

# STEM STARTER CHALLENGES

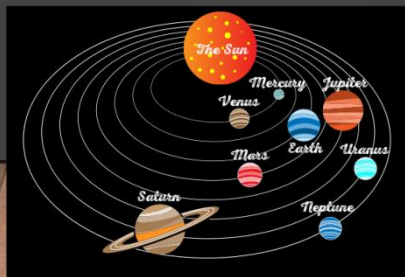
THE **"SPACE" LEARNING** IS A TEACHING AND LEARNING STRATEGY DESIGNED TO GIVE STUDENTS A DEGREE OF CHOICE OVER THE ACTIVITIES THEY COMPLETE AND THEREFORE MORE OWNERSHIP OF THEIR OWN LEARNING, WHICH THEN ALLOWS WORK TO BE MORE CLOSELY MATCHED WITH EACH STUDENT'S ABILITY. THIS IS VERY SIMILAR TO THE CHILLI CHALLENGE THAT MANY SCHOOLS OFFER.

CHOOSE YOUR CHALLENGE:

PLANET



SOLAR SYSTEM



GALAXY



# NO-HANDS CUP STACKING CHALLENGE

GROUP SIZE: 4

## RESOURCES:

- PAPER/ PLASTIC CUPS (MINIMUM 6)
- 1 X ELASTIC BAND
- 4 X PIECES OF STRING



### Planet

Reduce the number of cups used or simply use one cup and ask the children to work as part of a team to move one cup to a different position

### Solar System



### Galaxy

Introduce more than 6 cups and ask the children to be more creative with the towers they build and even turn the cups around so they are not upside down.

# PAPER PLATE/ PLASTIC CUP STEM

GROUP SIZE: INDIVIDUAL/ SMALL GROUPS

TASK- WHAT CAN YOU BUILD USING THESE RESOURCES?

## RESOURCES

- PAPER PLATES
- PLASTIC CUPS



### Planet

Give the children more direction and ask them to build something specific (this could be topic related)

### Solar System



### Galaxy

Give each group a challenge that the structure must be of a certain height/ width (this could even be mapped out with tape on the floor) , use every object provided and have an upside down cup at the top.

# PAPER PLATE STRAW MAZE

GROUP SIZE: INDIVIDUAL

## RESOURCES:

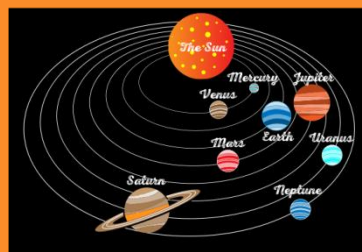
- PAPER PLATES
- STRAWS
- PVA GLUE AND SCISSORS
- POM POM (OR MARBLE)



### Planet

Use playdough on a table to construct a maze for a pom pom

### Solar System



### Galaxy

Hold a magnet underneath the plate to guide a paperclip through the maze

# LEGO MARBLE MAZE

GROUP SIZE: 2

## RESOURCES:

- 1 X LEGO BOARD
- 1 X MARBLE
- LEGO BRICKS VARIED LENGTHS



### Planet

Reduce the number bricks available for children or use Duplo bricks instead. Ask the children to make one path for the maze with an entrance and exit.

### Solar System

Use Lego bricks of 2 different lengths for the marble maze and the option of only one or two dead ends for the marble to fall into.

### Galaxy



# LEGO BALANCE SCALES

GROUP SIZE: 2

## RESOURCES:

- 1 X SMALL LEGO BOARD
- 1 X LEGO JOIN
- 2 X LONG GREY LEGO PIECES
- LEGO BRICKS VARIED LENGTHS



### Planet

Build a simple see saw design with lego pieces that allow movement up and down

### Solar System



### Galaxy

Challenge the children to build the design and then extend their learning thinking about and building other design that require this type of tilt movement.

