Sentinus Primary STEM Challenges

Sentinus

Department of Education
www.deni.gov.uk
AN ROINN Oideachais
MÄNNYSTRIE O Lear

WESTERN EDUCATION & LIBRARY BOARD

Learning Together
SOUTH EASTERN EDUCATION AND LIBRARY BOARD

Southern Education and Library Board

NEELB

Contents

Introduction

The Primary STEM Challenge is a Province wide design and build activity that promotes STEM (Science, Technology, Engineering & Mathematics) and has been run for many years by the five Education & Library Boards and Sentinus. This booklet has been developed in response to numerous requests from teachers for examples of best practice in developing Science and Technology & Design in the classroom.

The booklet provides tried and tested ideas for problem solving activities in Technology & Design and clearly illustrates how these address essential elements of the Northern Ireland curriculum. By providing easily accessible units of work it is hoped that it will encourage classroom practitioners to carry out some of the challenges in order to develop confidence and competence in the skills of Technology & Design.

Through participation in these activities, and by using tools including scissors, rulers and low melt glue guns, pupils will achieve progression in a range of areas which will assist in the development of skills including, manipulative skills, hand to eye co-ordination, thinking skills and personal capabilities.

Ultimately all of these contribute to the development of the pupils as:

- individuals;
- contributors to society;
- contributors to economy and environment.

Technology & Design is the perfect vehicle for helping young people develop a wide range of skills and capabilities.

How to Use This Booklet

This booklet is a complete resource which can be used as an introduction to Technology & Design while at the same time offering more experienced teachers ideas to support the development of good classroom practice and Thinking Skills and Personal Capabilities.

- As a stimulus for classroom activity;
- To support topic based planning;
- Potential Science Fair activities;
- Extended Schools activities;
- Preparation for entering the Primary Science & Technology Challenge;
- Follow up work after Primary Science & Technology Challenge;
- Supporting Area Learning Community activity.

Baseline Skills

What do my pupils need to be able to do to participate in Technology?

Every pupil should be able to get involved in Technology activities without any previous '***special***' skill set. Through involvement in technology activities pupils will develop the following skills:

- *be able to cut safely and effectively*
  - use a range of scissors including snips, pinking shears, left handed scissors, teachers' scissors to cut straight lines, curves, shapes, angles ;
  - cut a variety of materials including paper, card, stiff card, fabric, plastics (corriflute);
  - use a junior hacksaw to cut rigid materials i.e. wood, plastic.

- *be able to join materials safely and effectively*
  - use adhesive tape/masking tape/duck tape/double sided tape to be able to cut and manage tape when connecting different shaped and sized objects *e.g. be able to attach a cylinder to a cuboid*;
  - use glue including glue sticks, P.V.A., and low temperature glue-gun (use stands, mats, goggles, gloves and apron with the latter).

- *be able to pierce materials safely and effectively*
  - use hole - punches, hand drill with a variety of materials.

- *be able to hold materials safely and effectively*
  - use clothes pegs, tape, g-clamp, bench-hook, vice.

Technology in the Classroom Environment

The information in this booklet is intended to make Technology & Design accessible to all teachers and pupils, regardless of skills and knowledge levels or equipment available. The Challenges do not require a wide range of specialised tools, rather they are designed to be carried out with basic tools such as:

- low melt glue guns;
- junior hacksaws;
- scissors;
- snips.

While these tools are basic it is still important to ensure that safe practice is followed at all times. Pupils must be briefed on the safe use of tools and equipment at the beginning of each session and you should ensure that all pupils are familiar with classroom rules for safe working (see Page 84 of NI Curriculum Primary publication) further guidance is available in the booklet "Be Safe!" which is available from bookstore on the ASE website at www.ase.org.uk Encourage your pupils to contribute to the development of a code of conduct to ensure a safe working environment.

Northern Ireland Primary Curriculum Links

Science and Technology activity is an effective medium for promoting and developing the knowledge, skills and understanding outlined in the 'Whole Curriculum Skills and Capabilities' section of the NI Curriculum Primary publication (CCEA 2007).

The Document provides more detailed information on Pages 8 – 12. The following extracts are selected to illustrate appropriate links in the context of Technology activities.

Thinking Skills and Personal Capabilities

Children should be given worthwhile experiences that allow them to develop skills across the curriculum in:

- *Thinking, Problem Solving and Decision Making*
  - generating possible solutions, trying out alternative approaches, evaluating outcomes;
  - examining options, weighing up pros and cons;
  - making connections between learning in different contexts;

- making links between cause and effect;
- justifying methods, opinions and conclusions.

