LINTON
VILLAGE COLLEGE

Linton Village College

Deep Learning Day

A whole day STEM-based activity for all pupils in year 7.

The pupils did two of the six activities and did each activity for 2 hours.

This set of activities have been developed using the Bloodhound materials. They can be further developed for all KS3 pupils and potentially into KS4/KS5.

Contents

STEM Deep Learning Day

Overview

8.30-8.45	8.45-9.45	9.45-10.45	10.45-11	11-12	12-1	1-2.05	2.05-3.05
Assembly to introduce task	Design & Build		Break	Maths		Lunch	All in Hall for static poster demonstration and car races
	Food			Geography			
	Point of Sale			Science			

Times	Activities	Resources
8.45 - 9	Introduction to the day in the Hall Students will be arranged into 6 groups and stickers will be prepared Every child will participate in 2 sessions out of the 6.The emphasis will be on team work and effective participation. Self - management will have to occur in order for the students to produce the work for the boards. PLTS to be introduced in the lead in + cards to be used in the sessions	ICT – speakers
9 – 10.45	Session 1 of the carousel	
11- 1	Session 2 of the carousel	
	Carousel tasks: Design & Build Design & Build –Pupils work to create the most aerodynamic car design from Styrofoam. These designs are put in an air tunnel, the less it moves, the more aerodynamic. Food Diet – What does a racing driver eat? Can you design a meal suitable for one? Can you adapt this into a marketable ready meal? Look at exercise for drivers.	

	Point of Sale Marketing – Point of sale design. How to market this event to commercial sponsors and the general public to buy associated merchandise. Geography Geography – Use Google Earth to find a suitable site for testing the vehicle Maths Maths – Newtonian mechanics, established by experimenting with toy cars Science Science – Experiments with cars to investigate forces such as friction There will be a time for ambassadors from each activity to meet in their original groups to discuss what they have each been doing and agree a common direction. The meeting area for this is E4 – need to supervise during session 2. In this way the design team should influence the marketing team to inform the food team etc. At the end of lesson 4 representatives from each activity take their group's work to the main hall where they will collate the 'greater group's' work on a display board.	
2 – 3.05	Hall for exhibition Film excerpt? Presentation – ambassadors from each group present To the year group	Chairs ICT

Schedule for Friday 10th February 2012

Everyone will start in the Hall for a brief introduction from X before moving to their rooms for session 1.

	D&B	Geog	POSale	Science	Food	Maths
PERIODS 1 & 2	A	B	C	D	E	F
PERIODS 3 & 4	B	A	D	C	F	E

ACTIVITY	**STAFF**	**ROOM**
Design & Build		
Food		
Point of Sale		
Geography		
Maths		
Science		

Student experts - Nominated and selected by delivery staff	Area
	Design & Build
	Geography
	Science
	Point of Sale
	Maths
	Food

DLD Stem day: Science 'Starting and stopping'

Objectives: To investigate how the Bloodhound could be fuelled

To investigate how the bloodhound could stop safely

Outcomes:

Measure the energy in different fuels

Name different fuels

Describe how the energy in fuels can be used for propulsion

Explain ways the car can be slowed down.

Time	Student	Teacher	Resources
0-5		Introduce session – fuel and safety features. Show clip of previous land speed attempts.	Youtube video
5-10	Groups brainstorm ideas on how the Bloodhound could be fuelled	Explain different fuels and energy conversions on Ppt.	Ppt
10-20		Demo 'whoosh bottle' to show the energy from combustion of ethanol/ propanol	Water cooler plastic bottles, ethanol, propanol, metre ruler with splint taped at an angle to one end, matches
20-35	Working in 2 groups per team, each testing a different fuel – heating up a boiling tube of water. Discussion – which fuel is best	*Don't lose any bottles!*	Ethanol, propanol, evaporating basins, mineral wool, thermometers, boiling tubes, clamps&stands.
35-40	Use balloons to think about how propulsion works	Demo hydrogen 'pop', and use same demo to show expansion of balloon – reactions making hot gases cause increase in volume.	Balloons, Test tube, HCl, Mg, splint
40-45		Discuss how jet and rocket engines work	ppt
If time	Groups make poster explaining different fuels, and the forces involved in propulsion		Paper & pens

0-5		Introduce second session – stopping safely	ppt
5-40 40-50 50-60	Student brainstorm ideas of how we get a fast vehicle to slow down. Design safety feature which can be tested on trolleys Class test designs, y9 helpers judge. Finish summary posters	Introduce challenge – use the materials to stop the trolley slowly.	Trolleys, ramps, cardboard, tape, foam, newspaper

Making Bloodhound GO … And STOP.