# SIX BRICK CHALLENGE CARDS

GROUP SIZE: IN PAIRS OR SMALL GROUPS

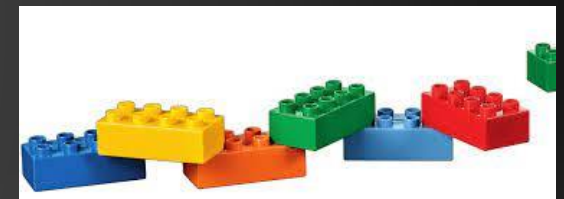
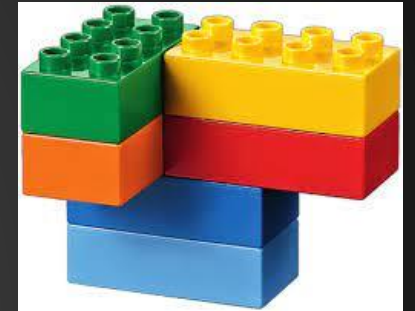
TASK- WORK THROUGH 6 BRICK CHALLENGE CARD EXAMPLES:

[HTTPS://EDUCATION.THEIET.ORG/MEDIA/5417/SIX-BRICKS-WORKSHOP-CARDS.PDF](https://education.theiet.org/media/5417/six-bricks-workshop-cards.pdf)

## RESOURCES:

6X LEGO BRICKS PER CHILD

COPY OF CHALLENGE CARDS



### Planet



### Solar System

Differentiate the challenge cards by making the structures more complex or increasing the number of bricks used.

### Galaxy

Further differentiate the challenge cards by making the structures more complex or increasing the number of bricks used. Try using Lego rather than Duplo.

# CARDBOARD MARBLE RUN

GROUP SIZE: 4

TASK – MAKE A MARBLE RUN FROM CARDBOARD TUBES AND JUNK

## RESOURCES:

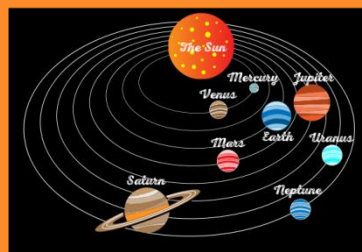
- CARDBOARD TUBES
- BOXES AND JUNK
- TAPE AND SCISSORS
- MARBLES



### Planet

Make a “wall” marble run by taping the tubes to a wall using masking tape

### Solar System



### Galaxy

Challenge groups to connect their designs together to make one huge marble run



# TOY PENNY SPINNERS

GROUP SIZE: INDIVIDUAL

## RESOURCES:

- 1 X ROUND CARD
- 1 X ROUND PAPER DESIGN  
(PREPRINT VARIOUS DESIGNS)
- 1 X GLUE STICK
- 1 X PENNY
- COLOURED PENCILS/ PENS



### Planet



### Solar System

Make several (3 or 4) of these spinners but of different diameters and compare how they work.

### Galaxy

Make several spinners all the same size and change the penny to other object or coins to compare how they spin. Option to use a time lapse camera to compare.

# PAPER CHAIN CHALLENGE

GROUP SIZE: INDIVIDUAL/ TEAM

TASK- MAKE THE LONGEST PAPER CHAIN THAT YOU CAN USING ONLY ONE PIECE OF A4 PAPER

## RESOURCES:

- 1 x A4 PAPER
- 1 x SCISSORS
- 1 x GLUE STICK
- 1 x MEASURING TAPE



### Planet



### Solar System

Children make individual chains but work as a team of 4 to combine into one long chain. Estimate, measure and compare lengths of chains.

### Galaxy

In groups of 4, children make individual paper chains with different chain widths of strips to hold the weight of a small object when suspended. Weigh, measure, compare and discuss results.

# PAPER PLATE STEM

GROUP SIZE: INDIVIDUAL/ TEAMS OF 4

TASK: HOW LONG CAN YOU MAKE YOU PAPER PLATE  
BY CUTTING IT IN SOME WAY?

## RESOURCES:

PAPER PLATES

SCISSORS

MEASURING TAPE/ STICK



### Planet



### Solar System

Children complete individual task but then work as a team of 4 to combine into one long chain. Estimate, measure and compare lengths of chains

### Galaxy

Work in a group of 4 to compare the design of the cuts used e.g. going round, across, zigzag etc. Remember to consider all variables including thickness of cuts. Measure, compare and discuss results.

