A collection of **STEAM** ideas

2020-1-MT01-KA229-074227

In Demand: (Teachers who) INvestigate, DEsign, MAke 'N' Deliver (results)

1st September 2020 – 30th June 2023

Head of Project: Ms Natalie Saliba

Project Coordinator: Mr Anthony Caruana

Participating Schools

St. Ignatius College, Siġġiewi Primary School Malta

St. John's Senior School Kilkenny Ireland

Ceipso Maestro Rodrigo Aranjuez Spain

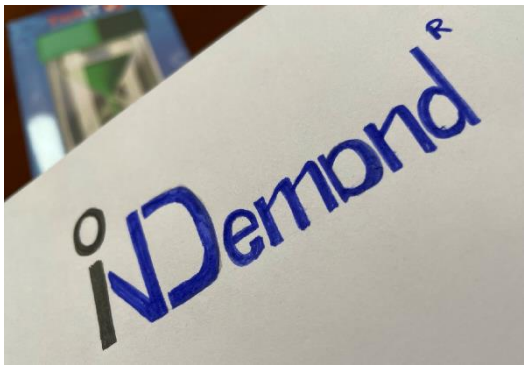
OŠ Vižmarje Brod Ljubljana Slovenia

Istituto Comprensivo F. De Sanctis Moiano Italy

InDemand Logo Design by Ms Sandra Abela

Erasmus+

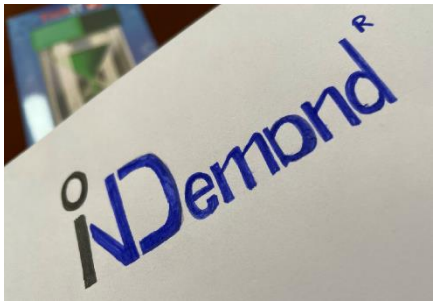
An Erasmus+ Project co-founded by the European Union



Introduction by the Head of the Project, Ms Natalie Saliba

For an educator, nothing compares to watching students participating actively in meaningful learning opportunities. The excitement that shows on their faces as they try out new things, and the sense of accomplishment once they master a task or complete a challenge assigned to them is what educators live for and what makes the hours of planning worthwhile. This project has given our teachers and students the opportunity to participate in STEAM projects and to share their successes with teachers and students from four other European countries. This exchange of good practices has had a positive ripple effect as more and more educators learn from their colleagues and are encouraged to try out new ideas in their respective classrooms. This collection of ideas is an overview of the different ideas that were shared during the project by the different partners. The various photos are proof that our students are being given meaningful challenging STEAM challenges and we, together with our partners, are proud to be leaders in this field which is ever growing in importance.

I take this opportunity to thank the Erasmus+ Programme co-founded by the European Union, for making this experience possible. Special thanks go to Mr Caruana, who oversaw the realization of this project.



Introduction by the Project Co-ordinator, Mr Anthony Caruana:

A lot of time has passed since I first had the idea of applying for an Erasmus+ project which focuses on meaningful STEAM activities for Primary School students. When I first discussed this idea with my colleagues back in December 2019, little did we imagine that soon after we would submit our application, a pandemic would hit Europe with full force, forcing many schools to close, resort to online teaching or else if open, work under a lot of restrictions. It is with a sense of satisfaction that I can look back and see what we managed to achieve despite these adverse conditions. Moreover I feel proud that we have offered our students these opportunities in STEAM education, at a time when they were deprived of many opportunities due to the pandemic restrictions.

A word of thanks has to go to the head of the project, Ms Natalie Saliba for her constant and unwavering support, and to my colleagues who have taken an active interest in the project. A heartfelt thanks goes also to the respective national coordinators of our partner schools, Sonja Sega, Pilar Mena, Orlay Mackey and Jusy Juliano, without whose input this project would not have succeeded and to the respective Heads of schools who have hosted the participants during the international mobilities.

Thanks also to the officials at Meusec who have helped us with our application and to the officials at EUPA, especially Ms C Ciappara who has offered her continual support for the duration of the project.

Challenge Idea No: 1

Section: Robotics

Target Age Group: 8-9 years

The Challenge:

How can we measure sound using Robo Wunderkind?

Rules to be observed:

- Use a maximum of 6 commands.
- For each sound level, create an action. (e.g. If the sound is 60db, then green light turns on)
- Start by planning the process in a group, using your whiteboards.
- You can make your robot move.

Think about:

What did you use to measure sound?
How is it measured?
What did you notice about the sound level?

Resources:

Mini whiteboards, paper, 2 sets of Robo Wunderkind. 2 tablets

Links: https://youtu.be/52RKe_tuMSI , https://youtu.be/SNKxWgHzRmk , https://youtu.be/9eid2qjsW3M

Idea contributed by Ms Francesca Bugeja and the pupils of Year 4.3 at Siggiewi Primary Malta

Challenge Idea No: 2

Section: Robotics

Target Age Group: 9 – 10 years

The Challenge:

Create a building of tomorrow: Use your robot to create a multi-practical device for transporting cargo and people with the goal of overcoming architectural obstacles.

Rules to be observed:

- The device has to be safe to use.
- It should make life in the multi-storey building easier and more comfortable.
- It should be beneficial to disabled people.

Think about:

How can disabled people be helped to become independent?
Is it possible to create this device in today's time?
How would such buildings affect people's lives in big cities?

Resources:

WeDo robot, legos and computer

Idea contributed by Ms Mirjam Sedmak and the pupils of Year 5.B at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 3

Section: Robotics

Target Age Group: 8-9 years

The Challenge:

How can we create a flashlight using the Robo Wunderkind?

Rules to be observed:

- Think about which commands you need to use to make the robot light its flashlight.
- Plan the process in a group, using your whiteboards first.
- Make sure all the pieces are connected well so that the robot is active.

Think about:

- What is light? Who invented it?
- Which device would you use if you need to search for something in the dark?
- Does this device work all the time? Can it be switched off and on? How?
- Can we create a flashlight? Can we create a smart lamp?

Resources:

Bulb picture, Thomas Edison reading text, Tablet & Robo Wunderkind 2 sets, Mini whiteboards

Idea contributed by Ms. Maria Aquilina and the pupils of Year 4.4 at Siġġiewi Primary Malta

Challenge Idea No: 4

Section: Robotics

Target Age Group: 11 -12 years

The Challenge:

Creating Traffic Lights

Rules to be observed:

- Use the components needed: red, green, yellow led lights and a bottom.
- Code the commands in the computer.
- Design the traffic lights structure, incorporating the different components within the commands.

Think about:

How to incorporate the bottom in a traffic light to make a pedestrian traffic

Resources:

Zum Kit BitBloq, chromeBook, various reusable materials

Idea contributed by Ms Pilar Mena and the pupils at Ceipso Maestro Rodrigo, Spain

Challenge Idea No: 5

Section: Robotics

Target Age Group: 5 – 6 years

The Challenge:

The Desert Quest - Programme the Qobo to find the pyramids on the mat.

Rules to be observed:

- Listen attentively and participate during a shared reading session using the book The Desert.
- Participate in the ensuing discussion on the desert and what could be found in it.
- Watch videos related to the pyramids.
- Programme the Qobo so that the robot finds its way to the pyramids placed on the mat. Challenge the children to use different starting points.

Think about:

Which are the correct cards that lead the robot from the starting point to the pyramids on the mat.

Resources:

Book about The Desert, Age-appropriate video clips on The Pyramids, Qobo and mat

Idea contributed by Ms M Deguara and the pupils of Yr1.3 at Siġġiewi Primary School Malta

Challenge Idea No: 6

Section: Robotics

Target Age Group: 10 - 12 years

The Challenge: Sumo bot fight

Design and build an Mbot robot using a school Mbot kit and some additional extra parts to make your robots look scarier. The robot will take part in a robot fight. The fight will be one on one, on a special rectangular or round board. The robots will have to push each other out of the board till one of them drops down. The winner robot will be the one which remains on the board alone.

Rules to be observed:

The robots must be controlled remotely, and no one is allowed to touch the robots during the robot fight.

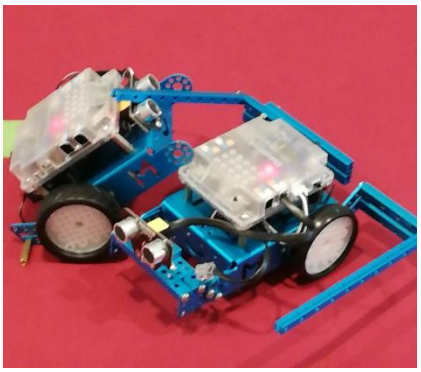
Think about:

What commands must be inputted in the programme?

How can you make the robot more effective? (Appearance vs effectiveness)

Resources:

Mbots, additional resources, tools, computer, board, foam protection



Idea contributed by Mr Tomaž Murn and the pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 7

Section: Robotics

Target Age Group: 11 – 12 years

The Challenge:

Using mBlock make a program for your mBot. The program should be designed to control your robot with the remote control during a robot football game.

