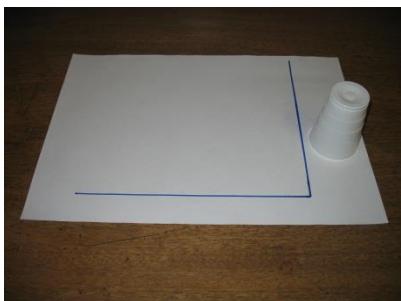


Figure 1: Axes drawn on the A3 paper

- Fold the A4 card into a triangle and tape together with the masking tape, see Figure 2.



Figure 2: A4 card folded and taped to form the support for the ruler.

- Lean the ruler on the card triangle to make a ramp.
- Rest the bottom end of the ruler on the A3 paper.
- Decide on the independent variable to be investigated.
- Place an upside-down cup with the hole at the bottom end of the ruler and the edge opposite the hole on the graph axis, see Figure 3.

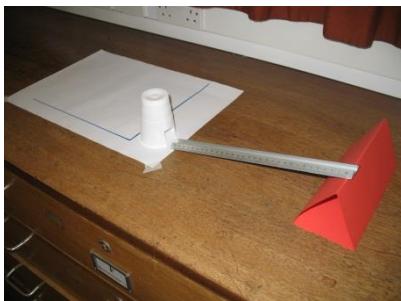


Figure 3: Ramp aligned to allow a marble to roll into the cup.

- Release a marble on the ruler so it rolls down the ruler into the cup, see Figure 4.



Figure 4: Releasing a marble on the ramp.

- The marble pushes the cup along the A3 paper.
- The distance travelled by the cup is the dependent variable.
- Mark the position of the furthest edge of the cup on the A3 paper, see Figure 5.

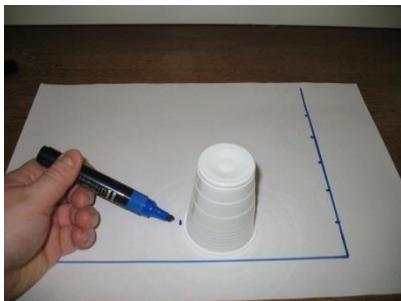


Figure 5: Marking the position the cup has been pushed to by the marble.

- Repeat an appropriate number of times and for an appropriate number of values of the selected independent variable.
- Plot a line of best fit.

Issues to consider

- Repeatability and reproducibility of measurements
- Random uncertainties
- Comparison of absolute and percentage uncertainties

Reference

Farmer, S. (2012). Real graphs from real data: experiencing the concepts of measurement and uncertainty. *School Science Review*, 94(346), pp81-84. Hatfield: ASE