09

The Smallpeice Trust

ENGINEERING @SCHOOL

The Robot Challenge

Subject: STEM/Engineering

Year group: 2-7

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Dare to imagine

#EngineeringAtSchool

This activity can be used as one of eight towards students obtaining the CREST SuperStar Award.

What Is CREST?

CREST is a nationally recognised scheme for student-led project work in the STEM subjects (science, technology, engineering and maths).

CREST gives young people aged 5–19 the chance to choose their own subject and methodology when completing their hands-on investigation.

CREST provides activities and project ideas for a range of ages, group size and abilities. From off-the-shelf, one-hour long challenges through to large-scale, student-led projects of over 70 hours work or more, CREST can be done by anyone.

What is CREST SuperStar?

SuperStar level is designed to be easy-to-run and low-cost for children typically aged 7-11 years. Children gain an Award by completing eight challenges.

You can download a CREST SuperStar passport template for your students to track their progress once you create an account via

www.crestawards.org/crest-star

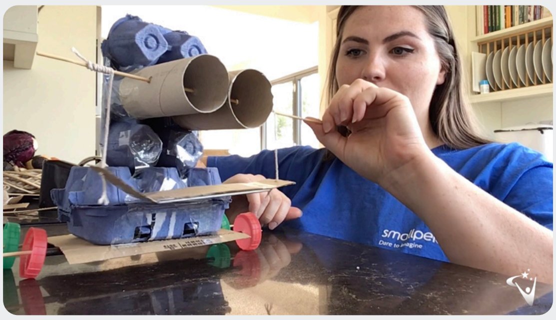
ENTRY FEE per child: £1 UK / £4 International*

Within four weeks of payment, you will receive certificates and fabric badges to give out to your class.

LENGTH OF LESSON: 1-2 HOURS

How to make your Robot:

https://bit.ly/31xXf09



LESSON OVERVIEW

Students work in teams of "engineers" to design and build their robot out of everyday items. They test their robot, evaluate their results, and present to the class.

Learning Objectives

During this lesson, students will:

- Design and construct a robot
- Test and refine their methods
- Communicate their design process and results

Learning Outcomes

- To develop an understanding of robots
- To develop an understanding of coding
- To design and build models by using different materials and to test selected functional characteristics of the model built with the chosen materials

Key Vocabulary: ROBOT, CODING, PROGRAMMING, MAGNET

Curriculum links

SCIENCE KEY STAGE 2

- Working scientifically: asking relevant questions and using different types of scientific enquiries to answer them
- Working scientifically: setting up simple practical enquiries, comparative and fair tests
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance
- Observe how magnets attract or repel each other and attract some materials and not others
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
- Working scientifically: making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- Working scientifically: gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- Working scientifically: recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- Working scientifically: using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions

DESIGN & TECHNOLOGY KEY STAGE 2

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at individuals or groups
- Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design
- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures

INTRODUCTION

What is a Robot?

Explain to students that: A robot is a machine that does tasks without the help of a person. Many people think of robots as machines that look and act like people. Most robots, though, do not look like people. And robots do only what a person has programmed them to do.

What is programming?

Explain to students that: Programming is a way to instruct the robot to perform various tasks.

What is coding?

Explain to students that: Coding refers to the process of writing instructions for machines in such a way that they are able to understand them.

Materials

1. 2 CARDBOARD TUBES
2. CARDBOARD
3. STRAWS
4. EGG BOXES
5. WOODEN STICKS
6. MILK BOTTLE TOPS
7. FRIDGE MAGNET
8. SCISSORS
9. STRING
10. TAPE

MAIN ACTIVITY

1. Students will need to work in pairs for this activity.

2. Explain that students must design and make a robot from everyday items.

3. Ask students to develop a plan for their robot. They will need to decide and agree on the materials they will use, write/draw their plan, and present their plan to the class.

4. Show students the student activity sheet and explain that they will need to follow the instructions to make their robot.

5. Student groups next execute their plans and build their robot using the materials they have chosen. They may need to rethink their plan, request other materials, or start again if the materials chosen are not working.

