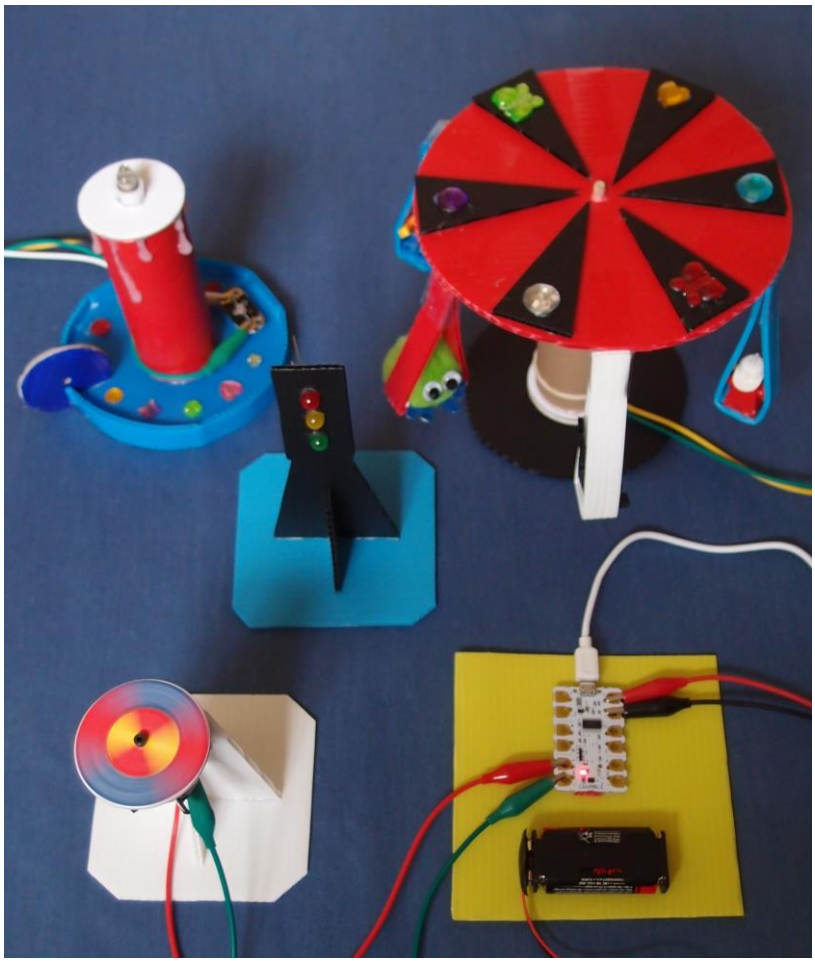

Crumble

Lesson Plan

www.tts-shopping.com

Product Code: TE10001

Crumble Summary

Recommended level – Years 5-6
Time taken – 3 hours per module
Pupils to work in groups of 3
Additional adult help is recommended
Expectation – to complete computer controlled working models
The modules are in order of difficulty, so it is recommended that you work through them in the order 1-5. However once you have completed module 1 (to set up the controller) you could then complete any of modules 2-5.

Associated resources:

Blogs
Crumble blog 1 - set up the controller
Crumble blog 2 - make a coloured spinner
Crumble blog 3 - make LED traffic lights
Crumble blog 4 - make a chair-o-plane
Crumble blog 5 - make a nightlight

PowerPoints
Crumble PowerPoint 1 - set up the controller
Crumble PowerPoint 2 - make a coloured spinner
Crumble PowerPoint 3 - make LED traffic lights
Crumble PowerPoint 4 - make a chair-o-plane
Crumble PowerPoint 5 - make a nightlight

Workbooks
Crumble workbook 1 – controller set-up
Crumble workbook 2 – coloured spinner
Crumble workbook 3 – LED traffic lights
Crumble workbook 4 – chair-o-plane
Crumble workbook 5 – nightlight

STEM Links

- Science: electrical circuits, forces, materials
- Technology (D&T): mechanical systems, electrical systems, computing, design and make process
- Technology (Computing): design, write and debug programs, use sequence, selection and repetition, work with variables and various forms of input and output
- Engineering: integrated mechanical, electrical and control systems, troubleshooting
- Mathematics: drawing 2-D shapes, measurement

Curriculum Learning Objectives – it is recommended to cover these topics prior to the exercise so that the pupils are reinforcing their knowledge and understanding, rather than meeting the topics for the first time.