Rules to be observed:

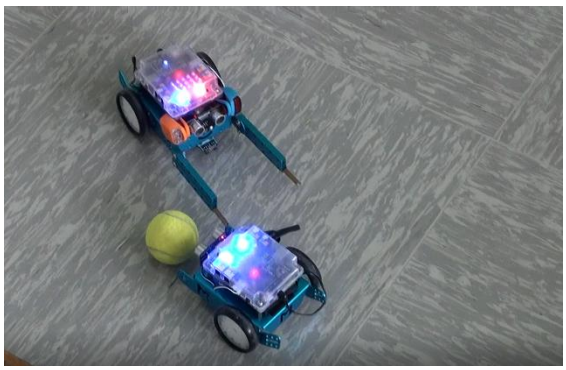
- The mBot must move when you press a button on the remote control.
- Each group must use the other keys on the remote control to steer the robot.
- No one may touch the ball or the robot during the game.

Think about:

- How to make a program that will most easily control the robot with the remote control?
- With the robot you will play a game of Robot Football. The group that will make the better program will find it easier to 'kick' the ball with the robot and score.
- Which blocks in mBlock will you use?
- How will you build a robot – which parts will you add?

Resources:

Robot mBot, computer, program mBlock, ball, two mini goals.



Idea contributed by Špela Zorman and the pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 8

Section: Robotics

Target Age Group: 8-10

The Challenge:

Write a program that drives Edison forward a set distance from a START marker to a STOP marker.

Rules to be observed:

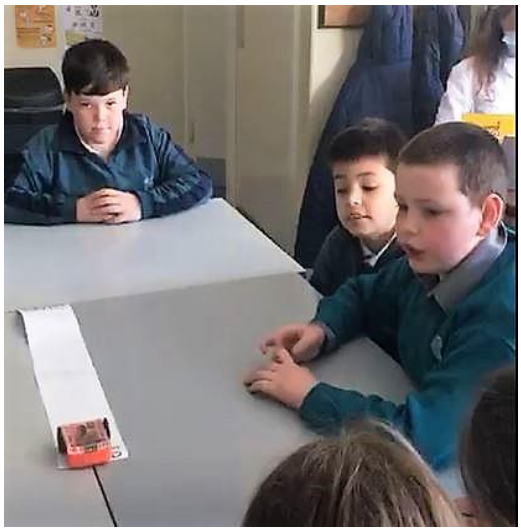
- You have to create your own START & STOP markers.
- The Edison robot must stop before driving over the marker.

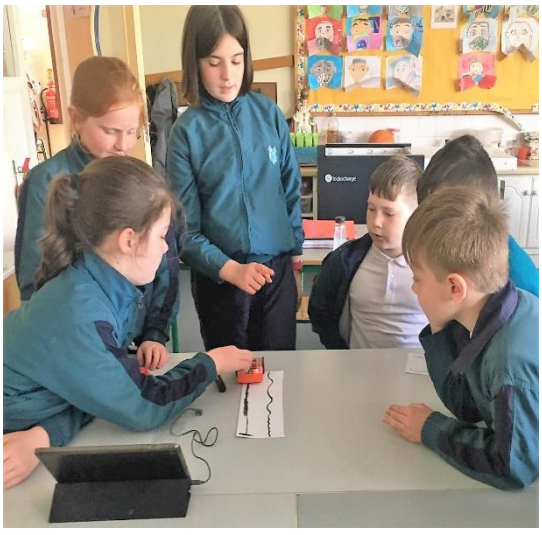
Think about:

- What is the quickest time that the robot can travel to the STOP marker and back?
- What is the slowest time that the robot can travel to the STOP marker and back?

Resources:

Edison robots, coloured tape, activity sheets.





Idea contributed by Ms. Mackey and the 4th Class at St. John's Senior School, Ireland

Challenge Idea No: 9

Section: Robotics

Target Age Group: 10-13 years

The Challenge:

Build a Motion Sensor to detect the presence of a special plant specimen.

Rules to be observed:

- Build an arm using the Motion Sensor.
- Program the rover to go forward until it detects the presence of the plant specimen. It has to stop and make a sound upon detection.
- Record your own sound to be used for the discovery.
- Record a video of the mission.

Think about:

Did the rover stop as intended? If not, why didn't the rover stop in front of the plant? How can this be rectified?

Resources:

LEGO WeDo sets, iPads

Lesson idea contributed by Ms. Dermody's Class, St. John's Senior, Kilkenny, Ireland

Challenge Idea No: 10

Section: Robotics

Target Age Group: 11-13 years

The Challenge:

Use your robot to move the balls into the cubes while going around the cone.

Rules to be observed:

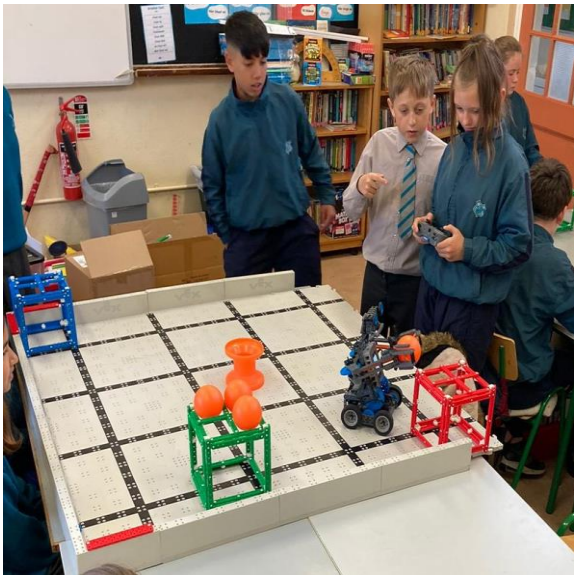
- You only have one minute and a half for each contestant to go around the cone and put as many balls as possible into the cubes .
- You have to go around the cone. You can't pick it up and move it around.

Think about:

Think about the best way to try and get as many balls in the cones as possible.

Resources:

We used the field, the orange balls, the cubes, the cones and the Vex robot [Kevin].



Lesson idea contributed by Mr. Kearns and the 6th Class St. John's Senior School, Ireland

Challenge Idea No: 11

Section: Robotics

Target Age Group: 7-8-9 years

The Challenge:

Reproduce the Italian flag on squared paper using the mBot block language

Rules to be observed:

- Use the symbols: colour, forward arrow, back arrow, up arrow and down arrow (ages 7/8/9).
- Use a 1cm 3x3 grid chart (ages 7/8/9).
- Use mBlock programming language (ages 7/8/9).
- Use movement and light blocks (ages 7/8), movement, light and sound blocks (age 9).

Think about:

What sequence of arrows to use to create the image?
How can instruction sequences be used, to solve a problem through computational thinking?

Resources:

squared paper, coloured crayons, pens, pc, robot mBot, mBlock program

Idea contributed by the teachers and students of IIA Moiano Italy

Challenge Idea No: 12

Section: Robotics

Target Age Group: 9-10 years

The Challenge:

Program mBot to move using the arrow keys of the pc

Rules to be observed:

- Use the mBlock programming language.
- Combine each movement with an arrow key on the PC (movement to the right moved by the right arrow, movement to the left moved by the left arrow, forward movement up arrow key and backward movement down arrow key, space bar stops the movement).

Think about:

Which blocks to use to match the arrow keys to the robot's movements?
Is there a daily use of instruction sequences to solve a problem through computational thinking?

Resources:

mBlock program, robot mBot, pc

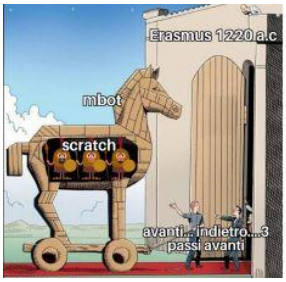
Idea contributed by the teachers and pupils at IC De Sanctis Moiano

Challenge Idea No: 13

Section: Robotics

Target Age Group: 11-12 years

The Challenge: Program mBot to avoid obstacles



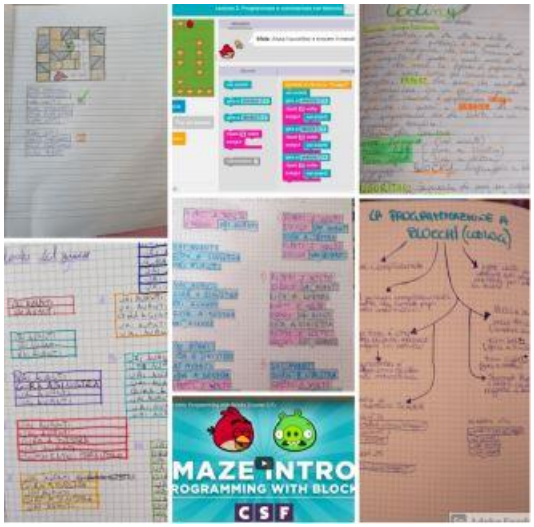
Rules to be observed:

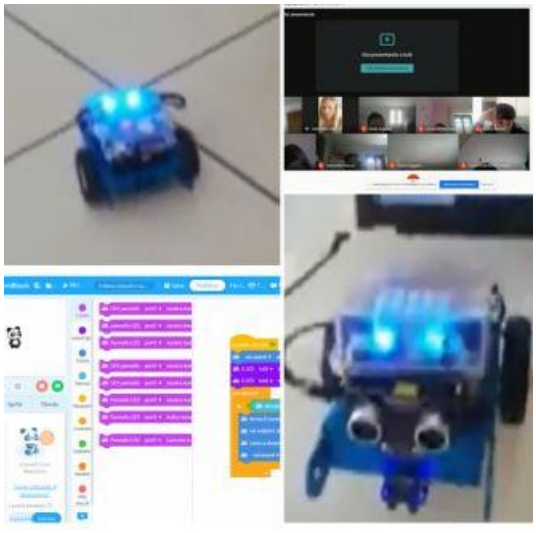
- Use the mBlock programming language.
- Use the block "repeat", "if-then", ultrasonic sensors.
- The robot must stop at a distance of about 15 cm from the obstacle.

