**S1/S2 Science – More experimenting at home**

You've probably seen the set of quick and easy experiments on the school website – Kitchen Science. You should try to do as many of these as you can.

But if you'd like something more challenging, then here are some experiments you can try at home where you do the whole thing – set it up, carry out measurements, take averages, change variables, record data, draw graphs, write up reports.

Have a look through the experiments on the following pages and choose one that you are most interested in and can manage to do at home.

Remember that all experiments involve *variables*:

- Independent Variable – the thing you will change.
- Dependent Variable – the thing you will measure.
- Control Variables – things that you keep the same.

Copy this results table, replacing the italic text with the names for your experiment:

| ***Independent variable*** | ***Dependent variable*** | | | Average ***dependent variable*** |
|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

You repeat every measurement three times and write the values in Trial 1 to 3. When you are finished, calculate average values in the last column. (Use a calculator! Add up the three values, press the equals sign, then divide that bigger number by 3.)

Draw a graph, with your independent variable on the x-axis and dependent variable on the y-axis. Note that some experiments suit a line graph while others suit a bar graph.

You may not have graph paper. You might be able to use squared paper from a maths jotter? Or if you have access to a computer and printer, we've put a page of graph paper at the back of this document.

**Writing your experiment report**

Write up a detailed report like you have practised in class. You should include:

- Title
- Aim (mention the independent and dependent variables here)
- Apparatus (labelled diagram)
- Method
- Results
- Graph
- Conclusion

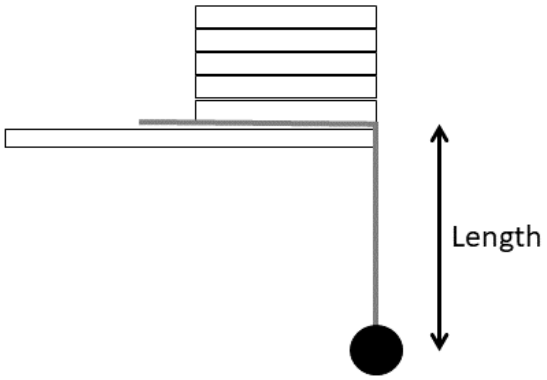
*Leith Academy, with thanks to Dunfermline HS, May 2020*

**Swinging solo! - Pendulum investigation**

**Background**: A *pendulum* is a fancy name for anything that swings back and forth under the influence of gravity. They are used in old machines like grandfather clocks to provide precise timing, because they swing with a fixed *period* – the time taken to swing from one side to the other and back. You will investigate how the length of the pendulum affects the period.

**Equipment needed**:

- Piece of string, about 1 metre long
- A mass you can tie onto the string, e.g. small rock, lump of plasticine, sellotape roll…
- Stopwatch (e.g. on a phone)
- A table
- Ruler or measuring tape
- Something heavy e.g. pile of books




**Independent variable**: Length of pendulum (cm)

**Dependent variable**: Time taken for 10 full swings (s)

**Instructions**:

1. Tie the mass securely on the string.
2. Place books to hold the string at the edge of the table, as shown in the picture.
3. Make sure the pendulum can swing freely away from table legs.
4. Using your ruler or measuring tape, adjust the system to get your first length.
5. Suggested lengths: 20 to 60 cm, going up 10 cm each time.
6. Move the pendulum sideways a short distance, let it go and start the stopwatch.
7. Stop the stopwatch when the mass has returned to its starting position 10 times.
8. Do steps 6 and 7 three times before changing the length!

**Graph**: Use a line graph for this one.

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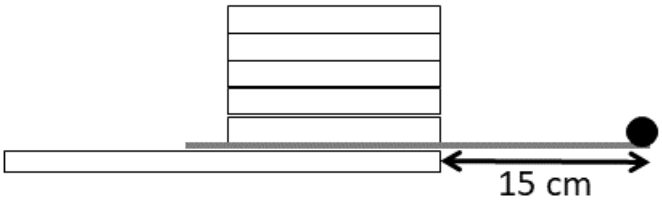
**Stressed spaghetti! – Bending strength investigation**

**Background**: When engineers build houses or bridges, they need to know how well the materials they use will hold up to *stress* and *strain* – for example, what kind of forces can they stand up to without breaking? You will investigate the breaking strength of an unusual building material – spaghetti.

**Equipment needed**:

- A packet of dried spaghetti
- Plasticine, play-doh or blu-tak
- Kitchen scales
- A table
- Ruler or measuring tape
- Something heavy e.g. pile of books




**Independent variable**: Number of pieces of spaghetti

**Dependent variable**: Mass required to break (g)

**Instructions**:

1. Use books to hold a piece of spaghetti at the edge of the table, as shown in the picture. Have 15 cm of spaghetti poking out.
2. Keep sticking small pieces of plasticine onto the end of the spaghetti until it snaps.
3. Use the scales to measure the final mass of plasticine.
4. Replace the spaghetti piece and repeat steps 1-3 to get your three trials.
5. Now do steps 1-4 using 2 pieces of spaghetti at a time, then 3, 4, and 5 pieces.
6. Remember to clear up any mess, and try to save the spaghetti to eat later!

