

Subject: Physics

Key stage: 4

Topics covered: interpreting distance, speed and time graphs, acceleration caused by forces

Investigating the effect of air resistance on acceleration

In this experiment you can attach accessories to the DynaKar in order to increase the air resistance and explore the relationship with acceleration.

What you will investigate

How air resistance affects acceleration

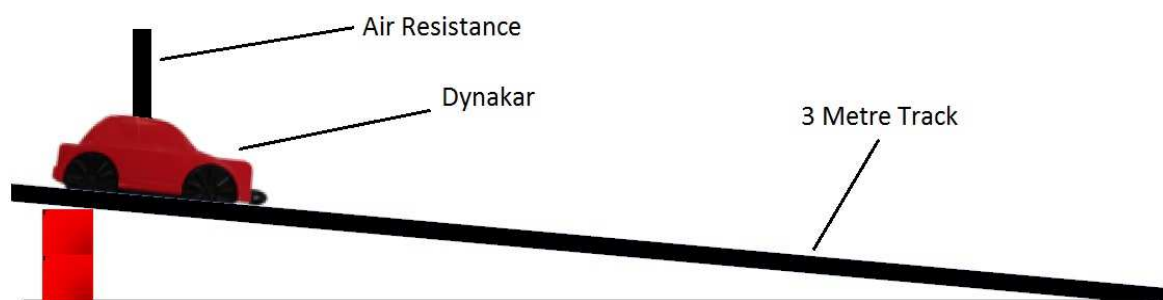
Equipment:

(All the equipment and software you need can be obtained from www.sciencescope.uk)

- A DynaKar
- DynaKar 2 Metre Track (The 1 metre track can be used though the results will be less visible)
- Sturdy pieces of rectangular material in a variety of sizes (e.g. corrugated cardboard)
- Logbook Graphing Software

Getting started:

Set up your DynaKar 3 Metre Track. Raise one end of the track to a height of around 75cm. Secure the raised end to a retort stand using the brackets provided with the track.

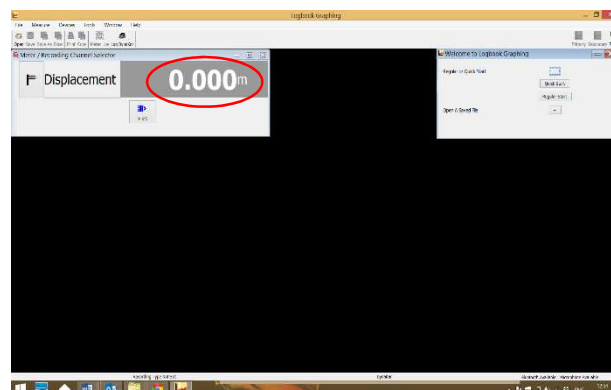


The experiment

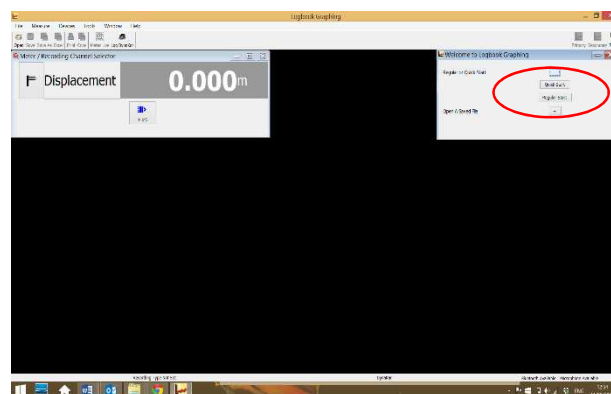
Open Logbook Graphing and plug the DynaKar wireless dongle into a USB port.

Check the dongle is connected to the DynaKar by moving the DynaKar wheels back and forth. The displacement log will vary.

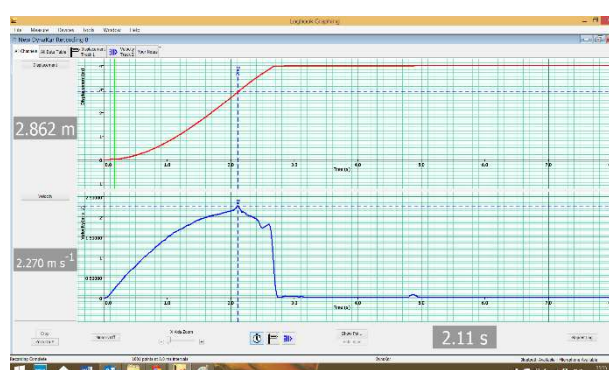
(If you have any problems connecting Logbook Graphing to the DynaKar please refer to the instruction sheet provided with it).



Place and hold the car at the top of the track and select "Quick Log" on Logbook Graphing.