Objectives:
To investigate how the Bloodhound could be fuelled
To investigate how the bloodhound could stop safely

Outcomes:

- Name different fuels
- Measure the energy in different fuels
- Describe how the energy in fuels can be used for propulsion
- Explain ways the car can be slowed down

http://www.youtube.com/watch?v=fmbH1ApUG8M

What makes it go?

Ethanol

Petrol

Hydrogen

Fuels

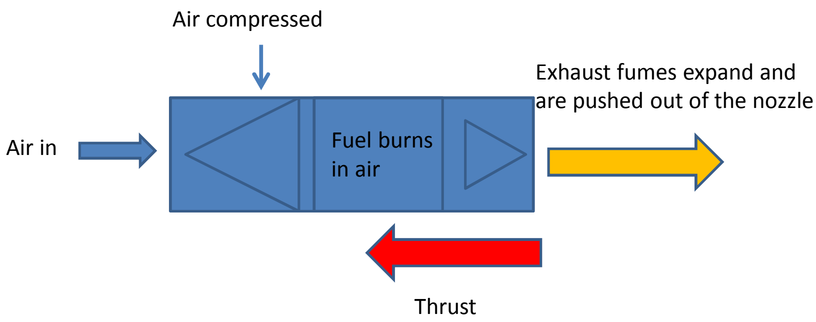
Solar
energy

Electrical
energy

Fuels differ from each other in:

- How much chemical energy they contain
- How quickly they release their energy
- How efficiently they release their energy

Jet propulsion

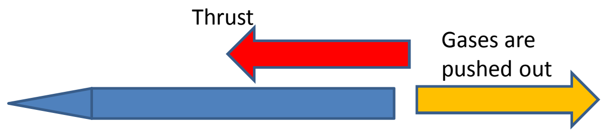


Rocket propulsion

Rockets carry their own oxygen supply as well as fuel so the fuel burns more quickly

The Bloodhound rockets will carry a type of rubber to burn and hydrogen peroxide (the same stuff they use for bleached-blonde hair!) as an oxygen supply

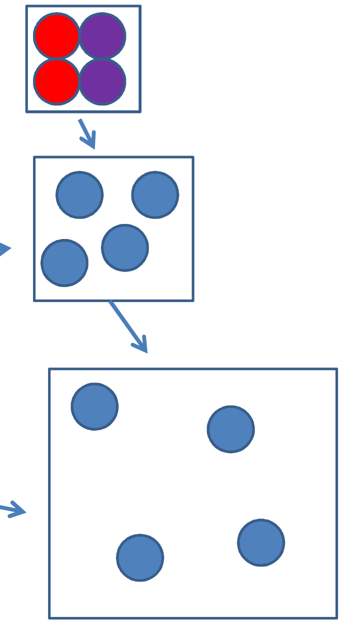
The rocket makes the car go forwards by firing out the hot exhaust gases



Combustion reactions produce gases

Gases take up more volume

Hot gases take up even more volume



The expanding gases produced by burning fuel powers engines

Chemical energy is converted to kinetic energy

- Fuel contains chemical energy, which can be converted to kinetic energy (moving)
- In your car, fuel reacts with oxygen (combustion)
- Hot gases are the products
- These expand, making parts of the engine move
- This movement is used to move the wheels

What makes it stop?

The bloodhound will accelerate to very high speeds, but it also needs to be able to stop!

The safest way to stop is to slow down slowly

Crumple zones

Escape lanes

Stopping safely

Brakes

Parachutes

Safety challenge

In your teams, design and build a safety device for your car that *slows it down slowly*

Use the ideas from crumple zones, escape lanes, brakes and parachutes to inspire you design

You may use any of the materials you like, but must share them fairly with other teams

At the end of the session, your design will be tested using the ‘trolley’ cars.

The winning design will be judged on these criteria:

Does the car stop?

Did it ‘slow down slowly’? – the car should come to a gentle stop, and not bounce / fall over/ bang into things!

Objectives:
To investigate how the Bloodhound could be fuelled
To investigate how the bloodhound could stop safely

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- Explain ways the car can be slowed down

Desert Selection Programme - Geography

Problem:

The Black Rock Desert in Nevada, site of the previous world land speed record, has deteriorated in recent years. BLOODHOUND requires a flat, smooth surface long and wide enough to safely reach, and slow down from, its target speed of 1000 mph.

Activity

Use Google Maps (click on satellite view) and identify the dry desert area at Black Rock City, Nevada. How big is the area? Is there a 12 mile straight for testing BLOODHOUND? There is a scale in the bottom left corner of the screen.