Think about:

What blocks will you use to allow mBot to stop in front of an obstacle?
How can instruction sequences be used to solve a problem through computational thinking in daily life?

Resources: mBlock program, mBot robot, pc





Idea contributed by the teachers and pupils of IC de Sanctis Moiano Italy

Challenge Idea No: 14

Section: Robotics

Target Age Group: 8-9 years

The Challenge:

Build a fan which can turn both clockwise and anticlockwise, and which can work at different speeds.

Rules to be observed:

- The fan has to be built using the Lego Wedo kit pieces.
- The hub has to be connected to the tablet.
- You have to code the robot using the tablet.

Think about:

How will you change the code to make it work at different speeds and turn both clockwise and anti-clockwise?

The connection between the robot and the tablet (How does Bluetooth work?)

Resources:

Lego Wedo 2.0 kit, tablet

Lesson idea contributed by the teachers and pupils at Ceipso Maestro Rodrigo (Spain)

Challenge Idea No: 15

Section: Robotics

Target Age Group: 9-10 years

The Challenge:

Build a space vehicle which can move and stop and change its speed and direction.

Rules to be observed:

- The vehicle must be built using the Lego Wedo kit pieces.
- The hub has to be connected to the tablet.
- You have to code the robot using the tablet.

Think about:

How will you change the code to make the vehicle travel at different speeds, change direction and stop?

The connection between the robot and the tablet (How does Bluetooth work?)

Resources:

Lego Wedo 2.0 kit, tablet

Challenge Idea No: 16

Section: Mechanics

Target Age Group: 10-11 years

The Challenge:

Make your haunted house scarier by incorporating a moving part using pneumatics.

Rules to be observed:

- Each project should have at least 1 moving part incorporating pneumatics.

Think about:

Which part of your haunted house will move?
How will you make it move?
How will you attach the moving part to the main structure?
What materials will you need?
How can the efficiency of the moving part be improved?

Resources:

planning sheet; syringes; tubing; various materials depending on the structure designed.

Idea contributed by Ms Daniela Baldacchino and the pupils of Y5.1 at Siġġiewi Primary, Malta

Challenge Idea No: 17

Section: Mechanisms

Target Age Group: 7 years

The Challenge:

Use balloons (air) to open the monster's mouth.

Rules to be observed:

- Create a monster face from a box – cut a face, leaving the back intact.
- Blow the balloon slowly in order to open the mouth with its force.

Think about:

How can the balloon open the monster's mouth?

What is the force that is causing this movement?

Resources:

balloons, recycled boxes.

Lesson idea presented by Ms Maria Tereza Micallef and the pupils of Year 3.1 Siġġiewi Primary Malta

Challenge Idea No: 18

Section: Mechanisms

Target Age Group: 9-10 years

A Rube Goldberg Challenge:

Create a machine that completes a simple task in an extraordinarily complicated way

Rules to be observed:

The machine must make use of everyday objects and involve a mechanical transfer of energy from one step to the next until it resolves in the final task it is intended to do.

Think about:

Changes in the movement of bodies by the effect of forces.

Observe the way the wheel and axle, pulleys, and inclined planes work.

Resources:

Various reusable materials

Lesson idea contributed by the teachers and pupils at Ceipso Maestro Rodrigo (Spain)

Challenge Idea No 19

Section: Mechanisms

Target Age Group: 9-10 years

Ripple Effect Challenge

Use Physical Education resources to create a chain reaction to bin a ball, without touching the ball itself.

Rules to be observed:

- Students have to use equipment used during Physical Education lessons.
- Students can only intervene at the start of the chain reaction to initiate the movement.

Think about:

Changes in the movement of bodies by the effect of forces.

What happens if the force generated is too strong or too weak?

Resources:

Physical Education equipment: bricks, mats, benches…

Challenge Idea No:20

Section: Mechanics

Target Age Group: 11-12 years

The Challenge: By exploring biomechanics, a field of engineering that studies how living things move, design and make a mechanical flower.

Rules to be observed:

- Watch a demonstration of how to make a mechanical flower.
- Make your own mechanical flower.
- Use only the materials provided.
- The flower must have three petals.
- The petals must have a mechanism to open and close.

Think about:

What purposes do the various parts of the mechanical flower serve?
What effect does tightening the strings have on the flower?
What effect does loosening the strings have on the flower?

Resources:

Cardboard, string, skewers, plastic straws, a pencil, scissors, masking tape.

Lesson idea contributed by Ms Orla Mackey and the 6th class pupils at St John's Senior School Ireland

Challenge Idea No: 21

Section: Mechanisms

Target Age Group: 13 – 15 years

The Challenge:

Design and create a chain reaction in a team, using the provided materials.

Rules to be observed:

- ICT should be included, eg Lego mechanisms (eg a robot) to activate the chain reaction.
- Each team will get identical materials, but each team can be creative in their own way.

Think about: (The aims of activity)

How can different solutions be designed with the same materials?
The learning diversity when constructing and achieving the goals.
The interactive use of ICT devices.

Resources:

Lego Simple Mechanisms Set (with belts, cogwheels, axles), Lego EV3 Mindstorms, Additional material: dominoes, elastics of different sizes, woodblocks, small automobile, cardboard, table tennis balls, balloon, tubes, plastic cups/bottles, string, straw…

Lesson idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 22

Section: Mechanics

Target Age Group: 11-12 years

The Challenge:

Create a balloon powered car using one of the simple machines – wheel and axle.

Rules to be observed:

- Tape 2 pieces of straw to one side of the water bottle.
- Make 2 axles by pushing a wooden skewer through the straws.
- Press bottle caps (with holes in the centre) onto the wooden end of the skewers. These are the wheels.
- Put the car on a flat surface, give it a push and make sure it rolls easily.
- Tape the neck of the balloon around some straws.
- Cut a hole in the top and bottom of the water bottle to push the straws through.
- Use tape to secure the straw to the bottle.
- Blow through the straw to inflate the balloon, put finger over the tip of the straw to trap the air.

Think about:

If car does not roll easily at the start: make sure axles are parallel to each other; the hole in each bottle cap is centred; the straws are securely taped to the water bottle.

What happens after finger is released from straw and balloon deflates – when the end of the straw is aimed backward, the air pushes the car forward.

Extension Activities: What adjustments can be made to make the car go further?

1) What happens if you inflate the balloon more?
2) What happens if you adjust the direction the straw is aimed? Does it work best if the straw is aimed straight back?
3) Is the car on a very smooth surface? Friction will slow down movement.

Resources:

Plastic Bottle, 4 plastic bottle caps, Wooden skewer, 4 straws, Balloon, Glue gun, Scissors

Idea contributed by Ms Claire and the pupils of 5th Class at St. John's Senior School Ireland