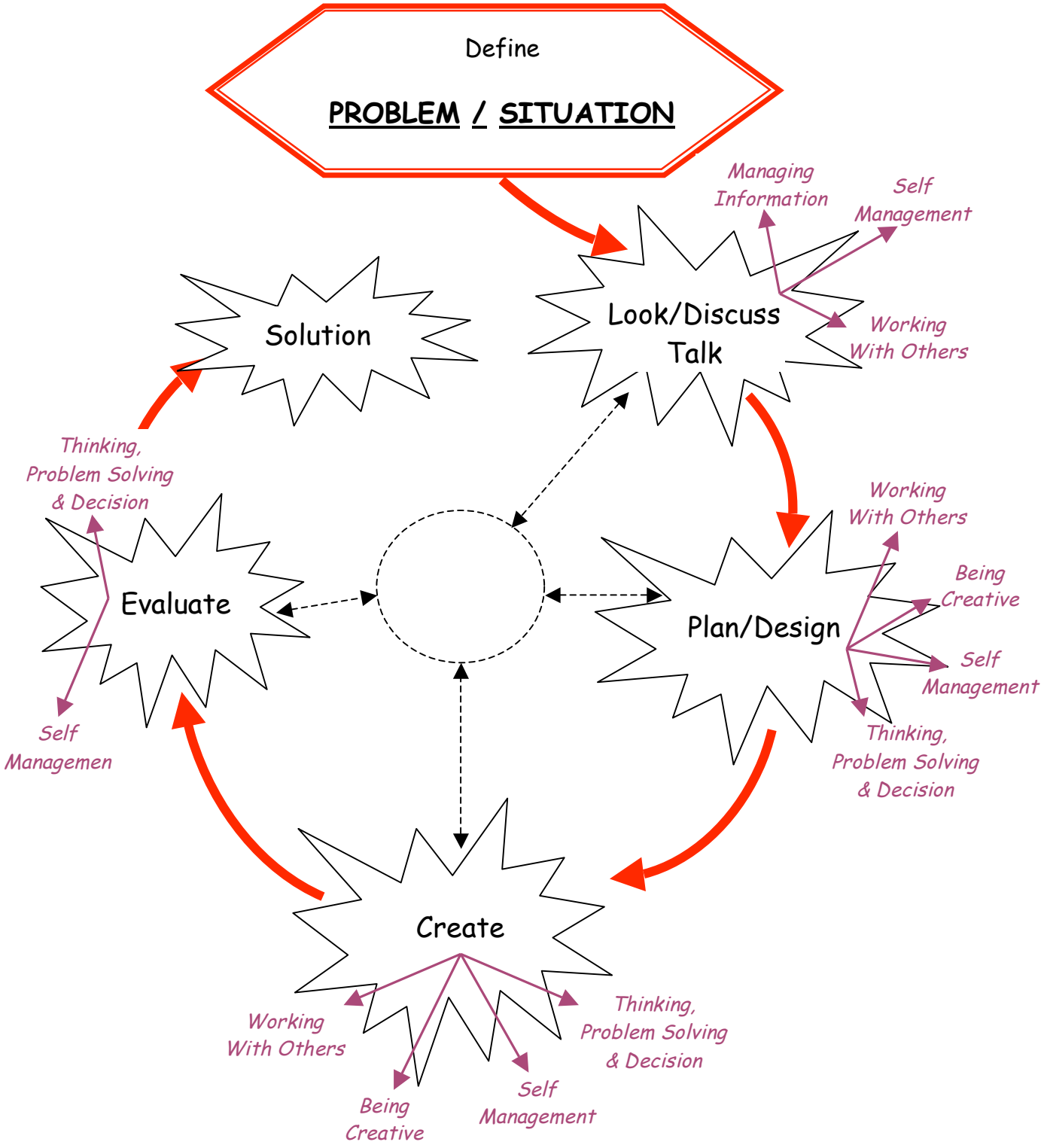
- *Managing Information*
  - planning and setting goals, breaking a task into sub-tasks;
  - selecting most appropriate method for a task;
  - communicating with a sense of audience and purpose.

- *Being Creative*
  - seeking out questions to explore and problems to solve;
  - learning from and valuing other people's ideas;
  - making ideas real by experimenting with different designs, actions, outcomes;
  - valuing the unexpected or surprising;
  - seeing opportunities in mistakes and failures;
  - taking risks for learning.

- *Self Management*
  - organising and planning how to go about a task;
  - focussing, sustaining attention and persisting with tasks;
  - reviewing learning and some aspect that might be improved;
  - comparing own approach with others and in different contexts.

- *Working With Others*
  - listening actively and sharing opinions;
  - developing routines of turn taking, sharing and co-operating;
  - taking personal responsibility for working with others and evaluating own contribution to the group;
  - respecting the views and opinions of others, reaching agreements using negotiation and compromise.

THE TECHNOLOGY PROCESS



Approaches to Learning and Teaching

Children learn best when learning is interactive, practical and enjoyable. It is important that children:

- have choice and exercise autonomy and independence in their learning, and where they are supported in taking risks in their efforts to succeed;
- are actively involved in planning, carrying out and reflecting on their work (in the Technology & Design process children will be using the Plan, Do, Review process, Page 10 NI Primary Curriculum document).

Assessment for Learning

This encourages the active involvement of children in their own learning by:

- developing their awareness of the skills and knowledge that are being developed;
- reviewing and evaluating their own and others work;
- setting their own goals following effective questioning and feedback;
- making their own suggestions for improvements.

In the Design & Technology process children actively decide their goals, create a plan and carry it out. They also judge or review their work and discuss how they could improve their design and construction.

STEM Challenges

The following pages contain a number of practical challenges which you can carry out in the classroom. These challenges vary in difficulty and are suitable for children with a wide range of technology skills. They are grouped in pairs with the second challenge in each case being a progression in difficulty from the first.

The information given for each challenge includes:

- A list of materials you will require to complete the challenge;
- A list of tools and equipment you will need;
- Marking criteria, should you wish to use them (these will give you a good idea of how the children perform against the established criteria);
- A design brief complete with rules.