Finding a new test site:

The Desert Search program, led by Andy Green, defined a list of priorities:

1. Flat ground (insignificant surface slopes)
2. Smooth surface (at the level of centimetres)
3. Large area (12 miles by 3 miles minimum)
4. Reliable surface dry-out period (may be different time of year for different climate regimes)
5. Access from road network (heavy loads)
6. Security (political and non-political)
7. Potential for publicity and constructive competition

Question 1

Why is the width of the test area important?

Question 2

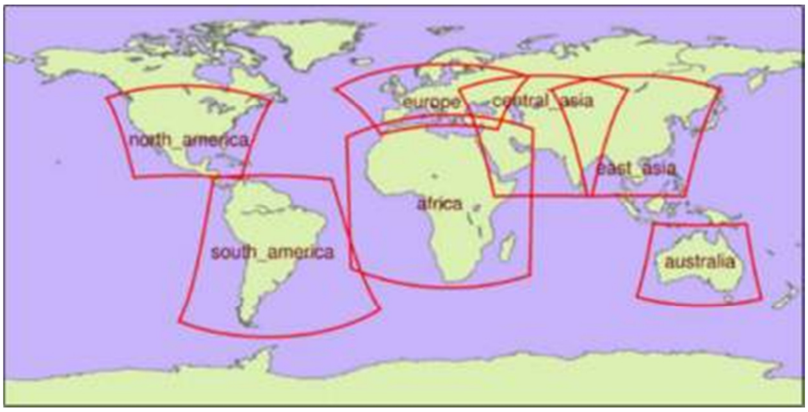
Use Google Maps and identify the road network to Black Rock Nevada.

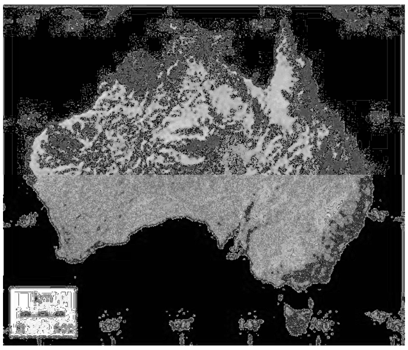
Where is the nearest Motorway (I roads in USA)? Where does it lead? Where is the nearest major airport? Seaport? Where is the nearest town where the Bloodhound crew could stay?

A semi-automated search for candidate test sites was devised:

1. Split the globe into 7 map regions

2. In each region seek flat areas of a minimum size in a digital elevation model of spatial resolution 100 m acquired by the Space Shuttle in 2000





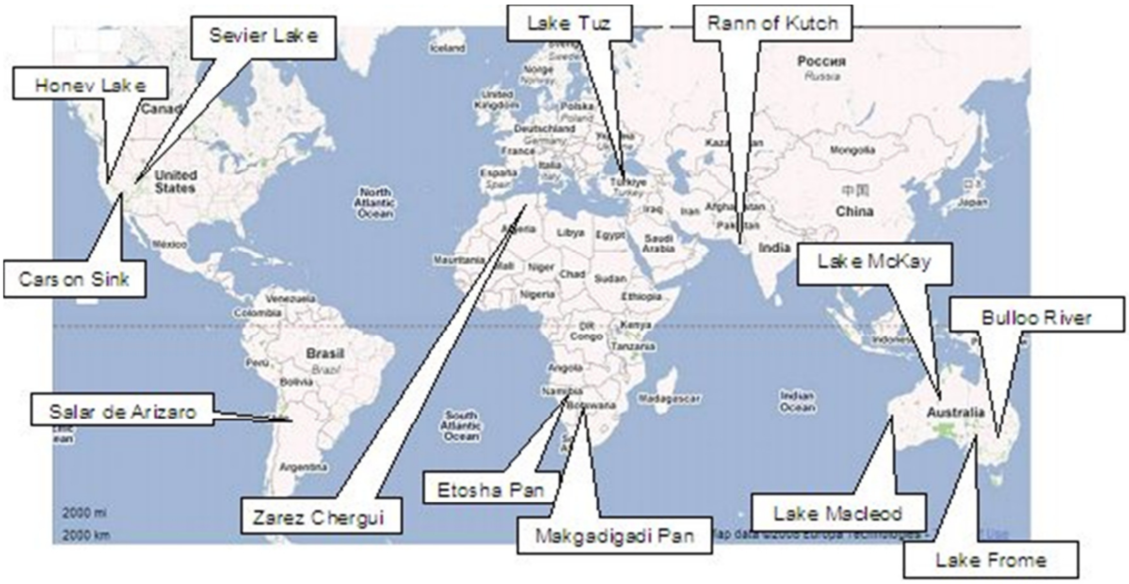
3. Reject areas known to be vegetated from a satellite image classification of land cover

4. Create maps of suitability from the combination of flatness and lack of vegetation

5. Use further high spatial resolution satellite data and Google Earth to refine the search to desert lake beds which potentially have the required smoothness

6. Make further refinements based on access, meteorology, political sensitivity and site visits

Thirty-six potential sites were identified in this way, nine of which are already known as land speed trial sites, and thirteen of which need further investigation:



Question 3

Locate the deserts in the above map on Google Maps and, using information from the rest of the web, discuss them in terms of Andy Green's priorities 4,5,6 and 7 above.