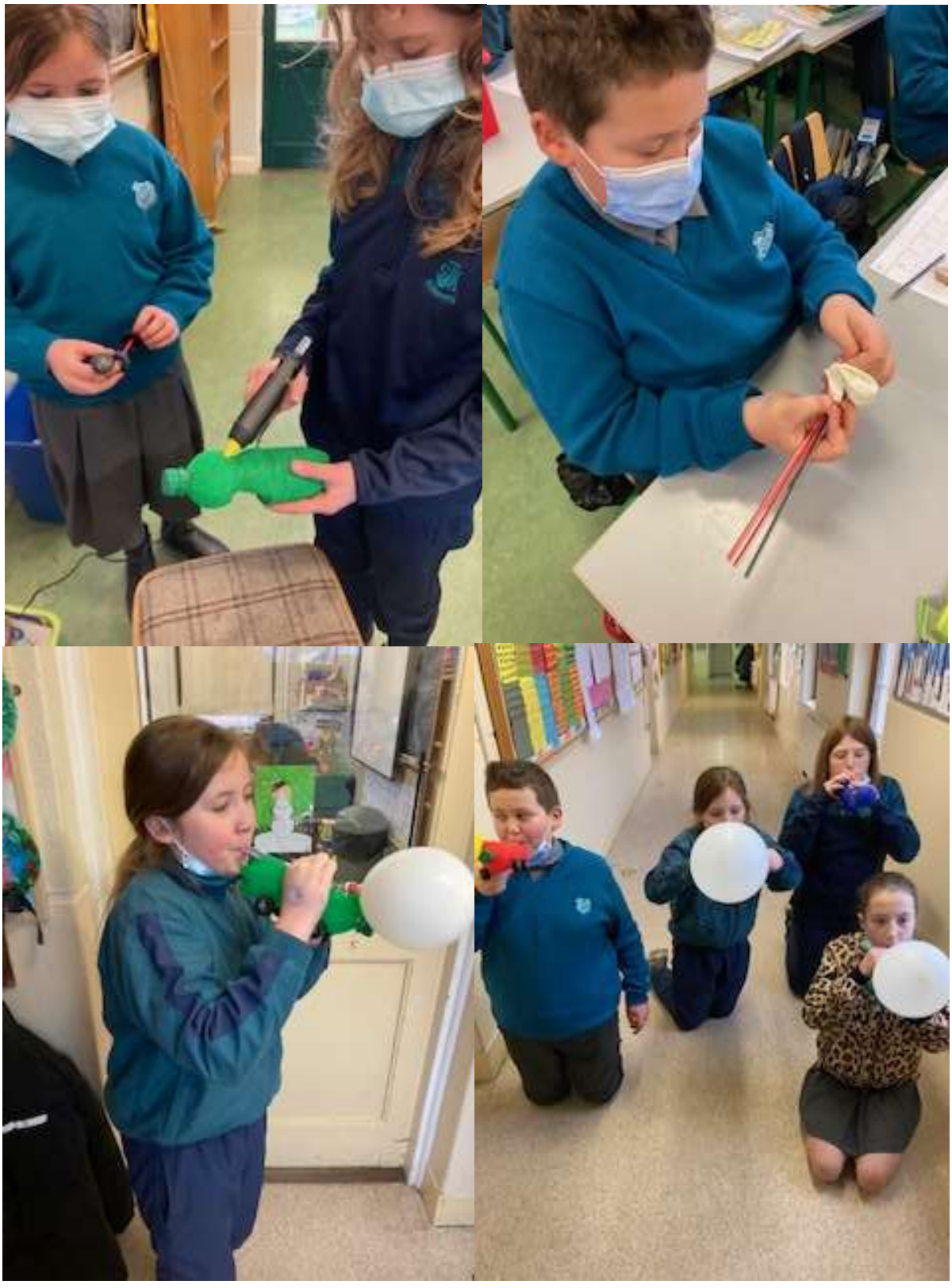


Photo Gallery

Idea contributed by Ms Claire and the pupils of 5th Class at St. John's Senior School Ireland

Challenge Idea No: 23

Section: Mechanisms

Target Age Group: 6-10 years

The Challenge:

"The mill of wishes" – Design and make a mill using cardboard, hot glue, wooden sticks, cutter, and colours.

Rules to be observed:

The sails of the mill must move through a mechanism which you design. (i.e., you cannot touch the sails themselves to move them.)

Think about:

How will your mechanism work?

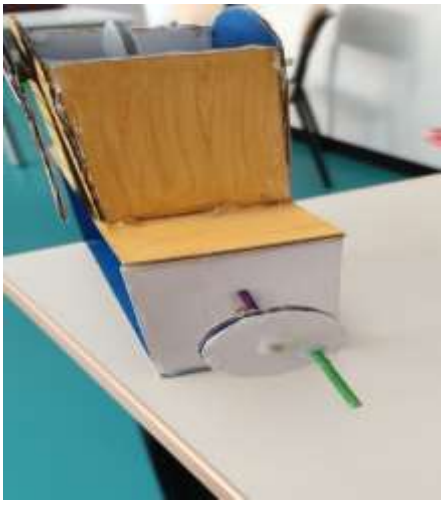
How can you make your mechanism more efficient?

How will you assemble the different components to make the complete model?

How will you decorate your mill?

Resources:

cardboard, hot glue, wooden sticks, cutter, and colours



Idea contributed by the teachers and pupils at IC De Sanctis Moiano

Challenge Idea No: 24

Section: Mechanisms

Target Age Group: 10-12 years

The Challenge:

Using LEGO® MINDSTORMS® EV design, make and programme your own robot on wheels.

Rules to be observed:

- Design your robot, stating what its function will be.
- Include sensors in your design.
- Build your robot using the provided resources.
- Programme your robot.
- Try it out and evaluate its effectiveness.

Think about:

How to design, build and program a robot on wheels.
How to measure the distance of obstacles with a programming mechanism that uses an EV3 brick to convert motor rotations to centimetres.
What blocks to use to allow EV3 to stop in front of an obstacle.
How sensors work.
The performance of your robot and how it can be improved.

Resources:

LEGO MINDSTORMS Education EV3, App EV3 Home LEGO® MINDSTORMS® 1.5.0, pc

Idea contributed by the teachers and pupils at IC De Sanctis Moiano

Challenge Idea No: 25

Section: MECHANISMS

Target Age Group: 11 years

The Challenge:

Create a device which can trigger a chain reaction movement.

Rules to be observed:

- Use the given parts to assemble a moveable device.
- The movement of the device (through a chain reaction) has to be initiated by the movement of air (e.g., blowing) or manually.

Think about:

How, when the constituent parts are correctly assembled, the movement is transmitted in a chain reaction manner, triggering movement in all parts.
How each individual part needs to be precisely combined with the frame as the force is transmitted from one piece onto another piece, till the last one.
When correctly assembled, all the components should move. An advanced level of construction means that the device starts moving through the movement of air (by blowing into the wind slot at the top of the device).

Resources / textbooks:

Od mravlje do Sonca 2, Naravoslovje in tehnika za 5. razred osnovne šole, Textbook,

Authors: Dr. Dušan Krnel, PhD; Barbara Bajd, PhD; Seta Oblak, MA; Saša A. Glažar, PhD; Igor Hostnik

Idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 26

Section: Mechanics

Target Age Group: 11 years

The Challenge:

Mahač (Make a moveable human figure)

Rules to be observed:

- Using the didactic material "Izotech" create a human figure, with a moveable hand.
- The movement has to be obtained through a drive wheel.

Think about:

How to assemble a moveable model, which meets the theoretical basis of steering gears (the movement transfers from the steering objects onto the moveable part).

How to connect the wooden wheel, 2 screws, nuts, washers and the wire together to achieve the required movement.

Resources:

Coursebooks and manuals: Naravoslovje in tehnika 5, Navodila za delo pri pouku tehnike, Izotech založba d.o.o., »Izotech« didactic material.
Authors: Franko Florjančič, Sonja Zajc

Idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 27

Section: Mechanisms

Target Age Group: 5-10 years

The Challenge:

The dancing caterpillar

Rules to be observed:

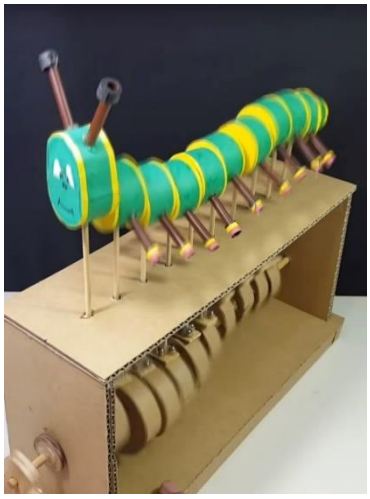
- Create a frame on which the caterpillar is to be assembled.
- Assemble a caterpillar from different circular cams.
- Create a dancing effect by attaching each cam to a corresponding cam situated inside the frame.
- The dancing effect is to be initiated by turning a handle located outside the frame.

Think about:

How can the cams be connected to create one whole caterpillar?
How can the dancing effect be achieved?
How can it also be used to tell and animate a story?

Resources:

double card, green card, yellow card, hot glue, strong hold glue, vinyl glue, wooden sticks



Challenge Idea No: 28

Section: Mechanics

Target Age Group: 10-12 years

The Challenge:

Make a mechanical catapult which can launch a ball of paper.

Rules to be observed:

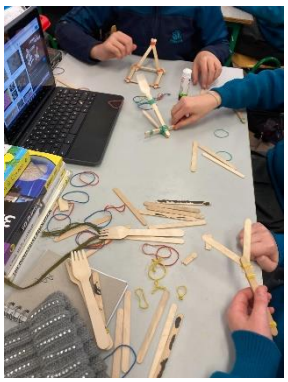
- Watch a demonstration of how to make a catapult using lollipop sticks and elastic bands.
- Make your own catapult.
- Use only the materials provided.
- The catapult can be designed in different ways however it must be able to launch a ball of paper.
- Competition time: Using your catapult launch a ball of paper. Which one works the best and record how far did the ball of paper travel?

Think about:

How does the catapult work?
What if the function of the lever?
What effect does the elastic bands have on the catapult?
What design works best and why do you think this is?
Is there any way you can alter your catapult to make it stronger?
Why were catapults useful in the past?

Resources:

Lollipop sticks, corks, glue, elastic bands, paper and chrome books.



Lesson idea contributed by Mr Eddie Kearns and the pupils at St John's Senior School Ireland

Challenge Idea No: 29

Section: Mechanics

Target Age Group: 4-5 years

The Challenge:

The Gear Wheel Challenge.

Rules to be observed:

- Take a gear wheel challenge card.
- Create the structure according to the specifications listed in the challenge card.
- All gear wheels have to move when the initial gear wheel is turned.

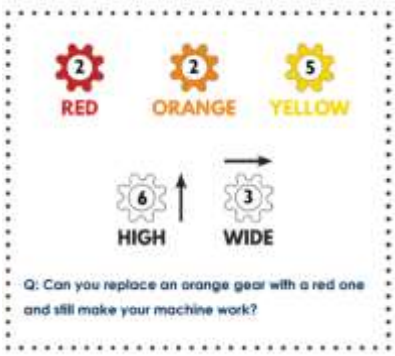
Think about:

Will the structure still work if a gear wheel is removed/changed?

Can you use a different arrangement with the same gear wheels and still make the structure work?

Resources:

Gear wheels of different sizes and colours, gear wheel challenge cards



Challenge Idea No: 30

Section: Mechanisms

Target Age Group: 8-9 years

The Challenge:

The wheel and axle challenge

Rules to be observed:

- Build a simple car using recycled materials.
- The car must have free moving wheels.