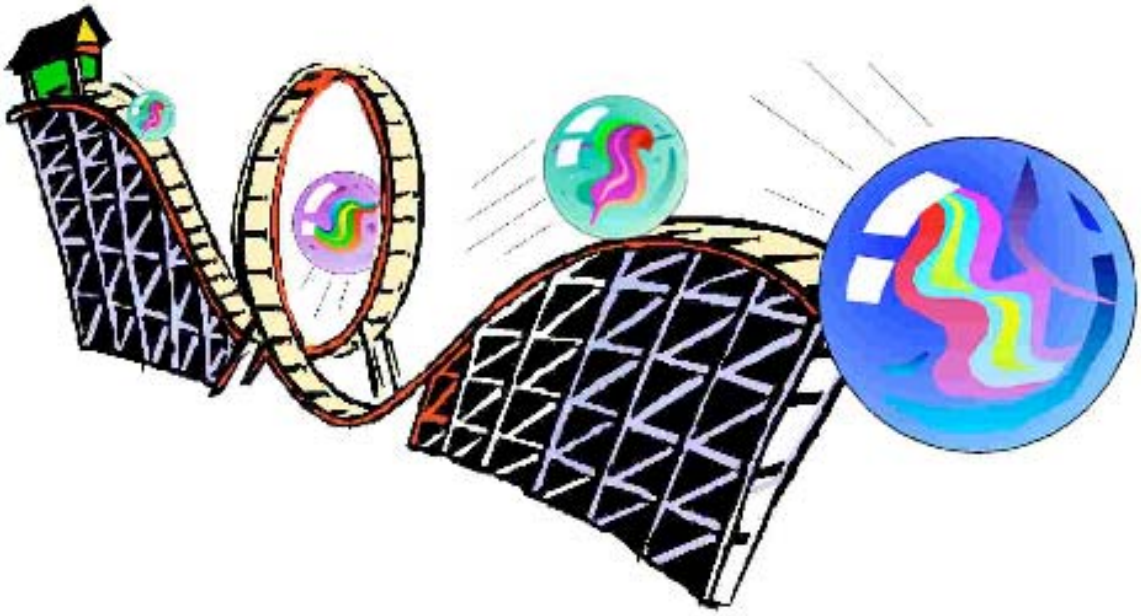
At the back of the booklet you will also find a generic example of a drawing sheet which can be enlarged to A3 for use in the design phase of the challenges.

It is important to note that considerable weighting is given to the design process in the marking criteria. Children should be encouraged to use the design sheets to the fullest extent and to modify their designs as their solutions progress through the build phase.

If your pupils have limited technology skills then why not try a few of the Stage 1 challenges first, coming back to the Stage 2 challenges when they have increased in confidence?

Challenge 1 - Level 1

Your Challenge is to design and construct a slow marble run. Your marble must travel as slowly and for as long a time as possible. It must be deposited, and stay, in a container at the end of its run.



Rules:

- you must only use the materials provided, in the most efficient way;
- you will have one hour to design and construct your model;
- your design will score five points for every second the marble takes to complete the run;
- the marble must travel without assistance once released;
- 10 points will be awarded if the ball is deposited and stays in the container;
- you can achieve up to 30 points for design and 30 for construction and efficient use of materials.

Challenge 1 – Level 1

Materials Required per Team:

- A3 card x 1;
- A4 card x 4
- Plastic straws x 10
- Polystyrene/plastic cup x 1
- Marble x 1
- Pritt stick
- Masking tape

Tools Required:

- Snips
- Scissors
- Pencils
- Rulers
- Rubbers
- Design sheets
- Glue guns and glue sticks
- Gloves
- Aprons
- Goggles

Marking Criteria

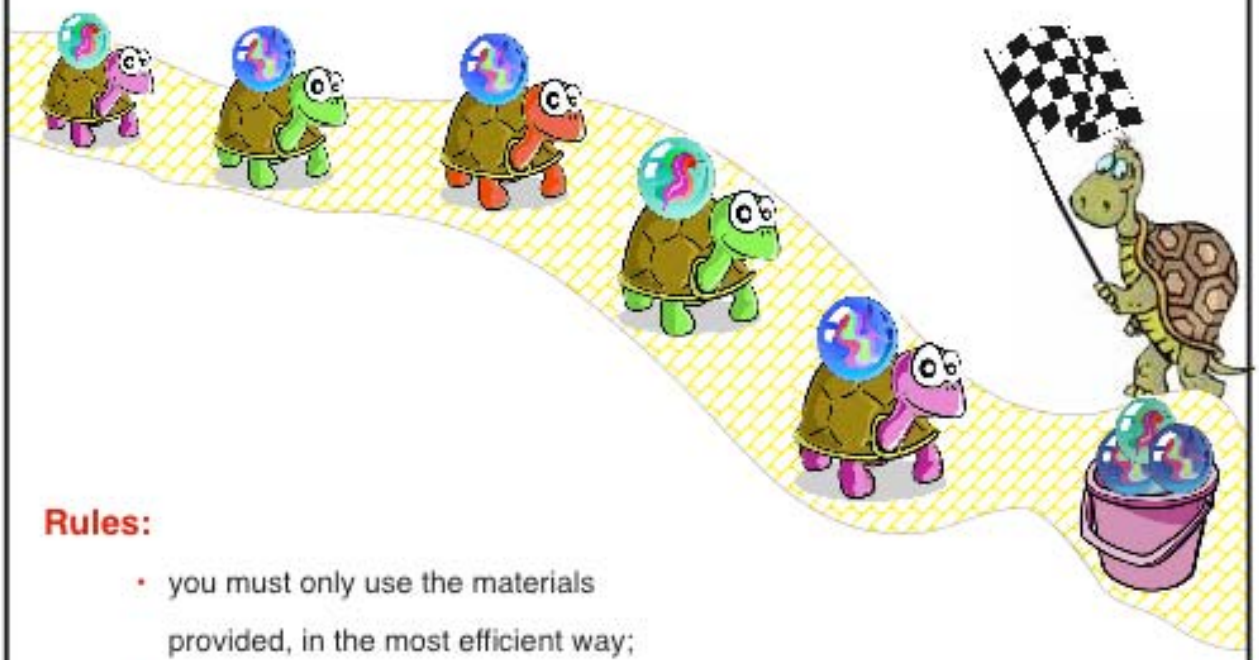
Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 10 points	Average appearance and construction, some attention to the use of materials. 11 – 20 points	Good construction and appearance, good selection and economic use of materials. 21 – 30 points