# BALLOON CHAIR

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- BALLOONS (FOR YOUNGER PUPILS THESE SHOULD ALREADY BE BLOWN UP)
- BALLOON PUMP
- TAPE
- SCISSORS

## Challenge:

*Design and make a chair using only balloons.*

### Planet



### Solar System

The balloon chair should hold the weight of one pupil for a minimum of 30 seconds.

### Galaxy

Create a balloon sofa that can hold the weight of two pupils for a minimum of 30 seconds.

# BALLOON ROCKETS

GROUP SIZE:4

## RESOURCES:

- STRING
- BALLOON
- STRAW
- SCISSORS
- CELLOTAPE



### Planet



### Solar System

Use different sizes and shapes of balloons and compare how they travel. Option to use a time lapse camera to compare.

### Galaxy

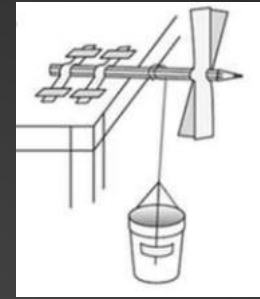
Complete solar system challenge and then use most effective balloon shape/ size and design a suspended object for the balloon to carry across the string. Compare with other group designs/ balloons.

# WIND POWER CHALLENGE

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- JUNK MATERIALS E.G. CARDBOARD, BOXES, BOTTLE LIDS, STRAWS ETC.
- 2 X A4 CARD
- 1 X PENCIL
- TAPE/GLUE
- SCISSORS
- WEIGHTED ITEMS (FOR TESTING ONLY)



## Challenge:

*Build a simple wind turbine that can lift a cup off the floor when powered by a hairdryer.*

### Planet

Create a simple wind turbine that turns when powered by a hairdryer.  
*No cup required.*

### Solar System



### Galaxy

The wind turbine should be freestanding on the table.  
Weighted items in the cup when testing the turbine.

# WIND POWERED CAR

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- WOODEN SKEWERS/STICKS X 3
- BOTTLE TOPS X 4
- STRAWS X 2
- A4 CARD
- TAPE/GLUE
- SCISSORS
- HAIRDRYER (FOR TESTING)

### Challenge:

*Make a car that can travel a short distance when powered by wind.*

### Planet



### Solar System

Increase the distance the car needs to travel.  
Add weight (a passenger) to the car – this must remain inside the vehicle during travelling.

### Galaxy

Create a vehicle and trailer. Use objects (eg marbles) as cargo in the trailer.  
Add a speed bump onto the track that the vehicle needs to go over.

# TIN FOIL CARGO BOATS

GROUP SIZE: 2

TASK- DESIGN A BOAT THAT CAN STAY AFLOAT. SLOWLY ADD COINS ONE AT A TIME SEE HOW MUCH CARGO YOUR BOAT CAN CARRY.

## RESOURCES

- TIN FOIL
- COINS
- BOWL OF WATER



### Planet

Build a simple boat that can carry up to 3 coins without sinking.

### Solar System



### Galaxy

Build a boat using tin foil and compare the designs of each boat noting which shape is the most effective- think of reasons why. Further challenge to make a boat from a different material, paper, cardboard, plastic.



# WATER WHEEL

GROUP SIZE: 2

TASK – MAKE MOVING WATER WHEEL

## RESOURCES:

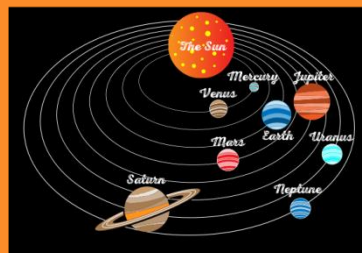
- STRAW OR WOODEN DOWELL
- 2 X PAPER PLATES
- 4 X PAPER CUPS
- TAPE
- WATER



## Planet

Use one paper plate and some plastic spoons

## Solar System



## Galaxy

Count how many rotations of the wheel you can get from one litre of water. Experiment with changing the height from which the water is poured and observe what happens.