Think about:

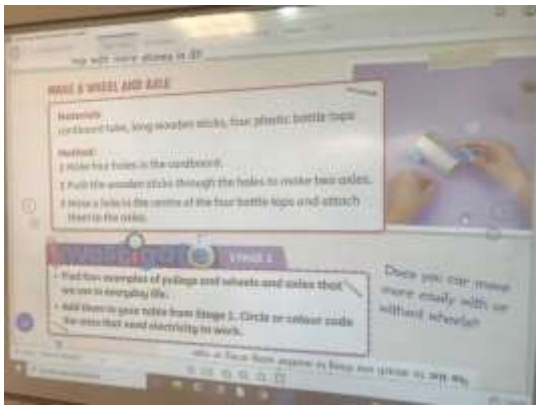
The movement that is taking place through the wheels and axle.

How efficient are the wheels and axles?

How can the designed be improved?

Resources:

Various reusable materials, scissors, glue



Challenge Idea No: 31

Section: Electricity

Target Age Group: 10-12 years

The Challenge:

Static electricity - Make a charged pendulum

Rule to be observed:

- When the cord touches the charged balloon, the negatively charged particles or electrons will run onto the bead made out of aluminium foil. The balloon and the bead end up with the same electric charge and therefore they will repel each other.

Think about:

What is static electricity?

Why does the charged balloon attract a cord but repels the bead?

Resources:

Balloon, wool cord, aluminium foil, clay plasticine dough, terry cloth/towel

Lesson idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 32

Section: Electricity

Target Age Group: 6-7 years

The Challenge:

Magic of lights: Design and make an object which lights up.

Rules to be observed:

- The objects are to be made up of plasticine as the conductive material and clay as insulation.
- LEDs are to be incorporated in the designs.
- LEDs are to be connected to the battery with silver paper.

Think about:

What do you notice about the way the LED and the battery have to be connected?

What can be done to improve the model?

Resources:

plasticine, clay, LEDs, battery, silver paper, various crafts items for decorating the model.

Challenge Idea No: 33

Section: Electricity

Target Age Group: 11-12 years

The Challenge:

Build a simple electrical circuit to make the bulb light.

Rules to be observed:

- Create a circuit using the items provided.
- The bulb must light once the circuit is completed.

Think about:

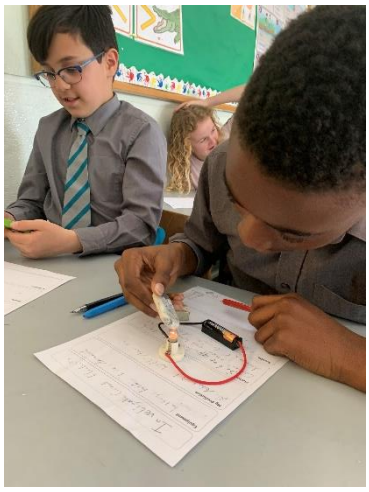
What purposes do the various components of the electrical circuit serve?

How could you add a switch into the circuit?

What would the switch do?

Resources:

D-Cell, an electricity source, an electricity receiver, a circuit, and components (such as wires, switches, motors, battery, etc)



Challenge Idea No:34

Section: Electricity

Target Age Group: 10 - 11 years

The Challenge:

Assemble an electric circuit so that the bulb lights when the switch is turned on.

Rule to be observed:

- Each circuit has to include at least one bulb, one switch and a source of power.

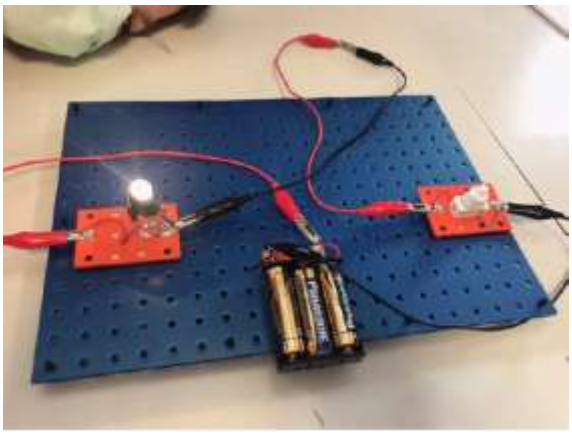
Think about:

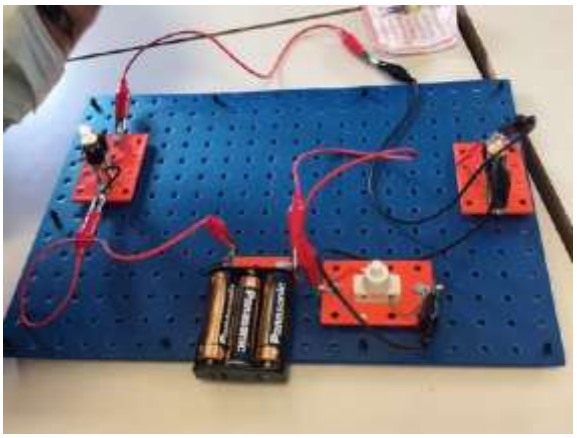
What is the function of the different components in the circuit?

How can you design and create your own simple switch from everyday things?

Resources:

Electricity kit





Challenge Idea No:35

Section: Electricity

Target Age Group: 9-10 years

The Challenge:

Assemble (parallel and in series) electric circuits according to the designs drawn beforehand.

Rule to be observed:

- Each circuit has to include at least two bulbs but only one source of power.

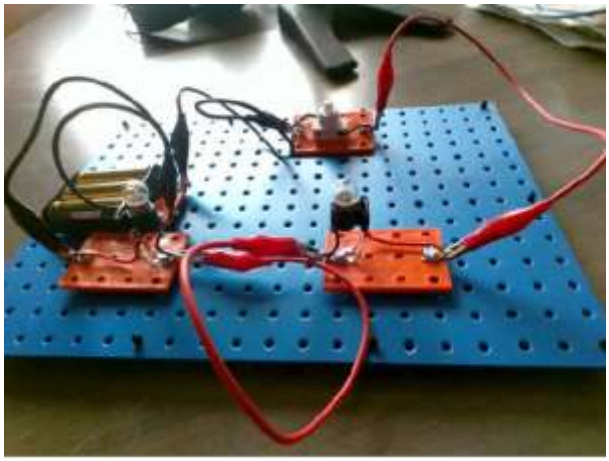
Think about:

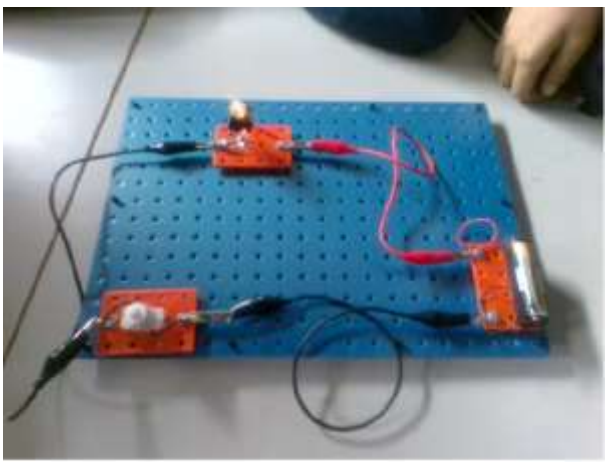
What happens when one of the bulbs in the circuit is unscrewed? Does it affect the other bulb?

The advantages of using one type of circuit instead of the other in different settings.

Resources:

Electricity kit





Challenge Idea No: 36

Section: Electricity

Target Age Group: 9 – 10 years

The Challenge:

Sustainable energy: Do additional renewable sources of energy exist besides wind and solar energy that would allow the use of clean technology and renewable energy in the future?

Rules to be observed:

- the source should be renewable,
- it shouldn't damage the environment,
- accessible to everyone,
- self-sustaining,
- side products are biodegradable

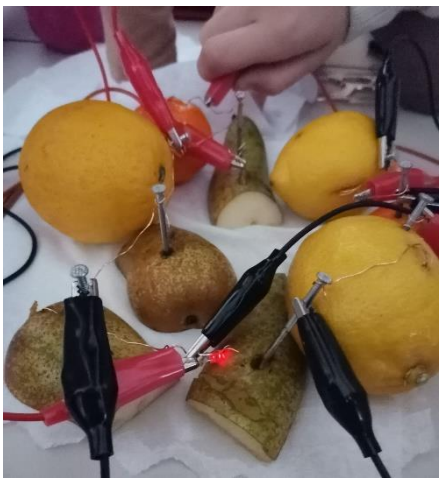
Think about:

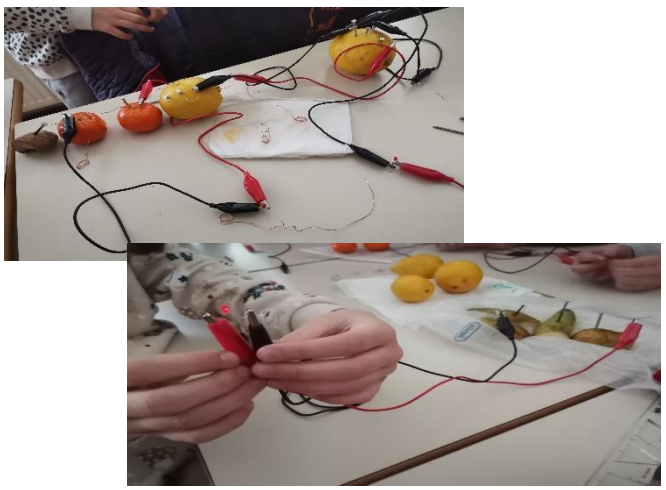
How can we change the power of electric energy source?

How does an additional diode influence the operation?

Resources:

Fruits, vegetables, copper wires, led diodes, galvanised nail, red and black wires with crocodile clips.





Lesson idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 37

Section: Electricity

Target Age Group: 8-9 years

The Challenge:

Turn on the wishes! – Light up your model.

Rules to be observed:

- The circuit has to be created using the adhesive copper tape, LED and a 3v battery.
- The circuit has to be glued inside/ behind the cardboard print / model.

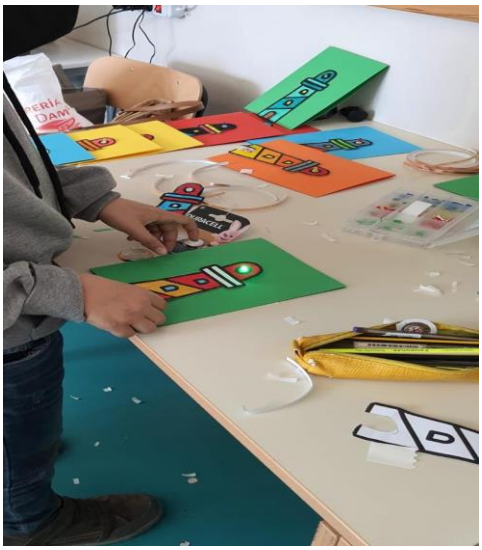
Think about:

The correct way the circuit has to be set up to ensure that the LED lights up.

Ways in which the model can be improved.

Resources:

LEDs, 3V battery, adhesive copper tape, various objects used to create the models, colours, glue.



Challenge Idea No:38

Section: Electricity

Target Age Group: 7-9 years

The Challenge:

Create a conductor testing insect (Based on an idea from 'Esperimenti tax-Xjenza' adapted to Maltese by Clare Azzopardi & Miriam Teuma, Merlin 2007.)

Rules to be observed:

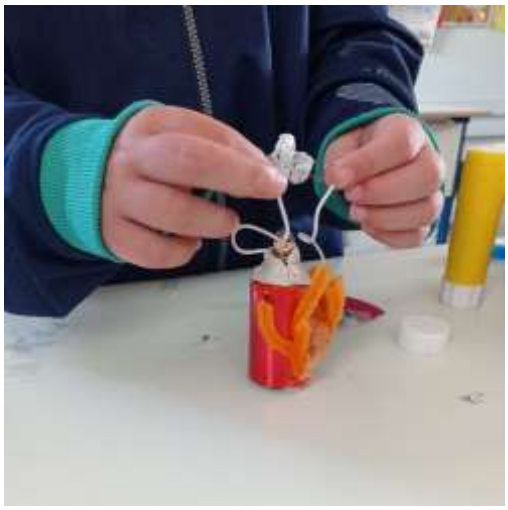
- The insect has to be a disguised electric circuit made up of a cylindrical battery, two pieces of wire and a bulb.
- When putting a conductor between the insect's 'antennae' the bulb should light.

Think about:

What are the materials that are allowing the bulb to light, made of?

Resources:

Battery, bulb, wire, pieces of foil, tack, pipe cleaners, card.



Lesson idea contributed by Ms Francesca Bugeja and the pupils of Year 4.3 at Siġġiewi Primary Malta

Challenge Idea No: 39

Section: Electricity

Target Age Group: 10 – 11 years

The Challenge:

Design and make an electric moving vehicle.

Rules to be observed:

- The vehicle must include an electric circuit and a motor.
- The vehicle must be able to move once the circuit is switched on.

Think about:

What will the vehicle's body look like?

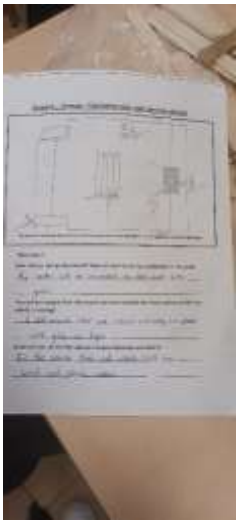
What materials will you use for the body and the wheels?

How will you fix the circuit to the vehicle?

How will you connect the motor to the wheels?

Resources:

materials for body of vehicle; electric circuit components; pulleys; rubber bands.



Lesson idea contributed by Ms Daniela Baldacchino and the pupils of Year 5.1 Siġġiewi Primary Malta

Challenge Idea No: 40

Section: Electricity

Target Age Group: 10-12 years

The Challenge:

Create a model of an electric vehicle that is propeller driven.

Rules to be observed:

- The vehicle must be powered through an electric motor.
- It must contain a switch to enable a change in direction.
- It must contain a propellor to power the vehicle.

Think about:

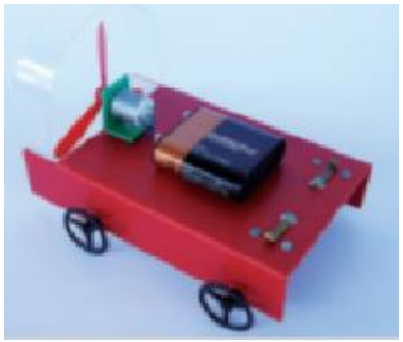
How can a switch to change the direction be included in the model?

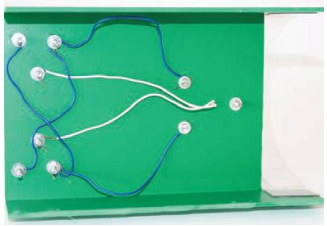
What is the function of the different components?

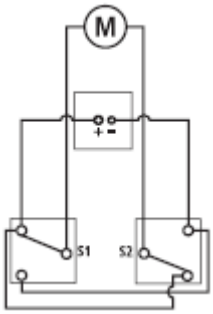
How effective is the propellor?

Resources:

Component kit, battery and plastic vehicle bodywork, cross head screwdriver, slip-joint pliers and glue.







Lesson idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 41

Section: Electricity

Target Age Group: 10-12 years

The Challenge:

Explore simple circuits including the use of switches. Come up with your own design using a motor to create a fan.

Rules to be observed:

- Before watching the video think about how you can make a fan with the given materials.
- Watch a demonstration of how to make a fan using a simple circuit
- Make your own fan
- Use the materials provided adding also your own ideas.
- The fan can be designed in different ways.

Think about:

Why are fans important?
When do we use them in everyday life?
What design works best and why do you think this is?
Is there any way you can alter your fan to hide the wires and the switch?

Resources:

Wires, batteries, motors, cardboard, switches.

Lesson Idea contributed by the teachers and pupils at St John's Senior School Kilkenny Ireland

Challenge Idea No: 42

Section: Electricity

Target Age Group: 10 - 11 years

The Challenge:

Walking with…ScaraBot

Rules to be observed:

- Create a circuit which includes a motor.
- Build your model using a cardboard cylinder and 4 markers. Customize the robot using googly eyes and pipe cleaners.
- Attach the motor (and the circuit) to the top of the model using a plastic bottle with cap, suitably cut and assembled.

Think about:

The way the circuit is assembled to ensure that the motor is turning in the desired direction

The way the circuit is attached to the model to ensure the desired movement.

Any improvements that can be made to your model.

Resources:

9V battery, milk caps, coloured rubber bands; 1 bottle of 1.5 litres with cap, pipe cleaners, adhesive eyes, markers, cylindrical cardboard, cutter, hot glue, rectangular mini electric motor, motor mounting brackets, propeller, shaft, scotch tape.

Challenge Idea No: 43

Section: Electricity

Target Age Group: 11-12 years

The Challenge:

Make a circuit with an electric motor and apply it to make a Scribble Bot.

Rules to be observed:

- Design a circuit which includes an electric motor.
- Use the items provided to create a circuit to make the motor turn.
- This circuit must be embedded in your Scribble Bot.
- The Scribble Bot must be able to 'scribble' with its marker legs once the circuit is switched on.

Think about:

How will you embed the circuit in the model?
Is the Bot moving in the desired way?
How can I improve the efficiency of the model?
How can I make the model more attractive?

Note: Children who have not placed the bottle cap in an off centred position will have difficulties moving the Scribble Bot as the motor will not vibrate. The bottle cap acts as a counterweight and throws the motor off balance.

Resources:

Electric circuit components; cardboard coffee cup; markers; bottle cap; masking tape; skewer

Challenge Idea No: 44

Section: Electricity

Target Age Group: 10-11 years

The Challenge:

Design and make your own torch

Rules to be observed:

- Your torch must incorporate a simple circuit and includes a switch which will enable you to switch on and off.
- Try to re-use materials as much as possible.

Think about:

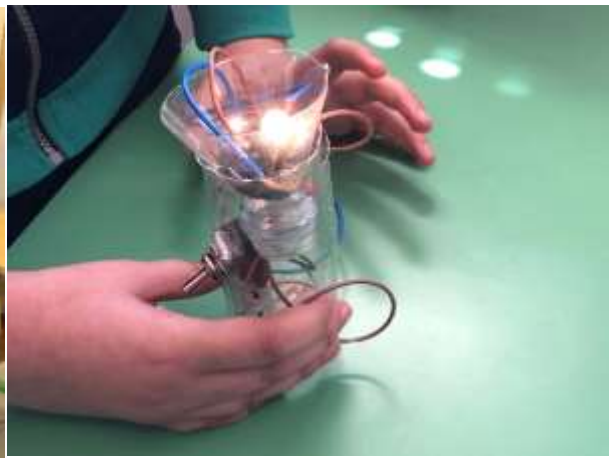
How will you ensure that the circuitry stays in place?