Performance – Does the product perform the task as specified in the Challenge?		
Award points if ball lands in container. 5 points	Award points if ball stays in container. 5 points	Award points for time taken for ball to travel the distance, 5 points per second. 5 points per second

Challenge 1 - Level 2

Your Challenge is to design and construct a slow marble run. Your three marbles must travel as slowly and for as long a time as possible and be deposited in a container at the end of the run. A bulb must be lit only when three marbles are in the container.



Rules:

- you must only use the materials provided, in the most efficient way;
- you will have two hours to design and construct your model;
- your design will score five points for every second the marble takes to complete the run;
- the marble must travel without assistance once released;
- each marble must be released when the previous one has stopped;
- 2 points will be awarded for each marble deposited in the container;
- 4 points will be awarded if the bulb lights;
- 15 points will be awarded if the bulb lights only when three marbles are in the container;
- you can achieve up to 30 points for design and 30 for construction and efficient use of materials.

Challenge 1 – Level 2

Materials Required

- A3 card x 1
- A4 card x 4
- Plastic straws x 10
- Corriflute
- Paper clips x 6
- Papers fasteners x 6
- Tin Foil
- Blu Tack
- Pipe Cleaners x 6
- Treasury Tags x 6
- Marbles x 3
- Ball bearings x 3
- Pritt stick
- Masking tape
- AA Battery holder x 1
- AA Batteries x 2
- Battery snap x 1
- Bulb x 1
- Bulb holder x 1
- Wire x 0.5m

Tools Required

- Hole punches
- Glue guns and glue sticks
- Gloves
- Aprons
- Goggles
- Snips
- Scissors
- Pencils
- Rulers
- Rubbers
- Design sheets

Marking Criteria

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 10 points	Average appearance and construction, some attention to the use of materials. 11 – 20 points	Good construction and appearance, good selection and economic use of materials. 21 – 30 points

Performance – Does the product perform the task as specified in the Challenge?			
Award points for time taken for marbles to descend, 5 points per second. 5 points per second	Award 2 points for each marble deposited in the container. 0 - 6 points	Award points if the bulb lights. 4 points	Award additional points if the bulb lights only when 3 marbles are in the container. 15 points

Challenge 2 - Level 1

Your Challenge is to design and build a winding mechanism that can be secured to a table/desktop. It must be able to raise an egg in a cradle from the floor to a height of 50 cm in the lowest number of turns.

Rules:

- you must only use the materials provided;
- you will have one hour to design and construct your model;
- your model will score one points for centimetre the egg is raised;
- you should build your winding mechanism to raise the egg in the lowest number of turns
- points will be awarded for good design work and quality of construction.

Challenge 2 – Level 1

Materials Required

- 600mm Pine Section
- 300mm x 4mm Dowel x 1
- A4 Card x 2
- 2m Cord
- Plastic Straws x 2
- Masking Tape
- Blu Tack
- Spool x 1
- Plastic Cup x 1
- Elastic Bands x 2
- Card Triangles

Tools Required

- Bench Hook
- Junior Hacksaw
- G-clamp
- Goggles
- Cotton Gloves
- Apron
- Glue Gun
- Glue Gun Holder
- Snips
- Hole Puncher

