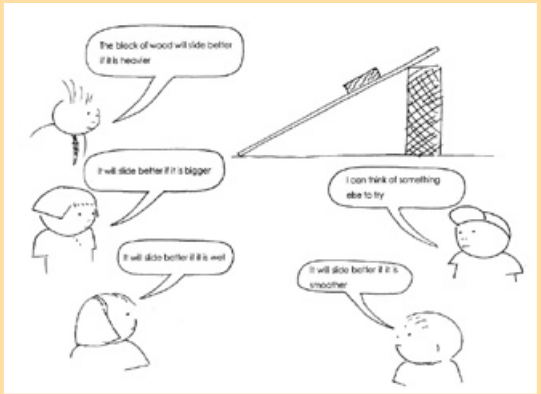
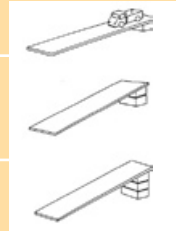







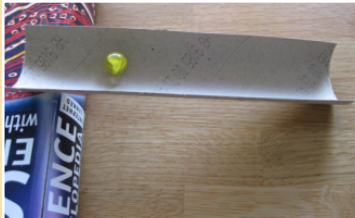
INVESTIGATING SLOPES

Equipment:	Lots of books or blocks (<i>of equal height if possible</i>), empty kitchen rolls, marbles or toy cars, measuring tape, small piece of plasticine or blu-tack, different materials (<i>e.g. carpet, wood, etc.</i>), scissors
Suggested Class Level:	All Senior and Junior
Preparation:	<p>Cut kitchen roll tubes in half lengthways.</p> <p>A discussion, and better still an activity, on ‘Friction’ (<i>see DPS activity FRICTION – SLIP OR STICK?</i>) would be good preparation for this activity.</p>
Background information:	<p>When a marble or toy car is let go at the top of a slope it is pulled down the slope by the force called gravity. Different weights are pulled down at the same speed (<i>remember Galileo’s famous experiment from the top of the Leaning Tower of Pisa</i>).</p> <p>But the distance they travel when they reach a flat surface at the bottom depends on the angle of the slope, the surface of the slope, and the type of surface onto which they run. If the angle of the slope gets too steep, the car or marble may fall off, i.e. take a nose-dive.</p>
Trigger questions:	<p>“What is a slope?” (<i>Children may talk about something being steep, at an angle...</i>)</p> <p>What do you notice when you walk/cycle up a slope/ down a slope? Do you go faster/slower? A good introduction could be a discussion on the following concept cartoon (<i>Brenda Keogh and Stuart Naylor, “Starting Points for Science”, Millgate House, UK, 1977, p 54</i>):</p> <p>Now place a marble at the top of a ramp (<i>a kitchen roll cut in half lengthways, and one end propped up on a book, will do</i>), and ask:</p> <p>What will happen when you let the marble go? What will happen when you make the ramp higher, i.e. when we add more books? What will happen when you make the ramp really really high? How would reduce the distance the marble runs on the floor? Can you think of anywhere slopes are useful? (<i>Ramps – e.g. for trolleys in supermarkets, wheelchairs; ‘hairpin’ bends on roads make it easier to go up or down very steep slopes</i>)</p>





INVESTIGATING SLOPES

Content:	SCIENCE: Forces (<i>Gravity, friction</i>) Materials (<i>Properties and characteristics</i>)	 
	MATHS: Number: operations (<i>estimate, calculate averages</i>) Shape and Space: lines and angles Measures: length (standard or non-standard) time Data: Represent and interpret	
Skills:	Predicting, investigating, experimenting, observing, recording; Exploring, planning, making, evaluating (<i>i.e. designing and making</i>)	
Cross-curricular Links:	SPHE: importance of ramps for people in wheelchairs History: when and where have ramps been used for transporting things up or down steep slopes? e.g. building the Pyramids in Egypt Geography: local studies (<i>any ramps in your area? Stones for building Dun Laoghaire pier were transported from Dalkey Hill by wagons on an inclined plane, i.e. a very long ramp</i>)	
Activities:	Older children: 1. What will happen to the car when we change the angle of the slope? “What will we keep the same?” (<i>Length of tube, type of surface</i>). “What will we change?” (<i>The angle of the slope</i>) “What will we measure?” (<i>The distance the car or marble travels</i>) Place the half-tube on the floor and place the marble or toy car in it – does it move? Place a book under one end of the roll – a piece of plasticine or blu-tack may be needed to keep it in place. Put the marble or toy car at the top of the tube. Predict how far it will roll along the ground. Then let it go (<i>just release it, do not push it</i>). Measure how far it goes. Repeat and take an average. Record the results.	
		



INVESTIGATING SLOPES

Place another book under the first one and repeat.

Repeat until the marble takes a nosedive from the top.

Number of books	Distance marble travels 1st reading	Distance marble travels 2nd reading	Distance marble travels Average

A graph could be made of the results:

Discussion/conclusion: "Did the angle of the slope make any difference to the distance the car/marble travelled?"

Did this fit in with their predictions?

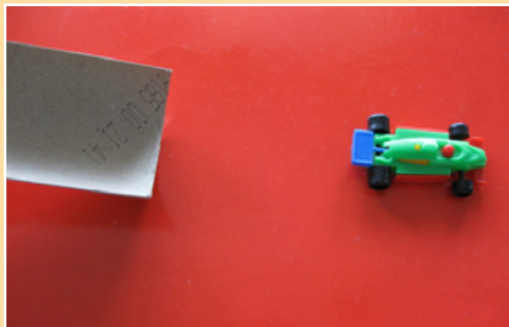


2. What will happen to the car when we change the floor surface which the car runs onto?(Let the children feel the different surfaces).

By keeping the angle of the slope the same and varying the surface onto which the marble rolls (carpet, wooden floor, grass, tarmac ...) children can investigate how to slow down moving things.

(a) A discussion on 'friction' and rough and smooth materials; (b) predictions as to which types of material would allow the car/marble to go furthest, and which would slow them down the most; (c) carry out the investigation as above.

The children can decide how to make a table to record their results, and then discuss which materials would be good for slowing down moving things (and apply this to moving cars and bikes).





INVESTIGATING SLOPES

Younger children:

This investigation can be done by younger children, measuring in non-standard units if necessary.

For fair testing, a suggestion might be for the teacher to push the car down the slope one time, and just let it go another time, and ask the children “Is this a fair test?” “Why not?”

Or perhaps measure one time from the front of the car, and another time from the back of the car; or start the cars from a different part of the ramp, and ask the children the same question, and then “Why do you think it is not fair?”

Number of books	Distance marble or car travelled

With how many books did the car travel the furthest?

Which surface slowed the car down the most?

Safety:

Follow-up Activities:

1. Longer slopes.

This investigation could be tried with longer slopes, e.g. empty kitchen foil or cling film rolls, or plastic gutter piping. Does the length of the slope make any difference?

2. Design and Make (*i.e. Explore, Plan, Make, Evaluate*)

Can the children design and make a ‘marble run’? E.g. use pieces of wood at different angles to control the movement and/or speed of the marbles. They can tape or stick down the pieces of wood, add tunnels, etc.

What different ways can they stop the marbles? (*e.g. Sand*)

The children could also time the different runs, change the angle by propping up the runs at one end by different amounts, time again, and compare the times. A graph could be drawn of ‘angle’ versus ‘time’.

Some examples of marble runs:

