Air Resistance - an Opposing Force (1)

Discovery Sheet

Aim

To investigate the effect of drag on cones of various sizes, dropped through the air.

Equipment

four BLOODHOUND SSC cone templates	scissors	PVA glue (Pritt Stick type)
3m retractable rule	stop watch or flipcam	pencil

Method

1. Work in pairs or groups.
2. Print out the BLOODHOUND SSC templates onto 160gsm paper.
3. Cut out the BLOODHOUND SSC cone templates
4. Cut along the yellow line where marked.
5. Put glue on the orange sector and then fold this section underneath the blue section and stick it down to form a cone - making sure that the paper is sealed flat.
6. Using a wall, or suitable surface, mark 2 metres up from the floor and make a mark. (Masking tape is best).
7. Measure a further 50 centimetres above the 2 metre mark.
8. One person takes one size of cone and on command drops it while another times its fall to the ground.
9. Repeat this several number of times to gain an average time for each cone.
10. Repeat the experiment using different sized cones.
11. Compare your results and look at the different times the cones took to fall and the surface area of the cone.
12. Complete your Discovery Sheet tables and discussion.

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Investigation

What I plan to do
What I will keep the same and what I will change
What I expect to happen
Diagram

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Results

Mass and dimensions of Bloodhound SSC cones			
Cone	Diameter of base (mm)	Slant height (mm)	Mass (grammes)
1			0.13
2			0.54
3			1.21
4			2.10

Cone	**Time Taken (Seconds)**	**Average Time Taken (Seconds)** $\frac{t1+t2+t3}{3}$
1	$t1$	
	$t2$	
	$t3$	
2	$t1$	
	$t2$	
	$t3$	
3	$t1$	
	$t2$	
	$t3$	
4	$t1$	
	$t2$	
	$t3$	

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Discussion

What actually happened?
Which cone reached the floor in the quickest time?
Which cone took the longest time to reach the floor?
Can you explain this? Think about the shape, weight and area of the cones.
What effect did gravity have on the cones? (Pushing? Pulling?)
Were there other forces acting on the cones?

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Discussion

Did your results agree with what you predicted might happen?
What did you find difficult in your investigation.

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How would you improve/change your investigation to make it better

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Extension Work & Science Discussion

BLOODHOUND SSC aims to travel on land at 1,000mph. In doing this it will have to overcome many forces that will try to stop or slow it. ***Drag,*** the opposition formed by air in front of BLOODHOUND SSC is one of these forces.

Drag is the aerodynamic force that opposes BLOODHOUND SSC's motion through the air; it is generated by every external part of the car.

To understand *drag* we must understand that if BLOODHOUND SSC is standing still then no *drag* is being generated.

- As soon as BLOODHOUND SSC moves it will create resistance from the surrounding air called *drag.*
- The faster BLOODHOUND moves, the more *drag* it will create.
- Our simple experiment took paper cones and dropped them with the external area of the cone facing the ground (?) trapping air beneath.
- The mass of the cone under the effect of gravity pulled it toward the ground while the air beneath the cone resisted the cones movement.
- As the velocity or speed of the cone increased, the frictional force, *drag*, also increased.
- Eventually the *drag* increases to balance the pull downward and the cone falls at a constant (even) velocity.
- We call this velocity, terminal velocity.
- In your opinion, when did *drag* start and end in your experiment?
- Try making cones of different slant heights. What would happen then and will they behave in the same way as the cones you have already tested?

  For cone templates of a different size, weight and surface area;

  Click here:

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Taking these ideas, discuss how you might change your cone to reduce the *drag*. Research BLOODHOUND SSC. Why is it designed with its shape? Research these things and present your findings to the class.

Your notes and ideas...