Marking Criteria

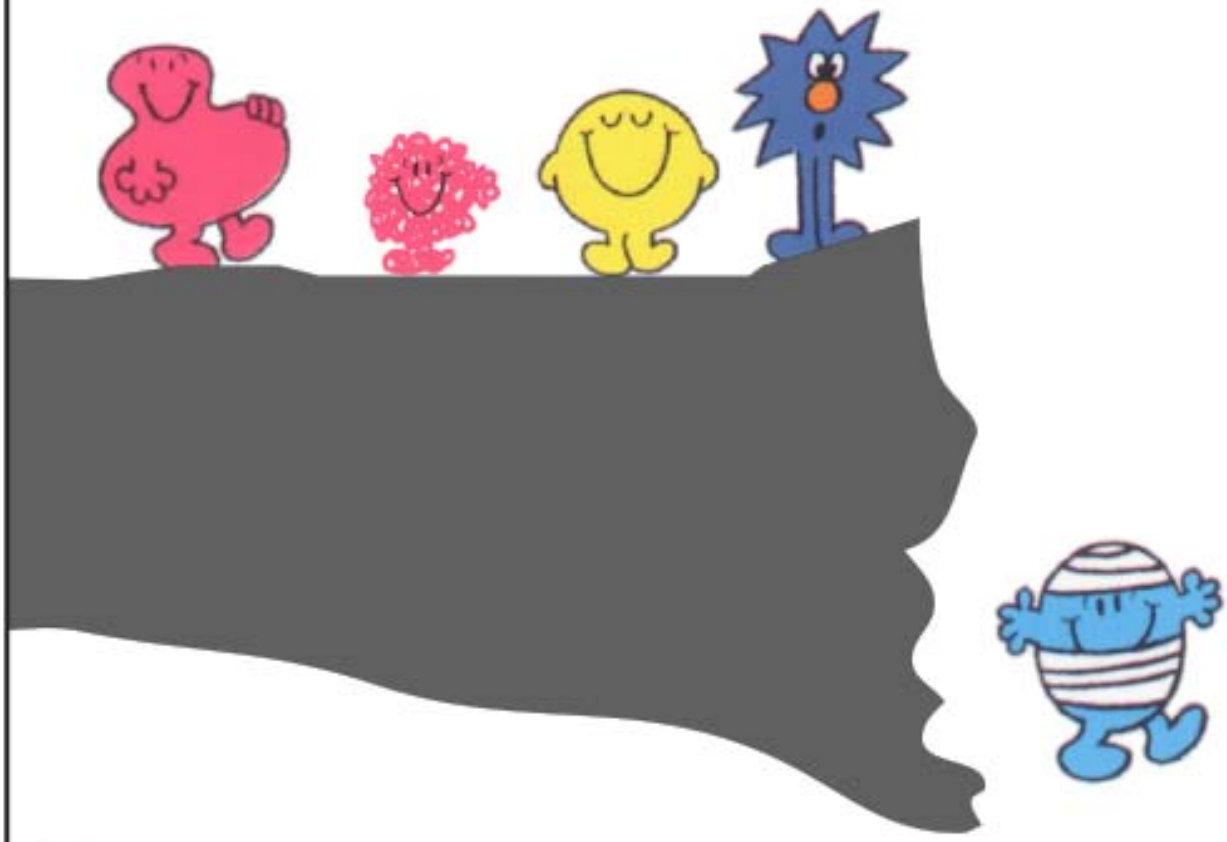
Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 10 points	Average appearance and construction, some attention to the use of materials. 11 – 20 points	Good construction and appearance, good selection and economic use of materials. 21 – 30 points

Performance – Does the product perform the task as specified in the Challenge?	
Allow one point for each centimetre the egg is raised. Maximum 50 points	Subtract half a point per turn of the mechanism.

Challenge 2 - Level 2

The Mr Men are at the top of the cliff. Their poor friend is trapped at the bottom. Design and make a free standing, motorised device and cradle that will lift the desperate Mr Man to the top of the cliff so that he can rejoin his friends. Your model should be controlled by a switch.



Rules:

- you must only use the materials provided;
- you will have two hours to design and construct your model;
- your model will score one point for every centimetre your Mr Man is raised and 10 points for reuniting him with his friends;
- points will be awarded for good design work and quality of construction.

Challenge 2 – Level 2

Materials Required

- Electric Motors
- Motor Clips
- Motor Pulley
- Batteries AA
- Battery Holders Double AA
- Battery Snaps
- Switch
- Single core wire
- 40 mm Pulley with 4 mm hole
- 60 mm Pulley with 4 mm hole
- Dowel Rod 600 mm x 4 mm
- Pine Section 600 mm x 8mm
- Elastic Bands Assorted Sizes
- A4 Card
- String
- 4 mm Corriflute
- Masking Tape
- Blu Tack
- Paper Fasteners
- Card Triangles (without holes)
- Card Triangles (with holes)
- Paper Clips
- Plastic Straws
- Pencils
- Rulers
- Rubbers

Tools Required

- Hole Punches
- Saws
- Bench Hooks
- Glue Guns
- Gloves
- Goggles
- Aprons
- Scissors/ Snips
- Wire Strippers
- Screw Drivers
- Metre Rules

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?	
Allow one point for each centimetre that the Mr Man is raised. Allow maximum points if he is raised the full height. Maximum 40 points	Award 10 points for reuniting the Mr Man with his friends. 10 points

Challenge 3 - Level 1

Your Challenge is to design and make a device that can be used to get a rescue line from the shore to someone in difficulty in a rough sea. The model must be built on the corriflute base and be accurate enough to propel a rope and safety ring to the person who is 70cms away. (The rope must be attached to the base or structure before firing.)

Rules:

- you must only use the materials provided;
- you will have one hour to design and construct your model;
- your model will score points for getting the rope to the person in distress;
- one end of the rope should be firmly anchored to the base of your structure;
- points will be awarded for good design work and quality of construction.

Challenge 3 – Level 1

Materials Required

- 600mm Pine Section
- Elastic Bands x 6 (varied sizes)
- Masking tape x 1m
- String 2 x 1 metre
- A4 Card x 2
- Plastic or wooden bead
- Corriflute base 300mm x 600mm x 4mm
- Blu tack
- Card Triangles

Tools Required

- Snips/Scissors
- Bench Hooks
- Junior Hacksaws
- G-Clamps
- Glue Guns
- Glue gun holder
- Glue Sticks
- Gloves
- Aprons
- Goggles
- Hole punch
- Pencils
- Rulers
- Rubbers
- Design sheets

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?	
Does the mechanism launch the rope? Award 10 points	How close to the person in distress does the rope land? Award 0 - 30 points

Challenge 3 - Level 2

To design and make a pneumatically operated, free standing draw-bridge. The bridge must have a span of at least 250mm and should open to the greatest possible angle to allow a ship to pass beneath it. The bridge when down should be 100mm from the table.