# MAKE YOUR SHARK SWIM

GROUP SIZE: INDIVIDUAL/PAIRS

TASK- FOLD THE EDGES OF THE FOIL TO CREATE A DISH. THEN DRAW YOUR SHARKS/SEA ANIMALS, ON THE BOTTOM OF THE FOIL (GOOD IDEA TO DO MORE THAN ONE). NEXT ADD WATER, POUR THE WATER INTO THE DISH CLOSE TO THE EDGES OF YOUR DRAWINGS. WITHIN SECONDS, YOU'LL SEE THE WHITEBOARD PEN INK REACTING WITH THE WATER, AND THE EDGES OF YOUR DRAWINGS WILL BEGIN TO LIFT. AS YOU ADD MORE WATER, THE INK WILL LIFT AWAY FROM THE BOTTOM OF THE DISH AND FLOAT TO THE SURFACE OF THE WATER. BLOW WITH A STRAW AND WATCH THEM MOVE.

## RESOURCES:

- TINFOIL
- WHITEBOARD MARKER PENS
- STRAWS
- WATER



## Planet



## Solar System

Make observations to try and determine what factors make the experiment work best  
Is it the colour of the ink? Does it depend how thick the layer of ink is?

## Galaxy

Can you pick up your floating shapes?  
Try to pick up the floating shapes with your fingers. They may completely deflated and look like a little strand of rubber, but when gently placed back on the surface of the water and jiggled a little, they can expand back into their original shape and be floated again.

# SLOW MARBLE RUN

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- 1 X A3 CARD
- 4 X A4 CARD
- 10 X STRAWS
- 1 X PLASTIC CUP
- JUNK MATERIALS E.G. CARBOARD TUBES
- SCISSORS
- TAPE/ GLUE
- STOPWATCH

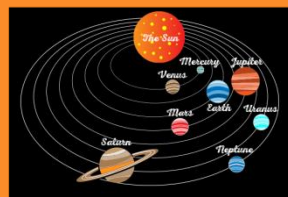
## Challenge:

*Design and construct a slow marble run. Your marble must travel as slowly, and run for as long a time, as possible. At the end of the run it must go into, and stay, in a container.*

### Planet

Remove the time element. Construct a simple marble run with a start and end point the marble must travel between.

### Solar System



### Galaxy

Pupils must use three marbles to travel along their marble run. Include one loop in the design of the marble run.

# CODING CHARACTER

GROUP SIZE: INDIVIDUAL/PAIRS

## RESOURCES:

- IPAD/ COMPUTER
- SCRATCH

### Challenge:

*Using Scratch, create a character than can move across the screen.*

### Planet



### Solar System

Use 3 different movements to make the character move. Include a different feature e.g. speech bubble

### Galaxy

Create a minimum of 2 characters that interact.

# SAFE VEHICLE

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- JUNK MATERIALS E.G. CARDBOARD, BOXES, BOTTLE LIDS, STRAWS ETC.
- 4 X A4 CARD
- TAPE/GLUE
- SCISSORS

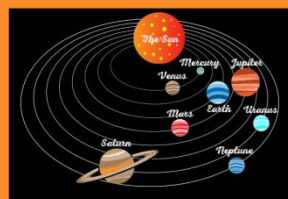
## Challenge:

*Design and make a vehicle that will safely carry an egg down a ramp and over a speed bump.*

### Planet

Reduce the gradient and length of the ramp.

### Solar System



### Galaxy

Change the load for the car to 6 marbles. All of the marbles must remain in the car as they travel. The car needs to travel up a ramp and down the other side before going over the speed bump.

# ROBOTIC HAND

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- CARD
- STRAWS
- STRING
- TAPE

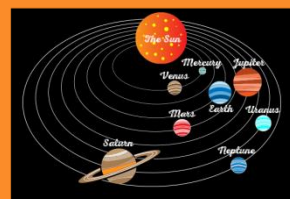
### Challenge:

*Create a robotic hand that can lift an object.*

### Planet

Create a robotic hand with fingers that move.  
*Remove the objective of lifting an object.*

### Solar System



### Galaxy

*The object needs to be moved from one point to another.*

# DOMINO CHAIN

GROUP SIZE: INDIVIDUAL/TEAM

## RESOURCES:

- DOMINOES
- WOODEN/ PLASTIC BLOCKS IN DIFFERENT SHAPES AND SIZES

## Challenge:

*Create a domino chain with a clear start and end point.*

### Planet



### Solar System

Increase the distance between the start and end point.  
Must include at least one ramp.