Science: Electricity (Year 6)

Pupils should be taught to:

- compare and give reasons for variations in how components function
- use recognised symbols when representing a simple circuit in a diagram

Pupils should construct simple series circuits to help them to answer questions about what happens when they try different components, for example bulbs and motors. They should learn how to represent a simple circuit in a diagram using recognised symbols. Pupils should be taught to take the necessary precautions for working safely with electricity.

Pupils might work scientifically by designing and making a set of traffic lights, or some other useful circuit.

Science: Forces (Year 5)

Pupils should be taught to:

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of air resistance and friction, that act between moving surfaces

Pupils should explore the effects of friction on movement and find out how it slows or stops moving objects. Pupils should explore the effects of pulleys and simple machines on movement.

Science: Materials (Year 5)

Pupils should be taught to:

- identify and compare the suitability of a variety of everyday materials for particular uses

Pupils should be encouraged to think about unusual and creative uses for everyday materials.

Design and Technology (Key Stage 2)

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. When designing and making, pupils should be taught to:

Design and Technology: Design

- design innovative, functional, appealing products that are fit for purpose
- generate, develop, model and communicate their ideas

Design and Technology: Make

- select from and use a wide range of tools and equipment to perform practical tasks
- select from and use a wide range of materials and components according to their functional properties and aesthetic qualities

Design and Technology: Evaluate

- evaluate their ideas and products and consider the views of others to improve their work

Design and Technology: Technical knowledge

- apply their understanding of how to strengthen, stiffen and reinforce more complex structures
- understand and use mechanical systems in their products [for example pulleys]
- understand and use electrical systems in their products [for example series circuits incorporating bulbs and motors]
- apply their understanding of computing to program, monitor and control their products

Computing (Key Stage 2)

Pupils should be taught to:

- design, write and debug programs that accomplish specific goals, including controlling physical systems; solve problems by decomposing them into smaller parts
- use sequence, selection, and repetition in programs; work with variables and various forms of input and output
- use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs

Equipment needed

Parts included in class kit:

- 10 Crumble controllers
- 10 micro-USB cables
- 10 motors

- 10 motor mounts
- 25 bulbs
- 10 bulb holders
- 10 battery holders
- 50 battery snap connectors
- 120 crocodile leads
- 10 motor pulleys
- 10 wooden pulleys
- 100 card discs
- 24 cardboard craft rolls
- 30 coloured LEDs (light emitting diodes)
- 10 LDRs (light dependent resistors)
- 1 pack of corrugated plastic
- 20 wooden rods
- 10 sheets of corrugated plastic
- 1 pack of rubber bands
- 1 pack of coloured gems

Tools and consumables (not included in class kit):

All models
- 10 computers (Windows XP SP3 or newer, or Mac OS X 10.6 (64-bit) and above)
- 20 AA cells (these are often called batteries). It is very important to use **zinc chloride** type of cells, **not** alkaline or re-chargeable ones. If the pupils accidentally short circuit their battery (which often happens) then alkaline or re-chargeable cells get extremely hot and can cause burns. Zinc chloride type cells are cheap and easily available (e.g. from discount stores).
- Rulers
- Pencils
- Large scissors
- Low melt glue guns and glue sticks (several needed, e.g. 3-4, as there could be a queue to use them!). **Note: High melt temperature glue guns should not be used, as they can cause nasty burns.**

Controller set-up
- Double sided sticky tape

Coloured spinner
- Coloured felt tip pens
- Coins (e.g. 2p pieces) or plastic bottle lids about 2.5 cm diameter

Traffic lights
- Pointed nail scissors

Chair-o-plane
- Pairs of compasses
- Protractors
- Pencil sharpeners
- Transparent sticky tape in dispensers
- Lightweight passengers e.g. plastic figures or bugs (optional)

Nightlight
- Pairs of compasses
- Double sided sticky tape
- A selection of materials and decorations. You could ask pupils to bring in a variety of 'throwaway' items such as plastic containers of various shapes and sizes, cardboard tubes etc. If you were to conduct the session in two parts then the pupils could design their lights and then collect the items they will need to construct them. Paint and/or coloured insulating tape is useful, e.g. for lighthouses.
- Pointed nail scissors

Vocabulary list

Algorithm - a set of instructions describing how to get something done. A flowchart is a pictorial representation of an algorithm.