Rules:

- you must only use the materials provided;
- you will have two hours to design and construct your model;
- you will be awarded 5 points for every 10 degrees th bridge rises, up to a maximum of 60 degrees;
- you will be awarded 10 bonus points if the bridge rises more than 60 degrees;
- points will be awarded for good design work and quality of construction.

Challenge 3 – Level 2

Materials Required

- 600mm Pine Section
- A4 Card x 2
- Syringes (1x 20ml, 1 x 10ml)
- Plastic tubing
- Corriflute x A4
- Plastic straws x 6
- Masking tape x 1m
- Blu tack
- Card Triangles
- Coloured markers

Tools Required

- Snips/Scissors
- Bench Hooks
- Junior Hacksaws
- G-Clamps
- Glue Guns
- Glue gun holder
- Glue Sticks
- Gloves
- Aprons
- Goggles
- Hole punch
- Pencils
- Rulers
- Rubbers
- Design sheets

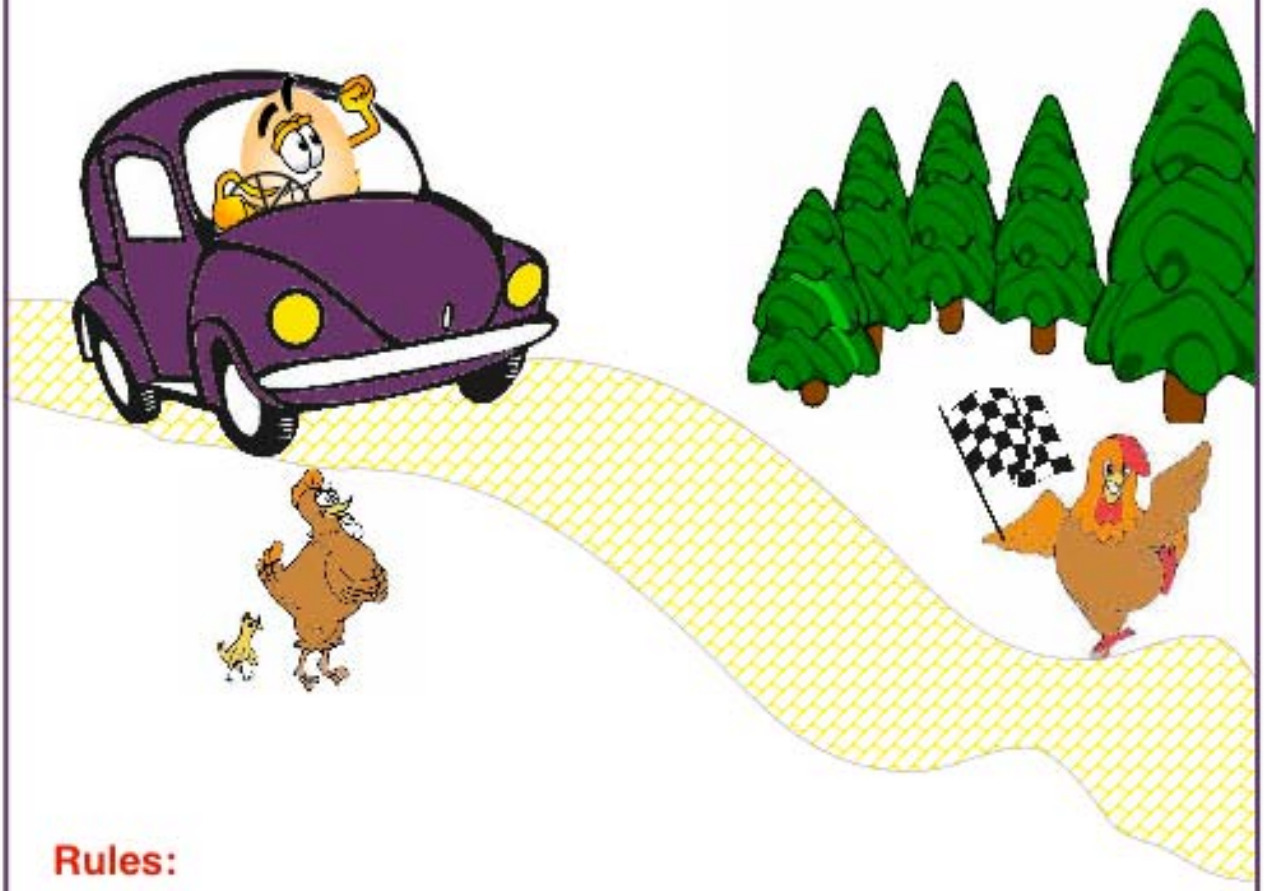
Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?		
Is the span of the bridge at least 250mm? Award 10 points	Can the bridge be raised? Award 10 points	How high can the bridge be raised? Award 5 points per 10 degrees. Award 0 - 50 points

Challenge 4 -Level 1

To design and make a vehicle which will carry an egg safely down a ramp and over a speed bump at the bottom.



Rules:

- you must only use the materials provided;
- you will have one hour to design and construct your model;
- you will receive extra points if your egg is secure;
- you must not use masking tape, glue or blu tack to secure the egg;
- you will receive extra points for the good use of materials;
- points will be awarded for good design work and quality of construction.