### Galaxy

Increase the distance between the start and end point.  
Must include at least two ramp/raised sections and one spiral.

# LEGO ZIPLINE

GROUP SIZE: 4

TASK – MAKE A ZIPLINE FOR A LEGO FIGURE

## RESOURCES:

- LEGO FIGURE
- ASSORTED LEGO
- LONG PIECE OF STRING



### Planet



### Solar System

Investigate the effect of gravity by altering the slope, what is the effect of making the slope steeper or more gradual?

### Galaxy

Measure the rate of acceleration of the figure by measuring the time to travel down the slope and the distance travelled. Challenge the children to increase the speed by reducing friction



# BUILD A WINCH

GROUP SIZE: 4

TASK – MAKE A MOVING WINCH USING JUNK MATERIALS

## RESOURCES:

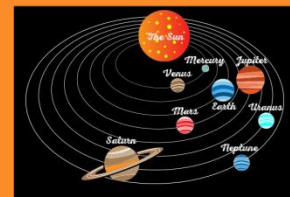
- CARDBOARD TUBES
- SPOOL
- STRING
- PENCIL
- TAPE / SCISSORS
- OBJECT TO USE AS A BASKET



## Planet

Build the pulley onto a table top (eliminate the towers)

## Solar System



## Galaxy

Try to lift increasingly heavy objects with the winch. Use scales to weigh the objects. Compare successful designs.

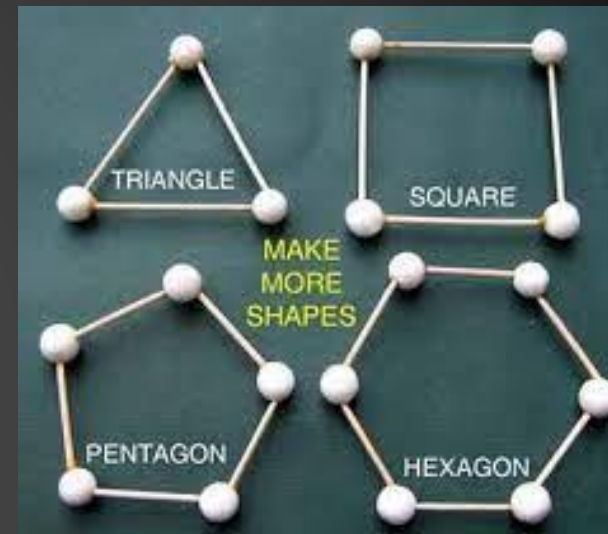
# BUILD A STRUCTURE

GROUP SIZE: INDIVIDUAL

TASK: THIS COULD BE AN OPEN-ENDED CHALLENGE ALLOWING CHILDREN TO DESIGN ANY STRUCTURE OR CAN BE MORE DIRECTED USING CHALLENGE TASKS FOR 2D AND 3D SHAPE.

## RESOURCES:

- SMALL MARSHMALLOWS OR GUMDROPS
- TOOTHPICKS OR SPAGHETTI



### Planet



### Solar System

Ask children to create a selection of regular and irregular shapes. Option to include facts about each shape e.g this shape has 4 equal sides

### Galaxy

Ask children to complete a selection of 3D shapes. Option to include facts about each shape e.g this shape has a square base, 4 triangular faces and 5 vertices.

# HURRICANE HOUSES

GROUP SIZE: 2/3

TASK- DESIGN A HOUSE THAT WILL BE HURRICANE PROOF WITH FIRM FOUNDATIONS

## RESOURCES

- PAPER
- LOLLIPOP STICKS
- PLASTICINE
- STICKY TAPE
- A SMALL FAN



### Planet

Allow children time to be creative simply by creating 2D or simple 3D designs using the materials

### Solar System



### Galaxy

Provide a cost for the resources and research who can build the most cost effective house that can withstand the winds of a hurricane.