Battery / cell – this converts chemical energy into electrical energy. It is used to 'push electricity around a circuit. If you connect cells together you get more 'push' – a battery consists of two or more cells.

Bearing – this supports the rod, keeping it in position whilst allowing it to rotate

Conductor – an electrical conductor allows electricity to flow through it. Metals are good conductors.

Drive belt – the belt which connects and transfers movement between the motor and pulley

Insulator – an electrical insulator stops electricity passing through. Plastic, wood, rubber and glass are insulators

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LED (light emitting diode) – a diode is a component which has a very high resistance in one direction, so the current can only flow in the other direction. An LED is a kind of diode which glows when electricity passes through it.

LDR (light dependent resistor) – this is a component made from a material whose resistance changes according to the amount of light falling on it.

Pulley – a grooved wheel over which a drive belt can run

Short circuit – an electric circuit which allows the electricity to flow round it with very little resistance, so the battery will drain quickly and get hot.

Risk Assessment

Conduct a risk assessment before undertaking the activity. A sample risk assessment is given below; you can use this as a starting point when writing your own. (L=low, M=medium, H=high)

Activity	Identified Hazard	Initial Risk Rating L/M/H	Control Measures	Controlled Risk Rating L/M/H
Use of glue guns	Burns	H	Children should be supervised by a responsible adult at all times when using the glue guns. Explain to children how to use the glue guns. Warn them that the ends are very hot. Use only low melt temperature glue guns. If burned hold under running water for ten minutes. Don't switch on glue guns until after safety briefing. In some schools children wear safety goggles when using glue guns.	M
Accidentally short circuiting battery	Burns, smoke inhalation	M	Explain how to avoid short circuits. Use only zinc chloride cells, not alkaline or re-chargeable ones as these can get very hot if short circuited.	L
Use of scissors & Sellotape dispensers	Injury e.g. to fingers	M	Make the children aware of the dangers. Do not give out the scissors until after the safety briefing.	L
Passenger flying off chair-o-plane	Bruising e.g. to eye	M	Use lightweight passengers only.	L
Running glue gun extension leads along floor	Trip hazard	M	Avoid using extension leads if possible. Otherwise make sure extension leads are run where they cannot be tripped over.	L
Damaged extension leads or glue gun leads	Electrocution hazard	H	Conduct a visual check of all electrical items before session to ensure the leads are undamaged.	L

Preparation needed

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- Build a sample model to explore any pitfalls, and to demonstrate to the pupils what they will be making and how it works. Instructions are given in the blogs.

- Use a craft knife and steel rule to cut some of the corrugated plastic sheets into 12.5 cm x 12.5 cm squares. You can get 16 of these from one sheet. They are needed for the controller set-up, chair-o-planes and possibly the nightlights (although pupils may choose to collect recycled materials for these instead).

- Use a craft knife and steel rule to cut some of the corrugated plastic sheets into 16.5 cm x 16.5 cm squares. You should get 9 of these from one sheet. They are needed for the coloured spinner, traffic lights and chair-o-plane.

- If making chair-o-planes use a pair of secateurs to cut pieces of wooden rod 15 cm long. You should get 4 pieces from one rod.

- If you are making nightlights you could ask the pupils to plan what they will be making in advance, and collect recycled items such as plastic containers to use in their design.

- Print out a copy of the relevant workbook for each group. Print it in landscape, double sided, flipping on the short edge. Fold each sheet in half to make an A5 workbook, with the TTS logo on the front.

- Download the Crumble software onto all the computers as follows. Set up a destination folder called 'Crumble' on the computer where you want to install the software, e.g. on your Desktop. Download the Crumble software onto the computer from here: https://redfernelectronics.co.uk/crumble/. Double click on the downloaded file and run the set-up wizard. Click 'Next' then when asked where to install the Crumble software click 'Change…' and choose the destination folder you set up earlier. Navigate to the destination folder and double click on 'Crumble'. The following window should appear: