**LAB: Measuring the Acceleration due to Gravity, *g***

Aim: To use one of five methods to measure the acceleration due to gravity, g.

**Method A – measuring the time-of-flight**

1. Set up the fast timer with the ball bearing launcher and trap door.
2. Ensure that system is working correctly, the timer should start when the ball is released and stop when the ball hits the trap door switch at the bottom.
3. Carefully measure the height between the release and the trapdoor, and perform the experiment three times to achieve an accurate average time of flight.
4. Repeat the measurements for a range of heights. You know the variables: *vo*, *x*, and *t*.
5. Use the equation *x = vot + ½ at2* to determine the mean acceleration. Compare with the official value of *g* = 9.81 m/s2.
6. Extension: plotting a graph of height against time squared should produce a straight line with a gradient = *g/2*.

**Method B – measuring the final velocity**

1. Set up a tube on clamp stands such that a 10.0 cm metal cylinder can fall through it – place a cushion on the floor to protect it. Set up a light gate at the bottom of the tube to measure the final velocity, *v*.
2. Measure the length of the tube, *x*. You now know the variables: *vo*, *x*, and *v*.
3. Use the equation *v2 = vo2 + 2ax* to determine the acceleration due to gravity.
4. Repeat for a range of different lengths of tube.
5. Plotting a graph of velocity squared against length should yield a straight line with a gradient = *2g*.

**Method C – ticker timer**

1. Attach a length of ticker tape to a 100 g mass.
2. Set up the ticker time on a clamp stand upon a stool.
3. Holding the mass below the ticker time, start the timer running and release the mass.
4. To measure the acceleration, it is possible to determine the initial and final velocities by measuring between two sets of dots on the tape, knowing that the time interval between adjacent dots = 1/60 second (speed = distance between adjacent dots x 60). Counting the intervals between your two velocities will give you the time taken to accelerate (1/60 x number of spaces)
5. Repeat for a range of heights.

**Method D – VideoPhysics App on iPad**

1. Set up a metre ruler against a wall and mount an iPad so that it can clearly see the ruler.
2. Drop a squash ball (or similar) and record the motion using the VideoPhysics app.
3. Use the scale and origin function to calibrate the distance travelled between the frames.
4. Analyse the graph – what value should the gradient be?

**Method E – VideoPhysics App on iPad 2**

1. Drop a squash ball (or similar) from a range of heights and record the motion using VideoPhysics.
2. Use the time stamps on the video to determine the time-of-flight.
3. Use the equation *x = vot + ½ at2* to determine the mean acceleration. Compare with the official value of *g* = 9.81 m/s2.
4. Extension: plotting a graph of height against time squared should produce a straight line with a gradient = *g/2*.