This will form the basis of your posters

Question 4

Locate the Bonneville Salt Flats in Utah using Google Maps and research the location on the internet; give two reasons why they are probably unsuitable for BLOODHOUND SSC.

Question 5

What is the difference between the salt lake surface and the alkali playa surface? Why is the alkali playa preferred?

Maths Lesson Plan

Time	Activity	Resources
0-10 mins	Introduce task and set up carousel.	Experiment plans pre-printed.
10 - 80 mins	Pupils carousel, using their dragster model to complete the various experiments (below) and record their data	Dragster models, ramps, timers. Pen & paper
80-100 mins	Class plenary – discuss outcomes of experiments and findings. Link findings to the Newtonian Mechanics.	
100 – 120 mins	Pupils create posters about their experiments in the style of R&D displays	Sugar paper, pens, plain paper, glue, scissors

Experiments

Friction compensated ramp	Method: The ramp should be set up with the thin end of the wedge under one end. Place the car on the ramp. It should not be moving. Push the wedge slowly under the ramp so that one end of the ramp gets higher. The dragster should start to move at some point - when it does, stop moving the wedge. If the wedge isn't lifting the ramp high enough then a block might be needed. Record the height at which the dragster started to roll. A plumb-line and protractor could also be added to the end of the ramp. This would allow students to calculate the angle it is above the horizontal. Drop the ramp down and repeat the test. Alter the dragster and see if it will start to roll at lower heights. These will tend to be alterations that stop the straw rubbing on the wheels for instance.
Rolling distance test	Method: Set the apparatus up as in the diagram. The ramp should be higher than needed for the FCR. The dragster needs to roll down it. Place the dragster on the ramp and release it. Measure how far the dragster travels. Change something about the dragster and see if it will travel further. The dragster will need to be placed the same distance up the ramp each time. The distance needs to be measured from a fixed point to the same part of the car each time. Adding a nose cone or changing the mass would be good initial ideas to test.

Wind Tunnel Test	Method: Place the dragster on the bench. Slowly bring the fan (which should be on!) towards the dragster. When the dragster starts to move stop moving the fan. Measure the distance that the fan is away from the dragster when it starts to move. Add a large spoiler to the dragster and repeat the test.
Propelled distance test	Method: Loop the paper clip onto the rubber band and fashion a hook from it. Put the hook so that it connects to the plastic ring on the dragster. Extend the rubber band by a set amount while holding the plastic ring. Release the car - it should travel. Measure the distance covered by the car. Add mass to the car (stones inside, blu tac, coins) and repeat.
Rolling direction test	Method: Set the apparatus up as in the diagram. The set distance chosen doesn't matter too much but will depend on the room available. Put the dragster a fixed distance up the ramp. Let the dragster run down the ramp. Measure how far away from the straight line path the dragster is at a set distance away. Alter the car and repeat the test aiming for a straighter path.
Propelled direction test	Method: Set the apparatus up as in the diagram. Loop the paper clip onto the rubber band and fashion a hook from it. Put the hook so that it connects to the plastic ring on the dragster. Extend the rubber band by a set amount while holding the plastic ring. Release the car - it should travel. The set distance chosen doesn't matter too much but will depend on the room available. Measure how far away from the straight line path the dragster is at a set distance away. Alter the car and repeat the test aiming for a straighter path.
Rolling Speed Test	Method: Set up the apparatus as in the diagram. Choose a distance over which the dragster will travel and over which it will be timed. Place the dragster on the ramp, the same distance up the ramp each time. Let the dragster go and start the stopwatch when it leaves the bottom of the ramp. Stop the stopwatch when the dragster has travelled the distance. Speed = distance/time, so calculate the speed of the dragster. Alter the height of the ramp and repeat the test.
Propelled Speed Test	Method: Set up the apparatus as in the diagram. Choose a distance over which the dragster will travel and over which it will be timed. Loop the paper clip onto the rubber band and fashion a hook from it. Put the hook so that it connects to the plastic ring on the dragster. Extend the rubber band by a set amount while holding the plastic ring. Release the car - it should travel. Start the stopwatch when it crosses the start line. Stop the stopwatch when the dragster has travelled the distance. Speed = distance/time, so calculate the speed of the dragster. Alter distance the rubber band is pulled back and repeat the test.

