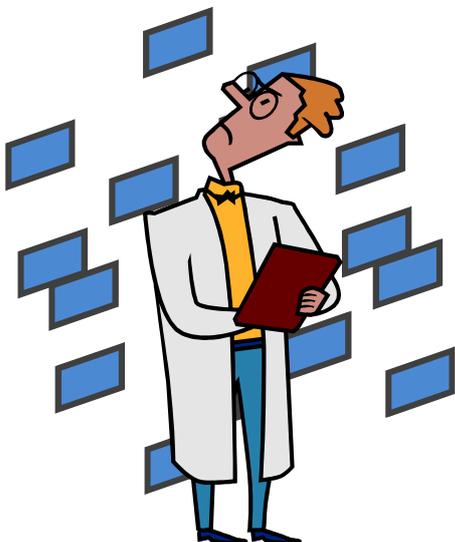




Tried and Tested Technology Challenges (T3C)

Teacher's Support Materials



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Tried & Tested Technology Challenges

1. A Balloon Powered Vehicle
2. A Model Boat
3. A Timer to ring a bell
4. A launcher for a ping-pong ball
5. An electrical Quiz board
6. A Sorting Machine
7. A Weighing device
8. A Marble transfer device
9. A Particular Pylon
10. An eco-friendly Christmas cracker
11. An egg transfer device
12. A Jack in the Box
13. A satellite grabber
14. A Windowsill Greenhouse
15. The Paper Engineering Challenge

The above challenges are ideal as an introduction to practical problem solving and the 'Design Process'.

Pupils should be encouraged to work as a team, to discuss ideas and plan before starting any practical work. Where necessary, they should carry out simple scientific investigations to support their design decisions.

The following notes are not prescriptive, but give suggestions for resources and solutions. Pupils should be encouraged to come up with their own ideas.

The Design Process

The general principals are the same for any project:

1. Define the problem being solved

Be able to state clearly what you are setting out to achieve

2. Consider a number of solutions

Brainstorm a few different design ideas before you start to make anything

3. Carry out research

Ask questions, interview experts, search on-line, look up books etc
Do simple experiments to help you make design decisions (e.g. to compare different materials before deciding what to use)

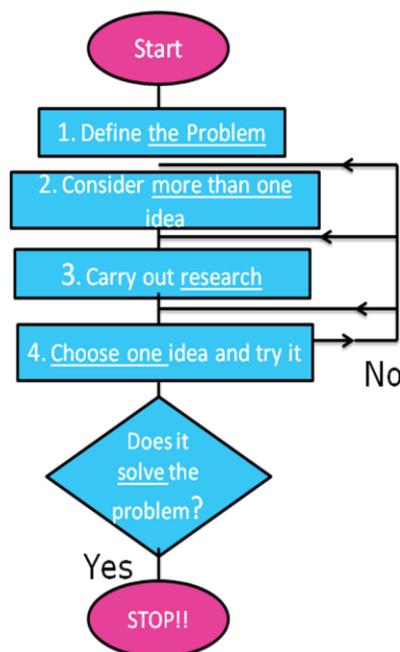
4. Decide on one design idea and build/make it

Make sure all the team are involved. Agree on a plan.

5. Evaluate the finished design

Test its performance. If unsuccessful, go back to stage 2 and make improvements and work up to stage 4 until the team agree the challenge has been successfully completed.

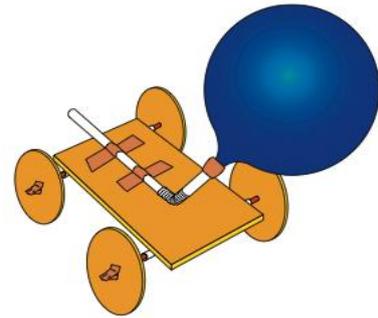
6. Complete a technology report/take photos for display



1. A Balloon Powered Vehicle

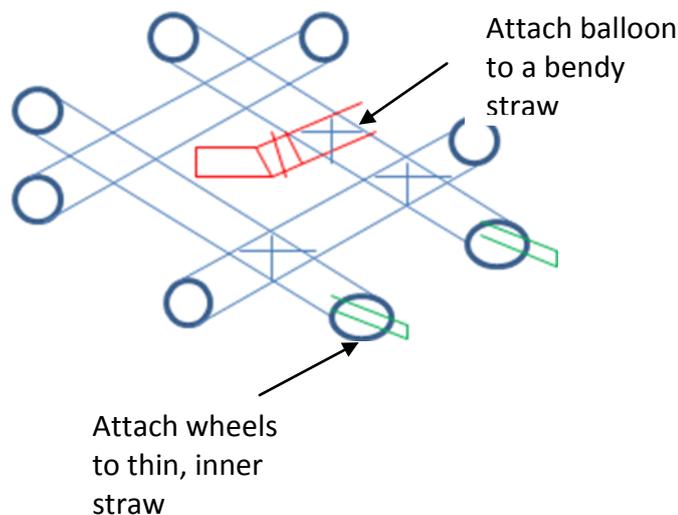
Resources Required

- CD wheels and Dowelling axles
- A4 card tubes to put round the axles
- Assorted Balloons – try different shapes
- Bendy straws (to channel the air from the balloon.)
- Small elastic bands
- Paper cup, polystyrene or cardboard box to support the balloon. (This should be attached to the card tubes round the axles)
- Ping Pong Ball



Handy Hints

- Homebase stock dowelling which fits the CDs
- The Technology Enhancement Programme website <http://www.mutr.co.uk/> has little adaptors which fit into CDs to improve their performance as wheels.
- Alternatively, card wheels attached to thin straws, placed inside wide straws, form a very lightweight chassis. Orthodontal elastic bands are useful to hold straws together.