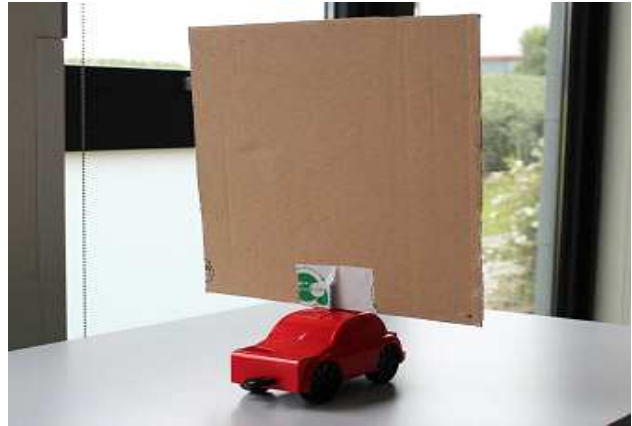


Release the DynaKar down the track. The software will log the DynaKar's displacement and velocity.



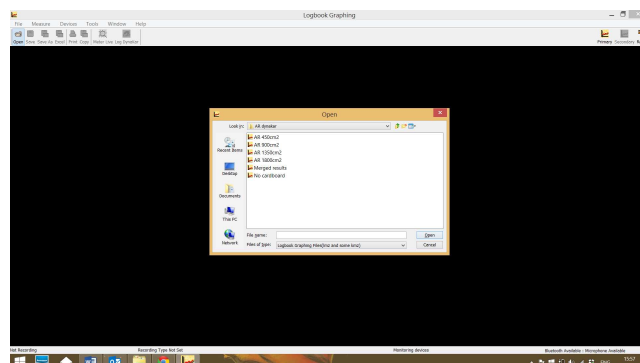
To increase the air resistance, attach a sturdy piece of material (e.g. a piece of corrugated cardboard) to the front or back of the DynaKar. Select 'Repeat Log' and release the DynaKar again. Save each graph individually.

Repeat this process as many times as you like using pieces of material with larger surface areas each time. The more readings you take, the more accurate your final result will be.

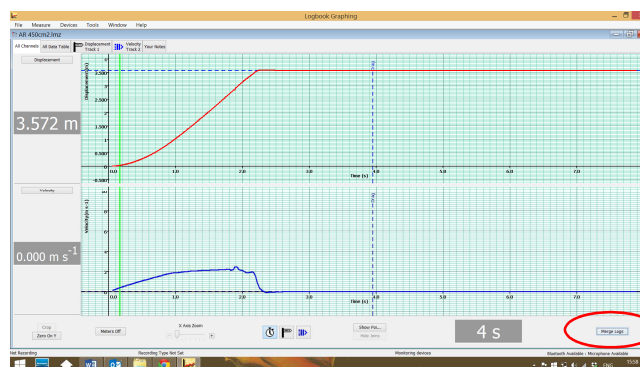


Analysing the results

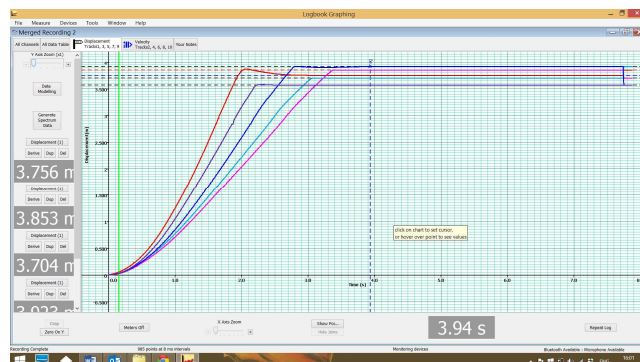
Open all of your saved graphs in Logbook Graphing



Click the 'merge logs' function, which will merge all open graphs.

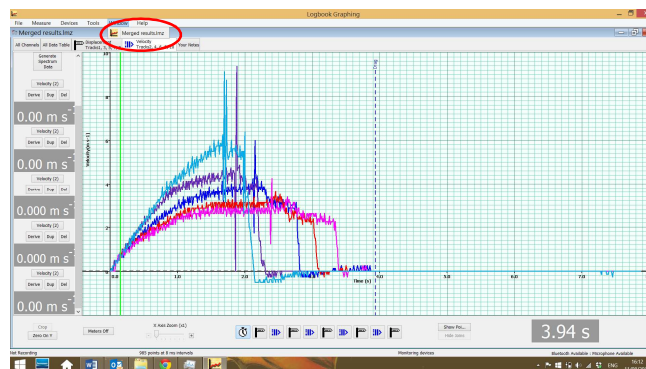


The new graph will display all of the DynaKar's journeys together.



Displacement-time graph

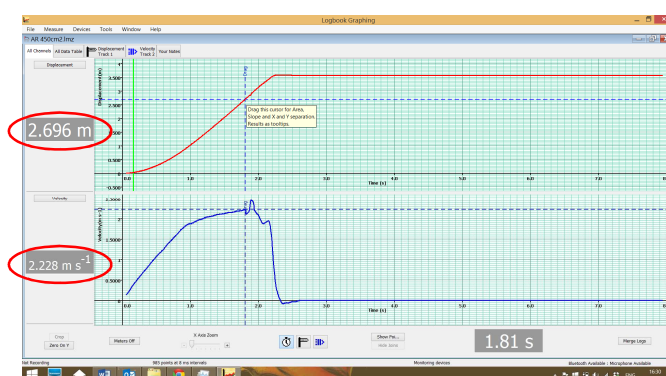
You can choose to display either the displacement-time graph or the velocity-time graph.



Velocity-time graph

For the 3 metre DynaKar track measure the journey distance as 2.7 m to allow for the length of the car.

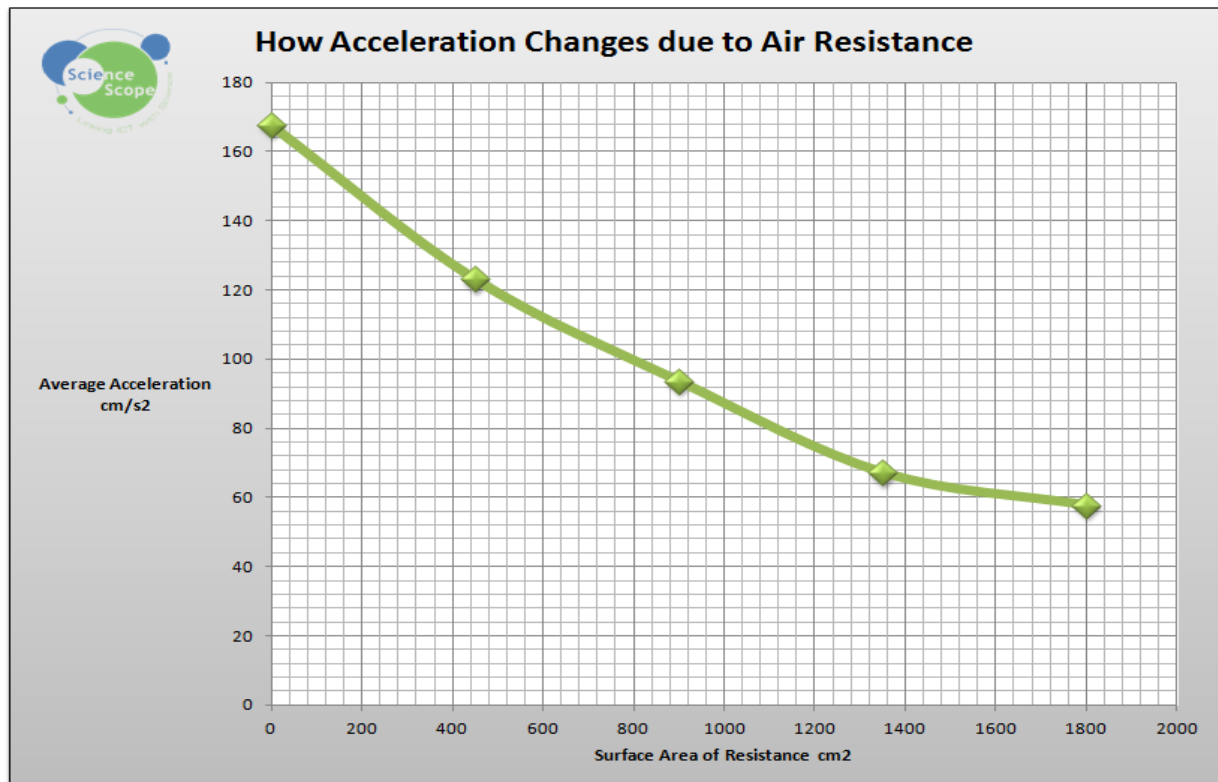
Select the point 2.7m on the displacement-time graph and Logbook Graphing will display the total change in velocity for the journey next to the velocity-time graph.



You can use these results to calculate how the surface area of the material affects the DynaKar's acceleration using the table below:

Reading Number	Surface Area of Material (cm ²)	Change in velocity (cm/s)	Time Taken (s)	Acceleration (cm/s ²)
1	0	285.00	1.7	167.65
2	450	222.80	1.81	123.09
3	900	192.00	2.05	93.66
4	1350	154.50	2.30	67.17
5	1800	142.00	2.46	57.72

Plot the following in a graph to illustrate the relationship between the surface area of the resistance and acceleration:



Taking it further

If you wish to explore this further try calculating the rate at which acceleration is affected by the surface area of the resistance.

Reading Number	Surface Area of Material (cm ²)	Change in velocity (cm/s)	Time Taken (s)	Acceleration (cm/s ²)
1				
2				
3				
4				
5				