**Graph**: Use a line graph for this one.

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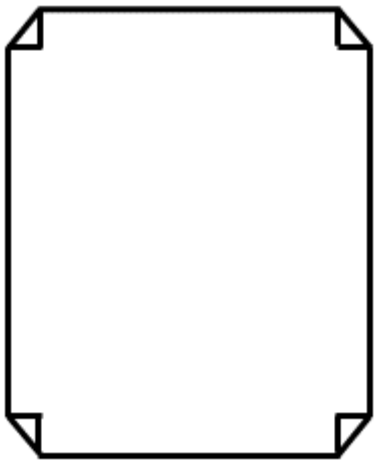
**Paper parachutes! - Air resistance investigation**

**Background**: Believe it or not, if there were no air on Earth, everything would fall to the ground at the same rate. This was shown by astronauts dropping a hammer and feather on the Moon (video). But we have air, which provides *air resistance*, slowing things down. You will investigate how air resistance affects falling pieces of paper.

**Equipment needed**:

- 5 sheets of A4 paper
- Stopwatch (e.g. on a phone)
- A good solid chair to stand on



**Independent variable**: Number of sheets of paper

**Dependent variable**: Time of fall (s)

**Instructions**:

1. Start with one sheet of paper.
2. Fold the corners over as shown in the picture.
3. Place the chair near to, but not under, an open door frame.
4. Stand on the chair (carefully!). Hold the paper up against the top of the door frame. The paper should be level, so it 'catches' the air.
5. Let go of the paper and start the stopwatch. (You may need a helper.) Stop when the paper hits the ground.
6. If the paper hits anything on the way down, ignore this measurement and try again.
7. When you've done three trials, repeat steps 2-6 using more sheets of paper.
8. NOTE: folding the corners holds the sheets together without needing glue or sellotape, which would add extra mass!

**Graph**: Use a line graph for this one.

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**Frustrating friction! – Stopping distance investigation**

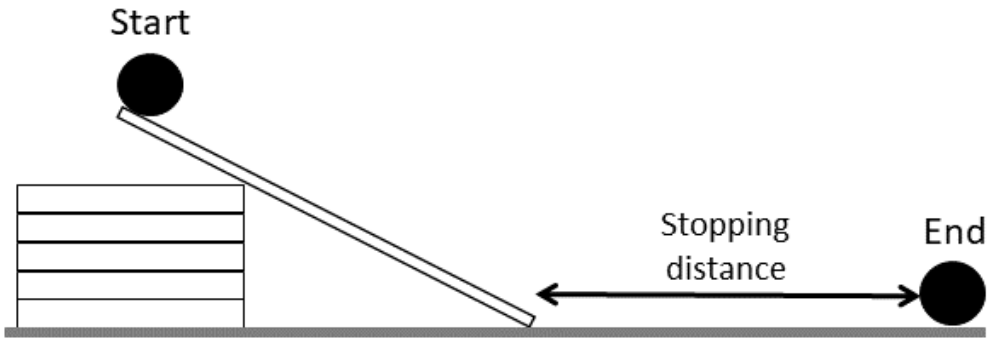
**Background**: The force of *friction* is sometimes annoying, but often very useful. If we didn't have it, we couldn't move or stop ourselves, and it is important for car makers to think about how long it will take cars to stop. You will investigate how different surfaces, which provide different friction, affect the stopping distance of a rolling ball.

**Equipment needed**:

- Ball (tennis ball is ideal, but football could work)
- Ramp (e.g. plank of wood, or two broom handles separated to make rails)
- Pile of books or similar to prop up ramp
- Different surfaces (e.g. carpet, kitchen tiles, concrete, grass, gravel…)
- Measuring tape or ruler

**Independent variable**: Type of surface

**Dependent variable**: Stopping distance (cm)




**Instructions**:

1. Set up your ramp. Make sure it is the same height and angle every time.
2. Let the ball go from the top of the ramp (don't push it!).
3. Measure the stopping distance as shown in the picture.
4. When you've done three trials, move to a different surface.

**Graph**: Use a bar graph for this one.

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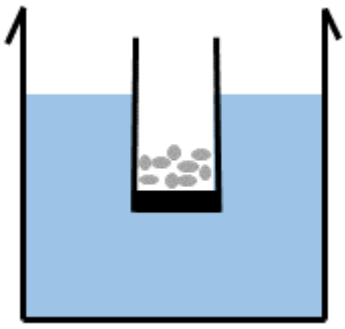
**Wobbling water! – Buoyancy investigation**

**Background**: The reason that some objects float is because water provides an upwards force called *buoyancy*, which balances the force of gravity. If you push the object down a bit, it will *oscillate* (bounce up and down) until the forces are balanced again. You will investigate how the oscillations of a floating object are affected by its mass.

**Equipment needed**:

- Bucket of water, or a deep sink filled up
- Drinking glass, ideally tall with a thick base
- Lots of small stones
- Kitchen scales
- Stopwatch (e.g. on a phone)



**Independent variable**: Mass of stones (g)

**Dependent variable**: Time taken for 10 bounces (s)

**Instructions**:

1. Start by adding just enough stones so that the glass floats without tipping over, as shown in the picture.
2. Tip the stones out to measure their mass on the scales, then put them back.
3. Push the glass down slightly, let it go and start the stopwatch.
4. Stop the stopwatch when it has bounced 10 times.
5. When you've done three trials, add some more stones and repeat steps 2-4!

**Graph**: Use a line graph for this one.

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