2. Model Boat

Resources Required

- Wood or polystyrene hulls
- Cocktail sticks or straw masts
- Card or cloth sails
- Plastic paddles
- Blutac
- Lolly sticks and elastic bands to hold paddle(s)
- Hair dryer or air blower
- Stopwatch
- Water Jug
- Tape measure or metre stick
- Mop!



Handy Hints

- Pupils should be encouraged to test different shapes of hull, to make their boats streamlined.
- Please be aware of hazards caused by water spillage.
- **Electrical devices should not be used with wet hands**



3. A Timer to ring a bell (after a specific time interval)

This challenge has a variety of possible solutions such as

- A candle timer
- A water clock
- A Marble (or domino) run



A Candle Timer

The candle requires a pin to be inserted at a suitable height so that it falls out when the wax melts. If it is connected using thread to a small metal object, and the thread placed over a simple pulley, the timer will make a noise when the object falls.

Pupils must only light the candle with adult supervision.

A Water Clock

If water passes through a funnel into a waiting container on a see-saw balance, the balance will tip to one side when it becomes the heavier one. This can trigger a noise, for example, if it causes a pin to burst a balloon or it completes a circuit with a bell or buzzer.

A Marble Run

A foil covered marble or falling domino can be set to complete a circuit after a prescribed length of time

4. A launcher for a ping-pong ball

The Technology Enhancement Programme <http://www.mutr.co.uk/> can supply a simple Launch pad kit to project the ping pong ball. The two motors rotate in opposite directions and there are rubber bands round the yellow discs to help grip the ball. Pupils are required to customise their kit so that they can set the device to fire at different targets.

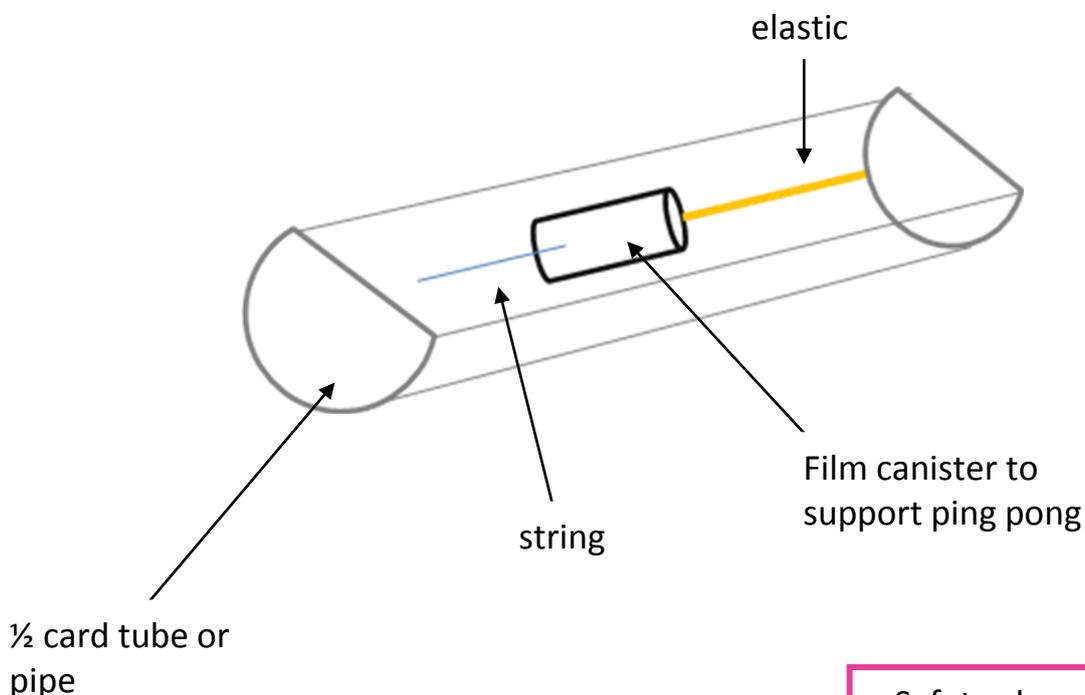
There is scope for investigations into how voltage or angle of projection affects the range of the launcher.

Enterprising groups may go on to develop a game based on the launcher.

OR

Make your own!!

(A cardboard tube, rubber band and film tub can make the basis of a simple firing device)

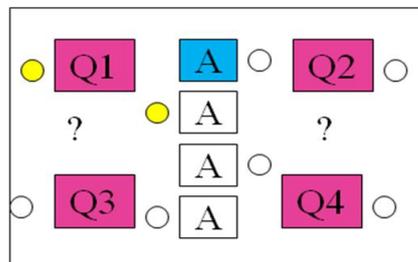


Safety glasses should be worn when firing projectiles

5. An electrical Quiz board (lights up or buzzes if answered correctly)

Resources

- 1 sheet card
- Paper fasteners
- Connecting wire
- 1 battery and bulb



Pupils choose their own theme for the quiz and design the board to give both the questions and the answers.

Paper fasteners placed beside each statement allow you to place a connecting wire on the back of the quiz board joining each question to the correct answer.

A simple circuit using one battery and one bulb should light up if connected across the question and the answer.

5. A Sorting Machine

Resources: A basic machine can be made using card, possibly supported using skewers or cocktail sticks.

One solution is to construct a ramp with trap doors built in so that the objects roll down the ramp and fall into a container below.

- If sorting by size, vary the trap door sizes, smallest first.
- If sorting into 5s or 10s etc, the container should be just tall enough to take the required number.

Please note: There are other solutions and pupils may want to investigate their own ideas.



6. A Weighing device

Handy Hint for Pupils: **1ml of water has a mass of 1gram.**

Two simple solutions are suggested below.



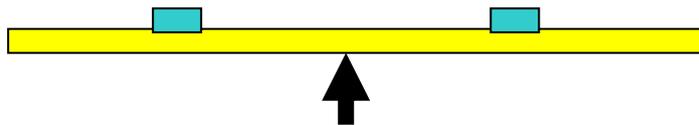
(i) Stretching elastic

A paper cup or water bottle hung from an elastic band or a spring will stretch the elastic/spring according to the weight of the object in the cup.

To calibrate their device the pupils can use fixed volumes of water initially to prepare a scale beside the device.

The unknown item to be weighed can then be placed in the empty cup and the weight calculated using the scale.

(ii) See-saw device



Equal masses will balance the see saw if they are equal distances from the turning point.

The unknown mass can be matched with water in an identical container. The volume of water needed (ml) will give the mass of the water (g)

7. A Marble transfer device

Resources

- Marble
- 8 sheets A4 card
- Scissors
- 1 roll sellotape
- 20 paper clips
- 4 wooden plant stakes or skewers



A helter-skelter type construction supported using skewers will give a runway for the marble. Sellotape can be used to provide a sticky surface to slow the marble down.

8. A Particular Pylon

Resources

Kit 1: Fruit pastilles, straws, and cocktail sticks

Kit 2: Pasta strands, marshmallows

Quantities of each kit has been left open for the group to agree in advance. A price should be put on each commodity to let the pupils work out the cost of their structure.

Handy Hints

- The test weight could perhaps be a weighted film canister or a real egg
- The pupils should definitely try to work to a plan so researching pylon styles is advised.
- Avoid really thin pasta strands.



9. An eco-friendly Christmas cracker



This challenge is designed to encourage an eco-friendly choice of materials – recycling encouraged!!

The cracker does not need to ‘Bang’ though craft shops do supply simple cracker ‘snaps’

This adapts easily to becoming an ‘enterprise’ challenge, with a focus on product design and promotion

10. An egg transfer device

No solutions offered here – pupil imagination and planning required.



Handy Hint

Testing safer using hard boiled eggs!

11. A Jack in the Box

Pupils can usually make a box, having drawn out a net to start off with. Ideas for the lifting mechanism and the egg ‘cup’ can vary widely.

(i) A balloon placed in the bottom of the box, inflated using a tube out the back of the box

OR

(ii) Attaching the eggcup to the lid of the box so that the egg is automatically lifted when the lid is opened.

OR

(iii) Springs made from the card can be squashed into the box when it is shut so that they push the egg up when the box is open.



This challenge gives scope for imaginative design!

12. A satellite grabber

The model satellite is made using a helium balloon. Pupils are first asked to attach model solar panels (using tissue paper and bendy straws) and just enough polystyrene to keep the model from floating upwards. This simulates the satellite in geostationary orbit.



The task is then to devise a way to recapture and retrieve the satellite from a distance (eg 1-2 m)

Suggested materials : garden canes, Elastic bands, sellotape, string, Paper cups etc

Pupils should **NOT** inhale the helium for safety reasons.

14. A Windowsill Greenhouse for tea-bag grow bags

This challenge gives pupils an opportunity to construct a model 'house' with materials such as polystyrene, straws, skewers, lolly sticks etc and acetate or polythene walls/windows. Alternatively, baguette trays or plastic containers may be suitable. Pupils can then investigate the effectiveness of using different types of tea bags as mini grow bags.



13.The Paper Engineering Challenge

This activity encourages good planning and teamwork, followed by communication and evaluation skills. Alternative tasks can be set, but these are cheap and cheerful!