Diet and Ready Meal for a racing driver – Food technology

Aim: The class will develop marketing skills and recognise what the main ingredients are to form the basis of a healthy ready meal for a Racing Driver.

Starter Activity: Students must know that food choices affect how they feel (mood) and how their bodies develop. Read out several menus from local restaurants in Cambridge. Begin asking the students whether the meals sound healthy or not. Show the power point. Teacher will INTRODUCE with the class the food pyramid and healthy eating concept. Teacher will discuss with the class some ideas of food they think would be suitable for a racing driver.

Main body of the session: Teacher will divide the class into pairs. Students will design a ready meal for a racing car driver that contains good food choices from each of the areas of the Food Pyramid. You must present your ideas in the form of a **poster.** This will be presented to the rest of the class.

Success Criteria

- 1. Have a main heading
- 2. Use pictures and colour to ensure your poster is attractive
- 3. Make sure your ready meal is for a Racing Car driver
- 4. Think about how your meal will attract customers.

They will need to include a cover and prices for the food items. Pairs will present their ready meal plan to the class. They will exchange plans with other pairs and use peer assessment against the success criteria.

Students will then form small groups and select a popular ready meal to market via a dramatized TV advert. What makes an effective TV advert?

- Persuasive language
- Offer
- Jingle
- Humour
- Any more???

Extensions: 1.) Students could create their own restaurant menus for athletes. 2.) They could suggest ideas for their own school lunch. 3.) They could keep a food journal for a week.

Plenary: Evaluate the reasons for the increase in ready meals consumption in the UK.

Resources:
Pencils, coloured pens, A5 paper, restaurant menus (online).

STEM DLD DAY

What does a racing driver eat?

DIET

FOOD A proper diet is vitally important to all competitive athletes. Racers have to be even more disciplined with their diets in order to achieve peak performance inside the race car. Driving a race car requires a tremendous amount of energy, and a driver must be properly nourished and hydrated beforehand.

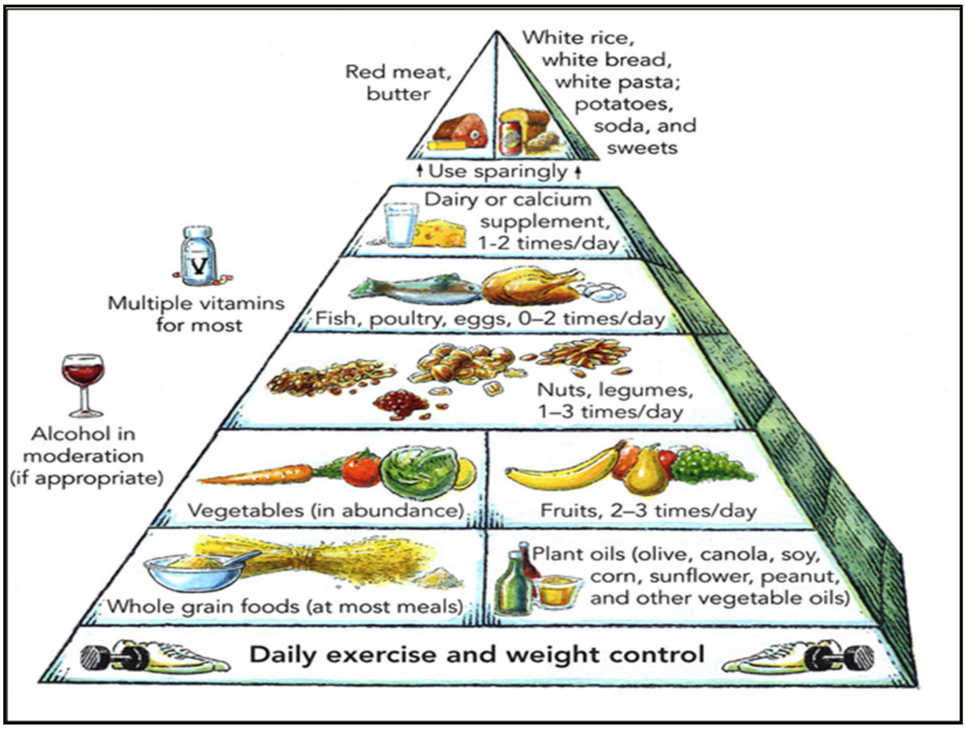
DRINK Hydration is even more important to racers because they often lose several pounds of body weight through perspiration during any given race. Becoming dehydrated during a race leads to many problems such as fatigue, diminished mental alertness, slower reactions, and driving errors. Normally though, most racers make sure to drink lots of water or sports beverages before, during, and after a race.

Fuel for a race event

- Pasta (stored ENERGY)
- Chicken (high in carbohydrates and protein).
- Energy bars
- Water
- Scrambled eggs
- Banana
- French fries

DESIGN BRIEF

There has been a large increase in sales for ready meals. A Racing car company wish to expand their range of ready meals for their drivers. You have been asked to produce a ready meal for their new range.



POSTER DESIGN

Design a ready meal for a racing car driver. You must present your ideas in the form of a **poster.** This will be presented to the rest of the class.

Success Criteria

- 1. Have a main heading
- 2. Use pictures and colour to ensure your poster is attractive
- 3. Make sure your ready meal is for a Racing Car driver
- 4. Think about how your meal will attract customers.

Good Luck!

TV ADVERT

Market your plans via the creation of a TV advert

What makes an effective TV advert?

- Persuasive language
- Offer
- Jingle
- Humour

- Any more???

Design and Make – Design Technology Lesson Plan

Intro 20 mins	Design brief explained, to design and build a very aerodynamic model of a 'land speed' record breaking car and test its aerodynamics. Introduction to the SSC project: Why does a super-fast car need to be aerodynamic? What is aerodynamics? What is air? What happens if the aerodynamics isn't designed correctly? Why would the makers test a model vehicle in a wind-tunnel before making an actual real size version? What other products would be tested in a wind-tunnel? STEM experts:	Six teams of 4, students introduced to the task: • Student 1, plastic moulding one wheel for their own team (three wheels already prepared if needed). • Students 2 & 3, to prepare and make the car body (cardboard prepared using a template pin), axle arrangement. • Student 4, to make good quality colour designs of car with a team name and colour scheme. All design work to be displayed in a portfolio.
40 mins	STEM experts guiding students	Various task activities as listed above, Teacher supervision.
1 hour	Equipment; junior hacksaws, glue guns, craft knives	Teams start to carefully assemble the components to make the cars, special attention given to axle alignment, which will control the vehicle.
1 hour, 20 mins	Wind tunnel testing Tape measure used to check distances.	Each team to measure how far each car is pushed back by the air fan, recording the measurements. A chart is generated to be added to each team's portfolio of experimentation with different aerodynamic designs. Nose-cone modifications are made to suit designs from portfolio. Modifications continue until the car moves least of all in front of the fan.
1 hour, 40 mins		Testing continues; wind resistance measured. Cars can be modified in between testing with card wings, aerofoils added with also team design emblem and logo.
2 hours	Plenary on aerodynamic engineering learning. Student experts to ask questions if they wish, testing knowledge and understanding of their learning on aerodynamics	Cars ready for race launching!

BLOODHOUND SSC
ENGINEERING ADVENTURE

Dragsters

How to make the basic car

You will need …

A sheet of paper

Scissors

A short length of 28mm tube

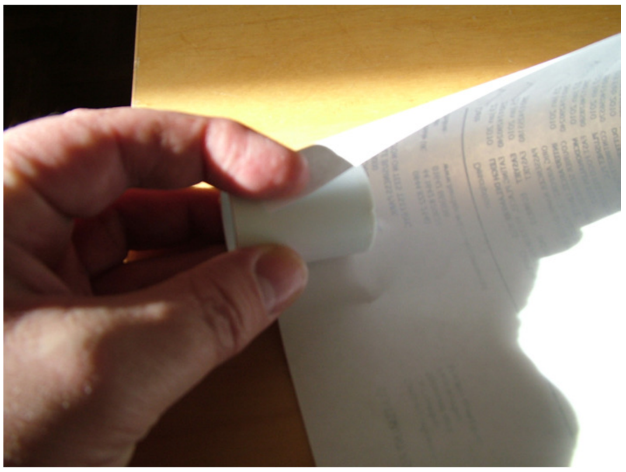
Wheels

Axles

Sticky tape

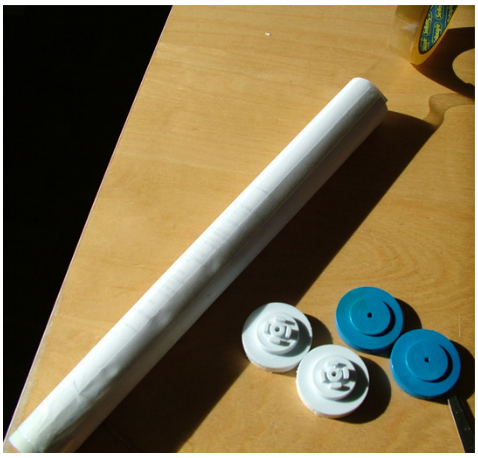
Drinking straws

Roll the paper into a cylinder around the short length of tube



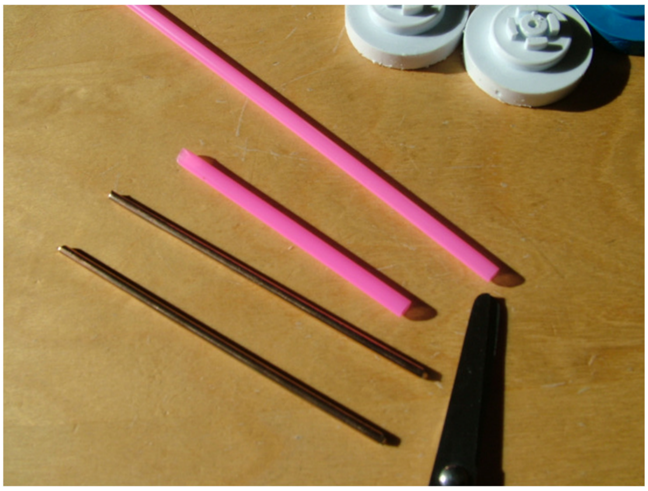
Tape the end firmly to the tube

Put tape along the edge of the paper



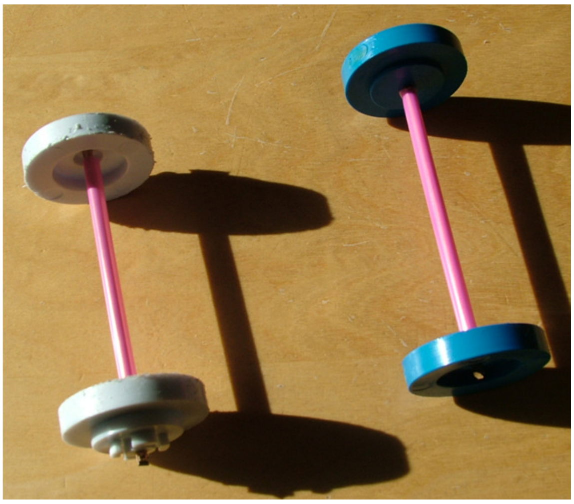
Put tape over the top to make the one end of the cylinder air tight

Next cut the drinking straws so they are slightly shorter than the axles

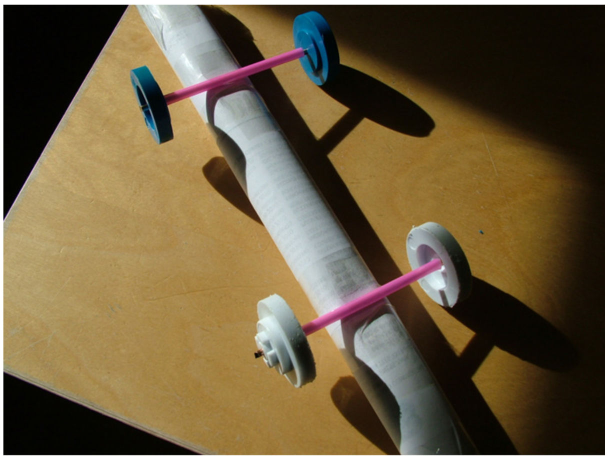


Put the axles inside the straws

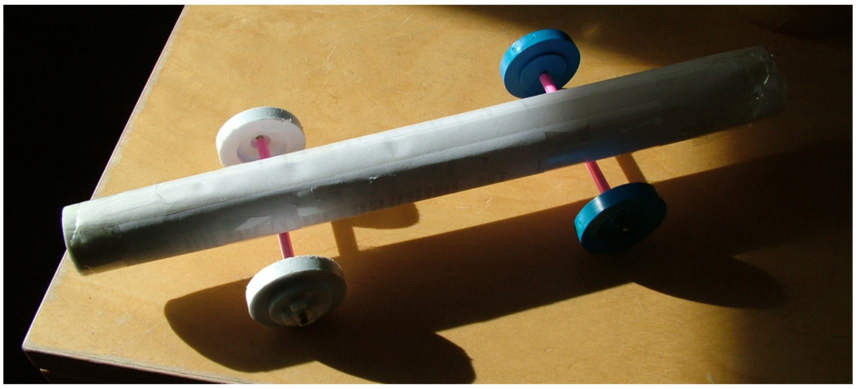
Push the wheels onto the axles



Tape the straws to the body



Finished!



Point of Sale Lesson Plan – Design Technology - Graphics

Starter:

Introduce task. Show images of point of sale stands to familiarise pupils. Discuss audience and use of colour, language, font, etc.