Challenge 4 – Level 1

Materials Required

- 30mm MDF Wheels x 4
- 4mm x 600mm Dowel
- 10mm x 600mm Square Section Pine
- A4 card x 4
- Plastic Straws
- Pritt stick
- Masking Tape

Tools Required

- Snips
- Scissors
- Bench Hooks
- Junior Hacksaws
- Glue Guns
- Glue gun holder
- Glue Sticks
- Gloves
- Aprons
- Goggles
- Pencils
- Rulers
- Rubbers
- Design sheets

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?			
Does the vehicle travel down the ramp unaided? 10 points	Does the egg stay in the vehicle? 10 points	Is the egg secure? 0 - 10 points	Does the vehicle cross the ramp at the bottom? 10 bonus points

Challenge 4 - Level 2

A lorry has overturned on the motorway, spilling its load of marbles on the road. Your challenge is to design and build a vehicle to transport a load of between 6 and 10 marbles over a distance of 3 metres and deliver them to a marked zone. The vehicle, with its load, should be able to travel up an incline and over a ramp The marbles must not be carried on the vehicle.

Rules:

- you must only use the materials provided;
- you are not allowed to incorporate tools or other equipment (rulers, pencils etc) in your model;
- you will have two hours to design and construct your model;
- marks will be awarded for good design and quality of construction;
- two points will be awarded for each marble your vehicle can carry (maximum 10 marbles);
- points will be awarded if your vehicle can travel up the incline and over the ramp;
- points will be awarded if the vehicle can deliver the marbles to the marked zone.

Challenge 4 – Level 2

Materials Required

- 56mm wheels x 8;
- A4 heavy card x 1 sheet;
- 300mm x 150mm x 3mm corriflute x 1 sheet;
- 4mm dowel rod x 600mm x 1;
- plastic straws x 6;
- 2 x AA battery holder;
- 2 x AA batteries;
- battery snaps;
- motor x 1;
- motor holder x 1;
- motor pulley x 1;
- axle pulley x 20mm x 1;
- axle pulley x 40mm x 1;
- wire x 2.5m (2 x 1m, 1x 0.5m)
- button switch x 1;
- paper fasteners x 6;
- elastic bands; x 3;
- treasury tags x 4;
- marbles x 10;
- plastic rivets x 4;
- Masking Tape;
- Blu Tack

Tools Required

- hole punches x 25
- wire strippers by 25;
- super snips x 25;
- sand paper;
- glue guns and holders x 5;
- glue sticks;
- cotton gloves x 5 prs;
- pencils;
- rulers;
- rubbers;
- design sheet

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?				
How many marbles does the vehicle carry? (2 points per marble) 0 - 20 points	Does the loaded vehicle go up the incline without assistance? 0 - 5 points	Does the loaded vehicle traverse the ramp without assistance? 0 – 5 points	Can the load be delivered to the marked zone? 0 – 10 points	Is the complete operation performed without any assistance? 10 bonus points

Challenge 5 - Level 1

Many people have been traveling from Earth to the International Space Station to work and live there. Some of the astronauts have been working hard to repair damaged solar panels on the space station and one of them has become stranded outside the craft.

Your Challenge is to design and construct a space craft with a door or doors which can open and close remotely to allow the stranded astronaut to enter. The doors must be able to close when the astronaut is inside.

Rules:

- you must only use the materials provided, in the most efficient way;
- you will have one hour to design and construct your model;
- your design will score up to 30 points if the doors open and close remotely;
- you can achieve up to 30 points for design and 30 for construction and efficient use of materials.

Challenge 5 – Level 1

Materials Required

- A4 Card (230gsm) x 5 sheets
- Jumbo Plastic Straws
- Blu Tack
- Pritt Stick
- Masking Tape x 1m
- Plastic Tubing x 1/2m
- 20ml Syringes x 2
- 10ml Syringes x 2
- Tee Splitter
- Aluminium Foil
- Gold Foil
- Astronaut

Tools Required

- Scissors
- Pencils
- Rulers
- Rubbers

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?		
Award points if doors open remotely. 0 - 10 points	Award points if astronaut fits in space craft. 0 – 10 points	Award points if doors close remotely. 10 points

Challenge 5 - Level 2

The Space Agency wants to send Bob the alien to the moon to carry out some very important scientific experiments to see whether crops will grow in lunar soil.

Your Challenge is to design and construct a free standing space rocket with a door or doors which can open remotely. You will also have to build a remotely operated transportation device to allow Bob to travel a horizontal distance of 30cm to the rocket door/s before blast off.

Rules:

- you must only use the materials provided, in the most efficient way;
- you will have two hours to design and construct your model;
- points will be awarded if the door/s open remotely;
- points will be awarded if the astronaut moves to the rocket on a remotely operated device;
- you can achieve up to 30 points for good design work;
- you will be awarded up to 30 points for good quality construction and efficient use of materials.

Challenge 5 – Level 2

Materials Required

- A4 Card (230gsm) x 5 sheets
- Jumbo Plastic Straws
- Blu Tack
- Pritt Stick
- Masking Tape x 1m
- Plastic Tubing x 1/2m
- 20ml Syringes x 2
- 10ml Syringes x 2
- Tee Splitter
- Aluminium Foil
- Gold Foil
- Astronaut

Tools Required

- Scissors
- Pencils
- Rulers
- Rubbers

Design - In their design and planning the teams should show their ideas of how they will meet the challenge. Drawings and sketches produced by the team should be taken into account.		
Maximum Points – 30 (See Design Sheets)		
Important Factors 0 – 10 points		
Little evidence of consideration given to these factors. 0 – 3 points	Some consideration given to the important factors. 4 – 6 points	Substantial evidence of consideration of factors. 7 – 10 points
Design Ideas 0 – 10 points		
Only one idea considered with limited sketching. 0 – 3 points	More than one idea with some sketching. 4 – 6 points	A full range of ideas considered accompanied by good sketches. 7 – 10 points
Final Drawings (side and bird's eye view) 0 – 10 points		
Poor quality drawings with little annotation. 0 – 3 points	Reasonable drawings with some notes and annotation. 4 – 6 points	Good quality drawings with plenty of annotation and dimensions given. 7 – 10 points