How easy is it to handle your torch?

How can you make it more attractive & effective?

Resources:

Assorted materials for body of torch; bulb, wires, batteries, switch, scissors, glue, wire cutter & stripper.



Lesson idea contributed by Ms Kristine Aquilina and the pupils of Year 6.3 Siġġiewi Primary Malta

Challenge Idea No: 45

Section: Electricity

Target Age Group: 15-16 years

The Challenge:

Assemble (parallel and in series) electric circuits according to the designs drawn beforehand.

Rules to be observed:

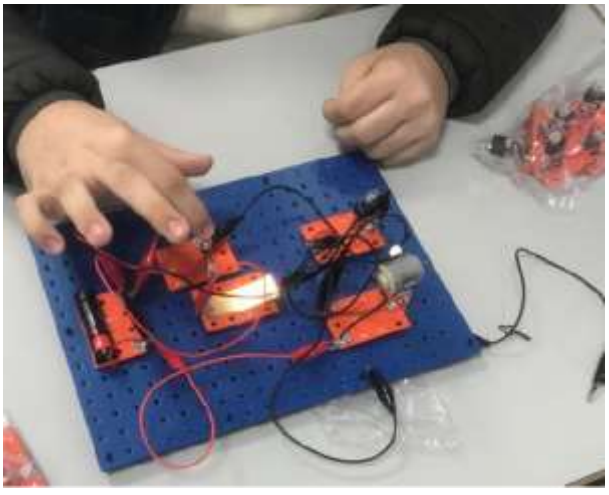
- Take measurements of voltage and resistance using the digital multimeter.
- Double check the data collected through mathematical calculations.

Think about:

The advantages of using a parallel circuit instead of an in-series circuit in electrical installations in homes.
How the position of the multimeter effects the readings it gives.
How Ohm's Law is verified in the circuits built.

Resources:

Electricity kit consisting of digital multimeter, copper cables with clamps, batteries, light bulbs, electric engine, pushbuttons, support, and screws.



Lesson idea contributed by the teachers and pupils at Ceipso Maestro Rodrigo (Spain)

Challenge Idea No: 46

Section: Structures

Target Age Group: 11 – 12 years

The Challenge:

Work in teams to design and create a structure using spaghetti.

Rules to be observed:

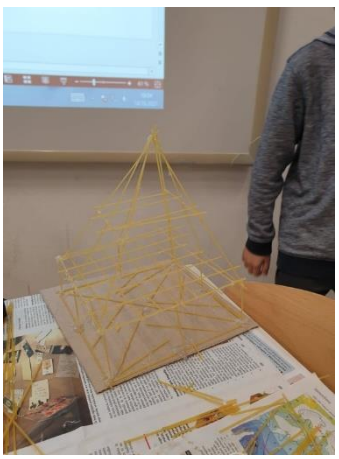
- Look at different buildings and structures from all over the world.
- Decide on the type of structure to be designed and built.
- Design and build your structure using only spaghetti strands and glue/ hot glue gun.

Think about:

How to make construction stand in a stable manner?
Which designs/ shapes lend themselves to more stable structures?
How would you improve your design/structure?

Resources:

Spaghetti, hot glue gun, glue



Lesson idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No:47

Section: Structures

Target Age Group: 11-12 years

The Challenge:

Build a tall, strong tower using spaghetti and glue balls.

Rules to be observed:

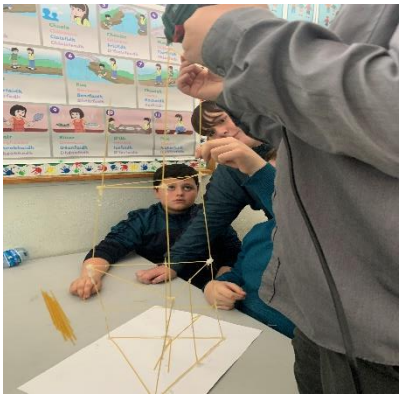
- Watch an online demonstration of making spaghetti structures.
- Design and make your own spaghetti structure.
- Use only the materials provided.
- Test your structure's strength by balancing objects on top of it.
- Make structures that have different shapes and see which one is the strongest.

Think about:

What shapes can you identify in your tower?
What challenges did you have while you were building your tower and how did you overcome them?
What do you notice about the strongest structures?
What do you think engineers have to consider when building structures?

Resources:

Spaghetti, glue gun, glue cartridges, paper (to protect table).



Lesson idea contributed by Ms Orla and the 6th class at St John's Senior School Kilkenny Ireland

Challenge Idea No: 48

Section: Structures

Target Age Group: 11 years

The Challenge:

Design and construct a paper dream house

Rules to be observed:

- All houses have to be made of paper materials.
- All houses have to be furnished using only paper materials.

Think about:

How can you make your house more stable?

How will you plan the division of the house plan? What will be included?

How can paper be used in different ways to create the various objects?

Resources:

»NARAVOSLOVJE IN TEHNIKA 5« textbook for Science and Technology for Primary School, grade 5, written by Simona Hribar Kojc , Dominika Mesojedec , Alenka Mesojedec , Špela Jenko

Idea contributed by the teachers and pupils at OŠ Vižmarje Brod Ljubljana Slovenia

Challenge Idea No: 49

Section: Structures

Target Age Group: 11 years

The Challenge:

Create a working structure that uses gears

Rules to be observed:

Using the LEGO Gears Programme, the challenge is to design and assemble a working model with a movable mechanism.

Think about:

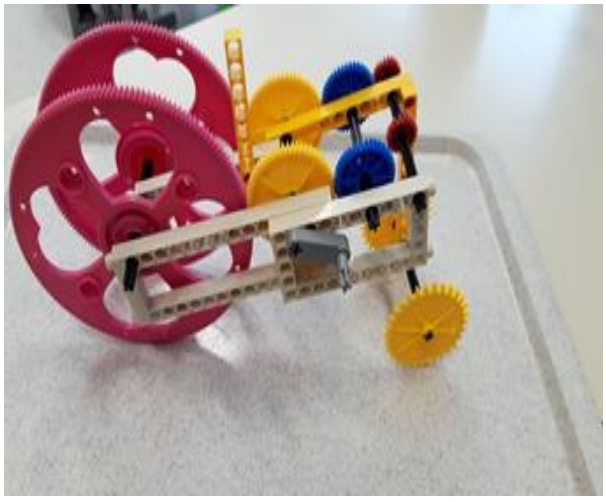
How are the gears interacting with each other to cause the desired movement?

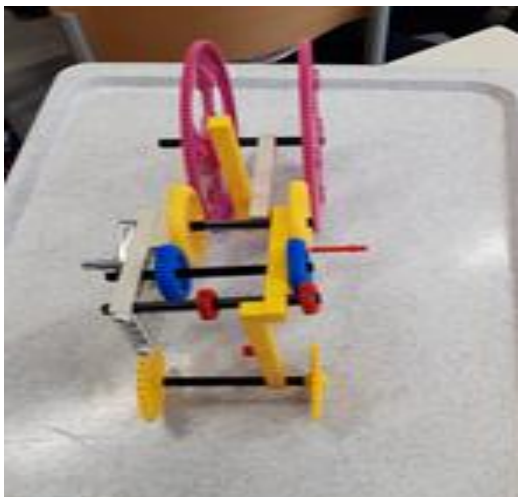
How can the model be improved?

Resources / textbooks:

»Od mravlje do Sonca 2« ; »Naravoslovje in tehnika za 5. razred osnovne šole« ; »Textbook«

Authors: dr. Dušan Krnel, PhD; Barbara Bajd, PhD; Seta Oblak, MA; Saša A. Glažar, PhD; Igor Hostnik





Challenge Idea No: 50

Section: Structures

Target Age Group: 11-12 years

The Challenge:

How can you make your paper bridge stronger?

Rules to be observed:

- Bridge has to be made from a single A4 paper
- Bridge has to span the gap between two piles of books
- Design and sketch different designs (single sheet, corrugated, folding up the sides, creating an arch)

Think about:

Which design is the weakest?
Which design is the strongest?
How can these designs be applied in everyday life?
How can you create a smooth surface in a corrugated bridge?

Extension Activities: Design and make a Truss Bridge (See Challenge 51)

Resources:

Sheets of A4 paper; piles of books; coins or other objects to use as a weight

Lesson idea contributed by Ms Claire and the 5th Class at St John's Senior School Kilkenny Ireland

Challenge Idea No: 51

Section: Structures

Target Age Group: 11-12 years

The Challenge:

Construct a Truss Bridge that can support at least 20lbs weight

Rules to be observed:

- Build a truss bridge according to the pattern sheet.
- The bridge has to be constructed out of popsicle sticks.
- Conduct a weight test using the spring scale and rope.

Think about:

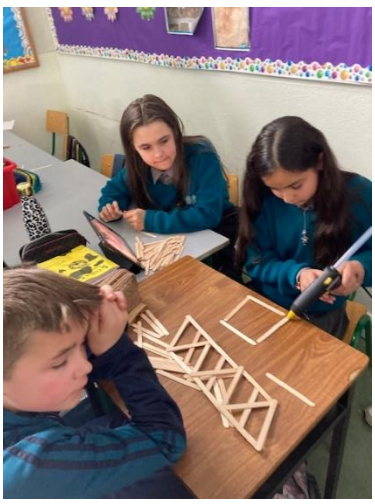
What makes the truss bridge so strong?

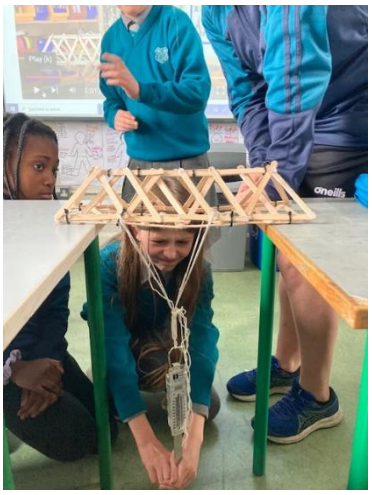
Why is the triangle pattern so strong?

How can you make a bridge stronger if it shows signs of weakness?

Resources:

Popsicle sticks; glue gun; spring scale, rope





Lesson idea contributed by Ms Claire and the 5th class at St John's Senior School Kilkenny Ireland

Challenge Idea No: 52

Section: Structures

Target Age Group: 5 – 6 years

The Challenge:

Design and build free standing structures using different materials.

Rules to observe:

- Listen attentively and participate during a shared reading session using the book **Dreaming up: A celebration of buildings**.
- Participate in brain storming session on materials that can be used by the pupils to build their structures. Form a list of materials that could be used during the hand on session.
- Each pupil will design and build a free-standing structure to build with a material of his/her choice from the list discussed. Calculate the quantity/amount needed to build the structure.

Think about:

Think about the process needed to build the structure. What difficulties were encountered and how were these overcome?

How can the structure be improved?

Resources:

Book – Dream Up: A Celebration of Buildings, pictures of different structures, different materials, paint, glue and colours

Lesson Idea contributed by Ms Miriam Deguara and the pupils of Yr1.3, Siġġiewi Primary Malta

Challenge Idea No: 53

Section: Structures

Target Age Group: 8-10 years

The Challenge:

Build a 'tower' from rectangle shaped pieces cut from a cereal cardboard box.

Rules to be observed:

- The tower has to be at least 30 cm high
- The rectangles have to be cut from one cereal box.
- The rectangles must be joined together through slits cut in them.
- Only a scissors, pencil and ruler can be used. (No glue or tape)
- The tower should be strong enough to support the weight of a mobile phone on top.

Think about:

How can you make the structure stronger?

Will all rectangles be of the same size?

Resources:

one empty cereal box; pencil; ruler; scissors.

Lesson idea contributed by Ms Maria Tereza Micallef and Year 3.1 at SIC Siġġiewi Primary Malta

Challenge Idea No: 54

Section: Structures

Target Age Group: 5 years

The Challenge:

Create a building from the materials provided (this was done after the children walked from the school to the village band club and had the opportunity to look at the different buildings.)

Rules to be observed:

- The structure must include two storeys and a staircase.
- Use the materials provided and your imagination.

Think about:

How do the different pieces fit with each other?

How can you make the structure more stable?

Resources:

Foam tiles; cardboard rolls; plastic cups; etc..

Lesson idea presented by Ms Charmaine Galea and the pupils of KG2.2 at SIC Siġġiewi Primary Malta

Challenge Idea No: 55

Section: Structures

Target Age Group: 8-9 years

The Challenge:

Create your own model based on a famous European Landmark (Eiffel Tower, Pisa Tower, Pyramid in the Louvre Museum…)

Rules to be observed:

- Study European Landmarks (Social Science Topic)
- Look closely at how these structures are built especially at the important parts of the design that gives stability and strength to the structure (walls, pillars, columns…).
- Create your own model based on one of these landmarks.

Think about:

Which materials will endure the test of time best?

Which design ensures the most stability?

How can your model be improved?

Resources:

Thin wooden sticks, plasticine, cardboard

Lesson idea contributed by the teachers and pupils at Ceipso Maestro Rodrigo (Spain)

Challenge Idea No: 56

Section: Structures

Target Age Group: 9-10 years

The Challenge:

The PE Structures Challenge

Rules to be observed:

- In groups think about how you can create your own structures using only your bodies.
- Try out your ideas taking into account safety measures.
- The structure has to be held for at least 15 seconds.

Think about:

How difficult was it to keep the position for at least 15 seconds?

How does the use of symmetry add to the aesthetics of the design?

What geometrical shapes are you mimicking?

Resources:

PE mats

Challenge Idea No: 57

Section: Structures

Target Age Group: 12-13 years

The Challenge:

Create a structure from simple materials that can support a great weight.

Rules to be observed:

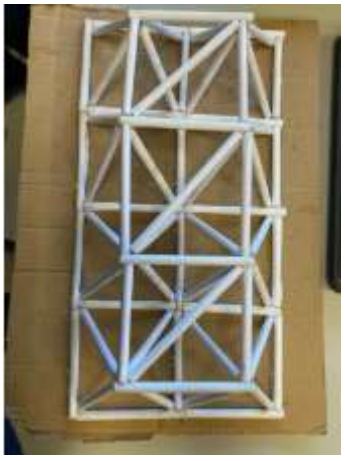
- The triangle is the only non-deformable polygon. Therefore, we will use the triangulation of the bars to achieve a non-deformable structure.
- Pay close attention to the size of the bars since the rigidity of the structure will largely depend on it: being paper, we will try to make the section as small as possible to reduce gaps in the bars.
- Pay close attention to the joining points of the bars since it will be at these points where the greatest stress to which the structure will be subjected will be focused.

Think about:

Was your structure strong enough to support the desired weight?
How is this design used in practice in real life?

Resources:

50 x 30 centimetres rectangle which will serve as the base for the structure. DIN A4 paper bars (210 mm x 297 mm). To join the bars we will use white glue or hot melt adhesive with paper to reinforce critical bars.



Lesson idea contributed by the teachers and pupils at Ceipso Maestro Rodrigo (Spain)

Challenge Idea No: 58

Section: Structures

Target Age Group: 11-12 years

The Challenge:

Plan and build a 3D model of atoms reusing materials.

Rules to be observed:

- The structure has to be built using the provided materials.
- On the design sheet, all measurements must be included.

Think about:

How can the structure be built, using wooden sticks, Styrofoam, and wires?

What will the measurements of your model be?

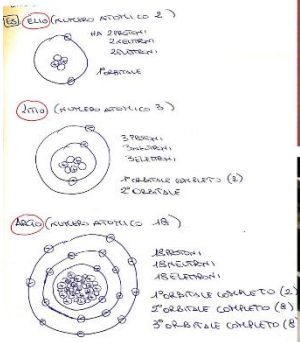
How many electrons, protons and neutrons does the atom model have?

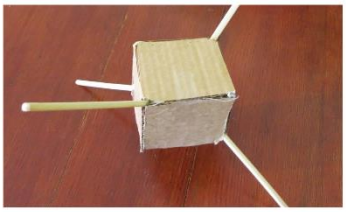
Was the design chosen adequate?

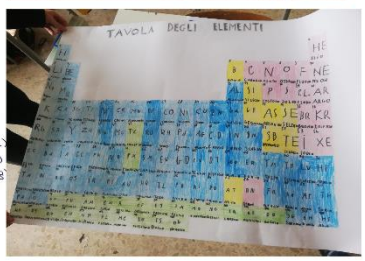
Can the structure be improved in any way?

Resources:

Periodic table, wooden sticks/toothpicks, calculator, Styrofoam, pencils, colours, felt-tip pen, white paper, wires.







Challenge Idea No: 59

Section: Structures

Target Age Group: 10-11 years

The Challenge:

Design and construct a castle using recycled paper.

Rules to be observed:

- The castle must be constructed entirely from cardboard.
- The boxes must be modified to the classic shapes of a castle.
- The castle must include windows and battlement towers.

Think about:

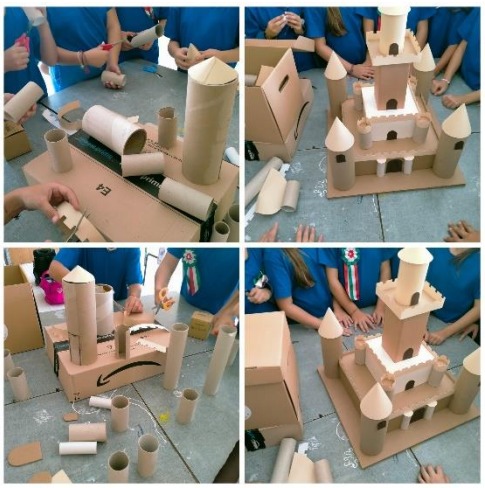
What are the advantages and disadvantages of working with cardboard?

How can the model be improved?

Extension: Can a moveable drawbridge be added to your model?

Resources:

Cardboard, paper chalk, glue, scissors.



Lesson idea contributed by the teachers and pupils of IC De Sanctis Moiano

Challenge Idea No: 60

A Final Challenge!

Target Age Group: 11-12 years

The Challenge:

Create the UK flag using coloured cardboard.

Rules to be observed:

- Work in groups to create one model.
- Exact measurements must be taken to ensure perfect symmetry.
- The flag has to be created using the given coloured cardboard.

Think about:

How will you ensure that perfect symmetry is obtained?

The correct tools to use to get the desired result.

Resources:

Cardboard, scissors, rulers, set squares, glue, pencil

Lesson Idea contributed by the teachers and pupils at IC De Sanctis Moiano