# LOLLY STICK BRIDGE

GROUP SIZE: 2

TASK – MAKE A BRIDGE STRONG ENOUGH TO CARRY A TOY CAR USING ONLY LOLLY STICKS AND PLAYDOUGH

## RESOURCES:

- LOLLY CRAFT STICKS
- PLAYDOUGH
- TOY CAR



### Planet



### Solar System

Increase the weight the bridge needs to sustain

### Galaxy

Reduce the number of lolly sticks available to complete the challenge. Investigate what shapes make the strongest bridge

# PEG & LOLLY STICK OPEN CHALLENGE

GROUP SIZE: INDIVIDUAL

TASK-CREATE SOMETHING USING ONLY LOLLY STICKS AND PEGS

## RESOURCES:

- LOLLY STICKS
- CROCODILE CLOTHES PEGS



## Planet



## Solar System

Provide a design challenge  
e.g. aeroplane

## Galaxy

# HOUSE OF CARDS

GROUP SIZE: 2

TASK – WHAT IS THE TALLEST STRUCTURE YOU CAN BUILD USING A SET OF PLAYING CARDS

## RESOURCES:

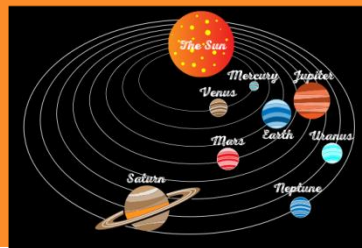
- PLAYING CARDS
- MINI FIGURE (OPTIONAL)



### Planet

Make a 2 story house with cards

### Solar System



### Galaxy

Can your structure support a small toy?

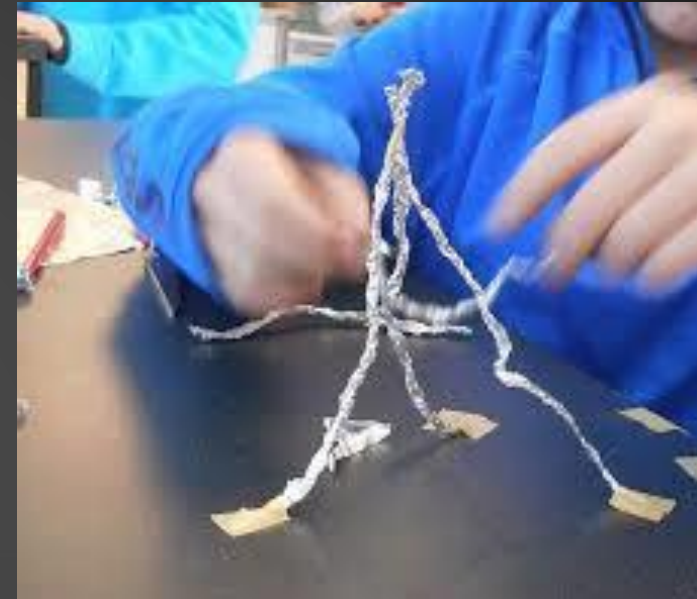
# TIN FOIL TOWER

GROUP SIZE: 2/3

MAKE THE TALLEST TOWER USING ONLY THE GIVEN AMOUNT OF TIN FOIL

## RESOURCES:

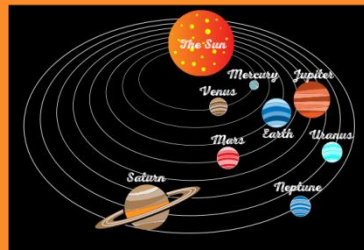
- TIN FOIL
- RULER/METRE STICK



## Planet

Construct a creative tower from tin foil without any height challenge

## Solar System



## Galaxy

Research the design and construction of metal towers (e.g. electricity pylons, Blackpool Tower, Eiffel Tower, Tokyo Tower) and incorporate these ideas into the design

# FORCES

## MAGNETIC CHALLENGE

### RESOURCES:

- MAGNETS
- PICTURE OF POLICE PERSON
- PICTURE OF ROBBER
- BLUE TAC
- BOTTLE TOPS
- SMALL BOXES



### Planet

Attach the picture of the Police Officer to a bar magnet. Attach the picture of the Robber to a second magnet. Will the Police Officer catch the robber or will the robber escape? Why? Which was the most difficult to do? Why?

### Solar System

“Float” your magnets in two boxes, away from other magnets. Make sure there are no magnets near your boxes. What do you see? How many magnets can you float?

### Galaxy

Use blue tac to attach a button magnet between the two bottle tops. Can you use another magnet to move the wheelie without touching it?



small magnet



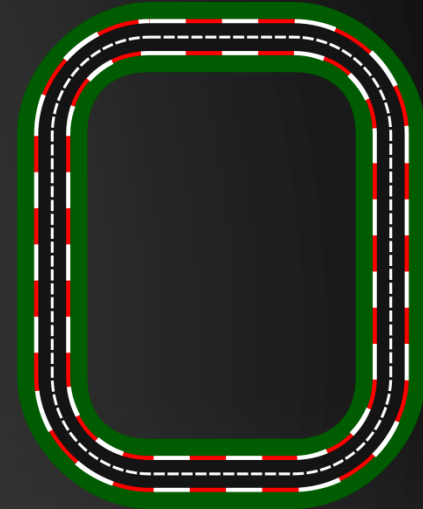
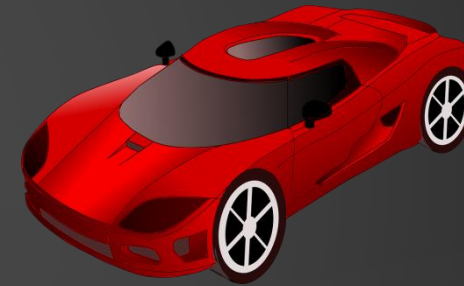
# MAGNETS

GROUP SIZE: 2

TASK- DESIGN A CAR, CUT IT OUT AND ATTACH A PAPER CLIP. DESIGN A RACE TRACK. USING A MAGNET ATTACHED TO STRING, RACE A FRIEND AROUND THE TRACK.

## RESOURCES:

- MAGNETS
- PICTURES OF CARS
- RACE TRACK
- STRING



### Planet

You can give children an already printed race track, ask them to race across a table or design a race track of their own.

### Solar System



### Galaxy

Can you find a way to race using the magnets underneath the track? How can you get the track to stay up?

# SLIPPY OR GRIPPY

GROUP SIZE: 2-4

TASK- LIFT ONE END OF THE BOARD TO REST ON THE TABLE, THE OTHER END ON THE FLOOR.

PUT A SHOE ON THE HIGHEST END OF THE BOARD. WHAT HAPPENS? CAN YOU FIND THE SLIPPIEST OR GRIPPIEST SHOE?

RESOURCES:

- SHOES FROM CHILDREN
- PIECE OF WOOD/BOARD LONG ENOUGH TO ANGLE FROM TABLE TO FLOOR



## Planet



## Solar System

Try the shoe challenge from different heights, from different heights – on a chair/a table. Can you measure the height? Repeat for different shoes. What are the results? Does the height matter? Why

## Galaxy

Can you create a graph to plot who's shoe started to slip at which height?

# MATERIALS DESIGN CHALLENGE

GROUP SIZE: INDIVIDUAL/ TEAM

TASK- DESIGN THEN MAKE;

## RESOURCES:

- A4 PAPER/CARD
- SCRAP MATERIALS
- SCISSORS
- GLUE STICK
- MEASURING TAPE
- ELASTIC BANDS/LENTILS/DRIED RICE
- OTHER RECYCLABLE MATERIALS



### Planet

Suitable clothing to dress teddy/doll for the rainforest/the artic. Can you make the clothes?

### Solar System

A musical instrument. Sketch and label your designs, then build a prototype. Which materials make the best sounds?

### Galaxy

A board game. Who will it be for? What will the rules be? Challenge someone else to play it.

# ENERGY

GROUP SIZE: INDIVIDUAL/ SMALL GROUPS

TASK- DRAW PICTURES OF, OR CUT OUT PICTURES OF THINGS THAT NEED, ENERGY TO WORK (FROM MAGAZINES OR CATALOGUES).

## RESOURCES

- PAPER
- PENCIL
- SCISSORS
- MAGAZINES
- GLUE



### Planet



### Solar System

Can you write down what types of energy they use?

### Galaxy

Added challenge: Is there a more sustainable energy source for these things?

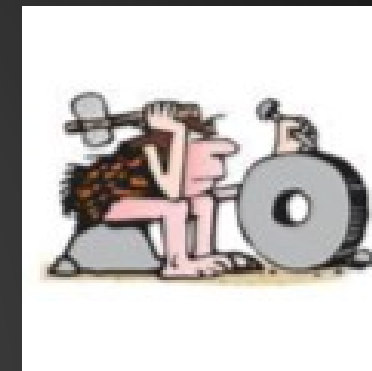
# HELPFUL INVENTION

GROUP SIZE: INDIVIDUAL OR GROUP

TASK- DESIGN A NEW INVENTION THAT WILL MAKE THE WORLD A BETTER PLACE

## RESOURCES

- PAPER
- PENS
- RECYCLABLE MATERIALS/PLASTICINE



### Planet

Allow children time to discuss what are their favourite inventions that already exist? Are there any inventions that already help make the world better? Children may find it helpful to create a 3D design using plasticine or recyclable materials.

### Solar System



### Galaxy

Create a Dragons Den style pitch for your invention.

# DESIGN A SUSTAINABLE TOWN

GROUP SIZE: 2-4

TASK- DESIGN A TOWN THAT USES ONLY SUSTAINABLE ENERGY FOR POWER. THINK ABOUT THE POWER SOURCES, WHAT WILL BE IN YOUR TOWN AND WHAT WILL NEED ENERGY TO WORK.

## RESOURCES

- PAPER
- PENS



### Planet

Design a house for Goldilocks and the 3 Bears to live in. Think about the things Goldilocks will need and the things the bears will need.

### Solar System



### Galaxy

Provide a cost for the resources and children work out the cost of building the town.

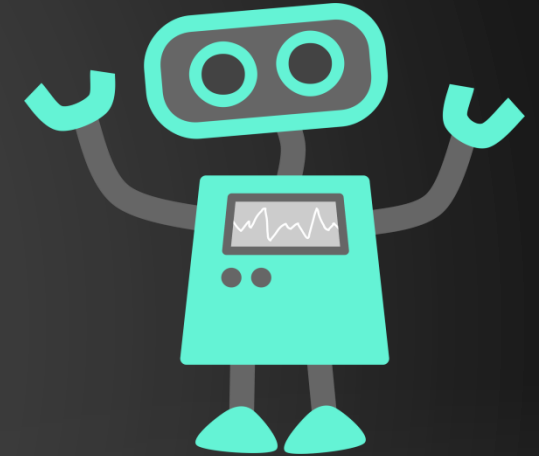
# ROBOT STEPS/COMPUTATIONAL THINKING

GROUP SIZE: 2

TASK- WORKING IN PAIRS, CHILD **A** GIVE DIRECTIONS TO CHILD **B** TO MANOUVERE TO A SPECIFIC DESTINATION. USE LANGUAGE SUCH AS "FORWARD 2 STEPS/TURN RIGHT/90 DEGREE TURN LEFT"

## RESOURCES

- PAPER
- PENCIL



### Planet

Allow children to use whatever language they need, to get their partner safely to the destination.

### Solar System



### Galaxy

Challenge the children by asking them to write the directions first. Can their partner use those exact directions to reach the destination?

# GUESS MY ANIMAL

GROUP SIZE: 2

TASK- DRAW AN ANIMAL AND WRITE ITS NAME E.G CAT, DON'T LET YOUR PARTNER KNOW WHAT IT IS. CAN YOUR PARTNER DRAW A PICTURE OF AND CORRECTLY GUESS YOUR ANIMAL? YOU CAN ONLY USE SHAPES AND LINES WHEN DESCRIBING E.G. DRAW 2 TRIANGLES 2 CM APART (FOR EARS)

## RESOURCES

- PAPER
- PENCIL



### Planet

Allow children to use language that describes the animals features e.g. draw 2 pointy ears/draw 2 round eyes.

### Solar System



### Galaxy

Time how long it takes? Can you beat your time for the next animal?