Construction - This area will take into account the use of materials, the quality of construction and the aesthetic appearance of the finished product.		
Maximum Points – 30 (See Design Sheets)		
Poor quality of construction, poor finish and appearance. 0 – 7points	Average appearance and construction, some attention to the use of materials. 8 – 14 points	Good construction and appearance, good selection and economic use of materials. 15 – 20 points

Performance – Does the product perform the task as specified in the Challenge?			
Award points if door/s of the rocket open remotely. 0 – 8 points	Award points if the astronaut can be remotely transported to the door of the rocket. 0 - 8 points	Award points if the transportation mechanism operates smoothly 0 – 8 points	Award points if the astronaut is aligned with the doors. 0 - 6 points

Design Sheet

Important Factors
(Write a brief note)

- **Structure – What will your model look like?**
- **Materials – Which materials will you use?**
- **Tools – Which tools will you use to build your model?**
- **Safety – How will you keep yourself and others safe?**

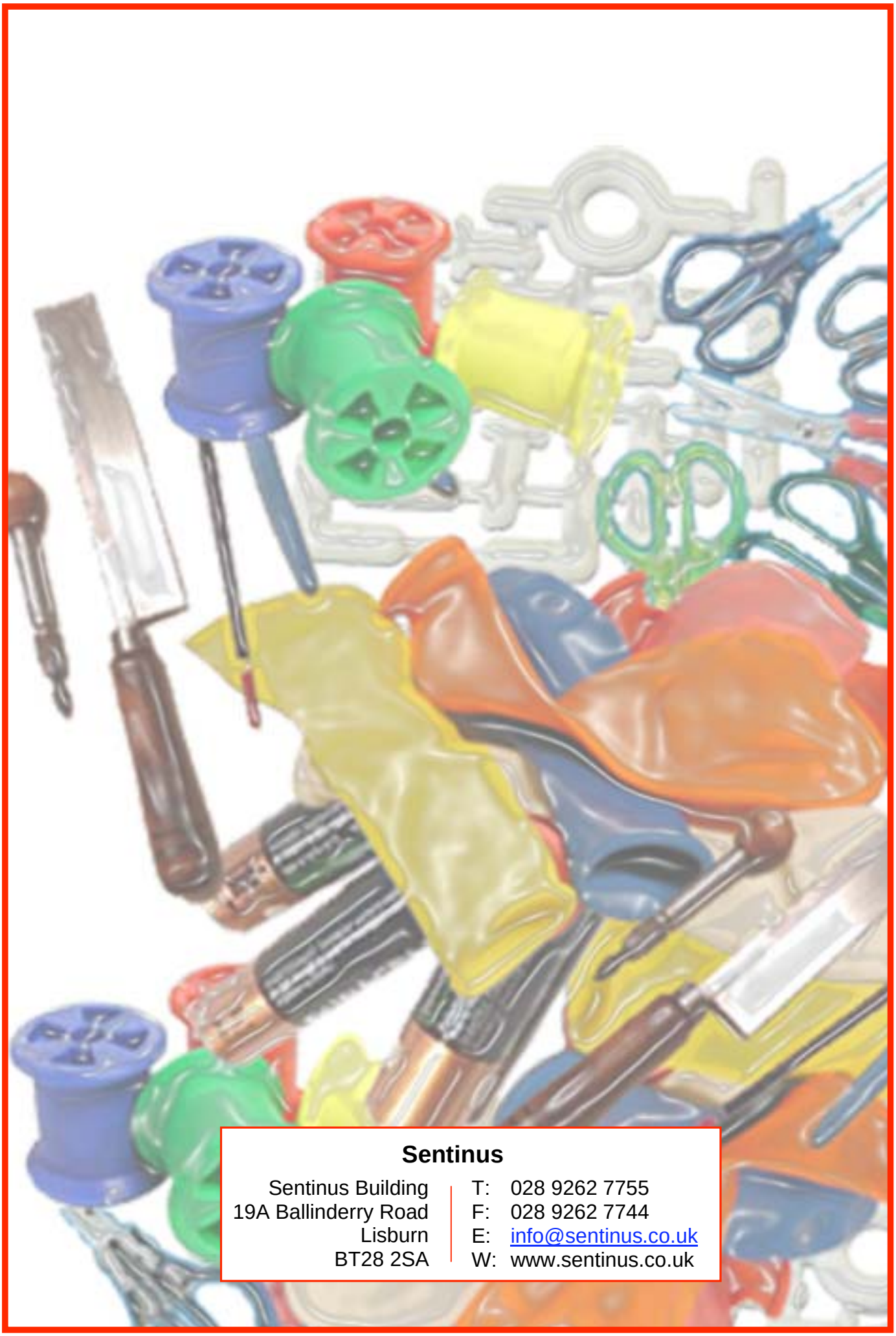
Side View

Plan View (Bird's eye view)

Remember: Good design means using only the materials you need – try not to waste materials

Design Ideas

Notes



Sentinus

Sentinus Building
19A Ballinderry Road
Lisburn
BT28 2SA

T: 028 9262 7755
F: 028 9262 7744
E: info@sentinus.co.uk
W: www.sentinus.co.uk