Main:

Pupils complete the task below:

- Design your own point of sale stand.
- Either design your own point of sale or use the template provided to create your point of sale.
- Add your graphics. You will need to design the back section of the point of sale stand also.
- Remember that the POS display is designed to support the *sale* of products and so may be a 'stand'

Pupils are provided with modelling card to physically construct their point of sale boards

Plenary:

Pupils compare their point of sale displays and make a short presentation on why theirs will appeal to customers

Point of Sale Display

Point of Sale Display

- Point of Sale Displays are usually made from card (generally cheaper) or from moulded plastic.
- The main principle being that they are disposable, have a deliberately limited life and are easy to manufacture and assemble.
- They may also be used as cheap display shelving for fairly light (weight) products.

Point of Sale Display

- Point of Sale Displays enhance the product and can easily be altered and redesigned as the product itself is repackaged or as the product change.
- More conventional POS displays may arrive at the retailer - or display point as a flat pack.
- This is clearly so that transport is easier and cheaper and damage is less likely to occur.


SPAIN
WINES FROM 1.99
SPAIN
BUY ANY 2 AND GET £1 OFF!
SHERRY & MONTILLA
Discover the taste of Spain
LAST WEEK
OF PROMOTION


HALF PRICE
Lucozade SPORT
CLIF BAR
CLIF BAR
CLIF BAR
OATMEAL RAISIN WALNUT
CHOCOLATE CHIP
VIPERACTIVE
VIPERACTIVE

Point of Sale Display

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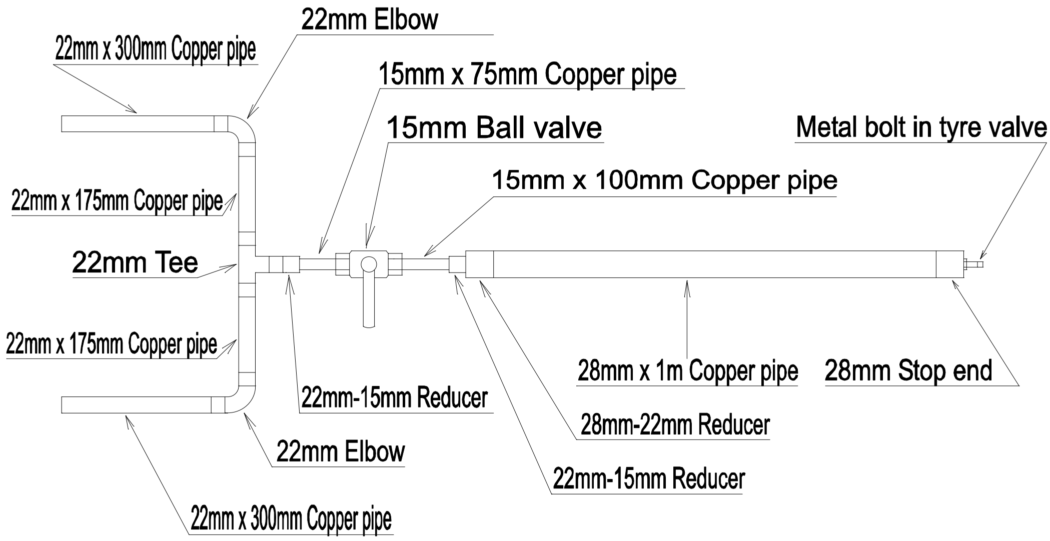
Pneumatic Launcher



Materials List

1 - Metal bolt in tyre valve.
1 - 28mm Stop end.
1 - 28mm x 1m Copper pipe.
1 - 28mm-22mm Reducer.
1 - 22mm-15mm Reducer.
1 - 15mm x 100mm Copper pipe.
1 - 15mm Ball Valve.
1 - 15mm x 75 Copper pipe.
1 - 22mm-15mm Reducer.
1 - 22mm Tee.
2 - 22mm x 175mm Copper pipe.
2 - 22mm Elbow.
2 - 22mm x 300mm Copper pipe.

Assembly Instructions

- Drill 28mm stop end to suit metal bolt in tyre valve.
- Solder 28mm stop end to end of 28mm x 1m copper pipe.
- Fit metal bolt in valve to 28mm stop end when cool.
- Solder 28mm-22mm reducer, 22mm-15mmreducer and 15mm x 100 copper pipe to 28mm copper pipe.
- Solder 22mm x 300mm copper pipes to 22mm elbows.
- Solder 22mm elbows to 22mm x 175mm copper pipes.
- Solder 22mm x 175mm copper pipes to either side of Tee.
- Solder 22mm reducer to 22mmTee.
- Solder 15mm x 75 copper pipe to22mm-15mm reducer.
- Join both assemblies using the 15mm ball valve.

Operating Notes

Pump the cylinder up to 60 P.S.I. ready for launch. * Do not exceed 60 P.S.I.*
If only one car is being launched block off the end you are not using.
You may wish to consider building the launcher with only one launch tube instead of two to reduce the inconsistencies when launching.
Take great care when using compressed air.