6. Next, teams will test their methods on different students.

7. Teams complete an evaluation / reflection worksheet, and present to the class.

PLENARY (QUESTIONS TO ASK STUDENTS)

1. Did you succeed in creating a robot?
2. Which materials did you use for your robot?
3. How many items did you manage to pick up with your robot?
4. Which was the hardest item to pick up with your robot?
5. Did you decide to revise your original design or request additional materials while in the construction phase? Why?
6. If you could have had access to materials that were different than those provided, what would your team have requested? Why?
7. Do you think engineers have to adapt their original plans during the construction of systems or products? Why might they?
8. If you had to do it all over again, how would your planned design change? Why?
9. What designs or methods did you see other teams try that you thought worked well?
10. Do you think you would have been able to complete this project easier if you were working alone? Explain…

STEM Day Risk Assessment

Risk Assessment for	**Engineering at School Projects**
Assessment undertaken on	31/03/2020
Assessment undertaken by	Jessica Lee
Signed	

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
1	General Activity and Workspace	**Slips, trips and falls:** Injury due to tripping over items	Students and adults	Activity supervised by adult supervisor. Deliverer reminds students about safety in video introduction.	M	Students and adults
2	Use of Materials: paper/card, plastic containers	**Injuries:** Injury due to paper cuts, cuts from sharp edges **Injuries:** Injury due to misuse	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
3	Use of materials: elastic bands, sellotape, glue stick, blu-tack, small toys, paper fasteners, LEGO pieces, nuts & bolts or equivalent.	**Injuries:** Injury due to use as a missile **Slips, trips and falls:** Injury due to slipping on dropped items **Injuries:** Ingestion risk of choking.	Students and adults Students and adults Students and adults	Activity supervised by adult supervisor. Activity supervised by adult supervisor. Activity supervised by adult supervisor.	L	Students and adults
4	Use of materials: plastic, corrugated carboard	**Injuries:** Cuts from sharp edges	Students and adults	Activity supervised by adult supervisor.	L	Students and adults

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
5	Use of sharp tools: Scissors, craft knives	**Injuries:** Cut to self	Students	Activity supervised by adult supervisor.	M	Students and adults
		Behaviour: Cut to others	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
		Behaviour: Vandalism of property	School or home	Activity supervised by adult supervisor.	L	Students and adults
6	Testing of projects: bathtub, drop from height, items on floor	**Spillage of water on floor**: damage and injury due to slip	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
		Slip, trip or fall: Injury due to falling from testing area, tripping over items in testing space	Students and adults	Activity supervised by adult supervisor.	L	Students and adults

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The Robot Challenge

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Suitable for ages: **5+**

Time needed: **1hr+**

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Dare to imagine

DESIGN A ROBOT

You are a team of engineers who have been given the challenge to design your own robot out of everyday items.

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Dare to imagine

What is a Robot?

A robot is a machine that does tasks without the help of a person.
Many people think of robots as machines that look and act like people.
Most robots, though, do not look like people. And robots do only what a person has programmed them to do.

PLANNING STAGE

In your team, discuss the problem you need to solve. Then develop and agree on a design for your Robot. You'll need to decide and agree what materials you want to use.

Draw your design in the box and label the different parts and materials you plan to use. Present your design to the class.

You may choose to revise your team's plan after you receive feedback from class.

ROBOT DESIGN & MATERIALS

MATERIALS

1. 2 CARDBOARD TUBES
2. CARDBOARD
3. STRAWS
4. EGG BOXES
5. WOODEN STICKS
6. MILK BOTTLE TOPS
7. FRIDGE MAGNET
8. SCISSORS
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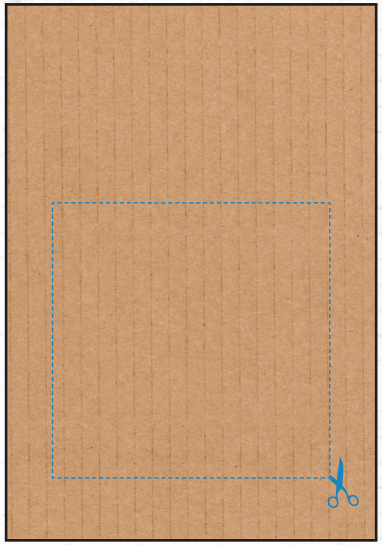
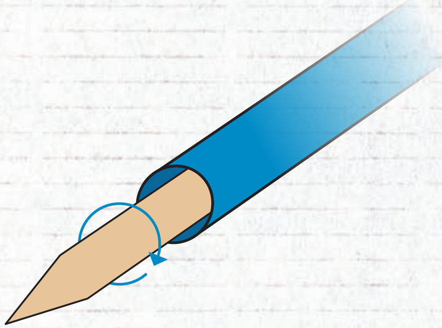
BUILDING STAGE 1 OF 2



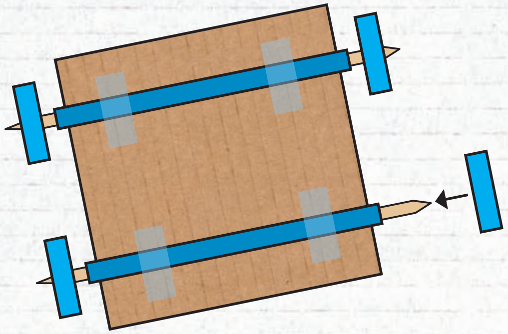
1.

Make a base for your robot by cutting out a cardboard square.



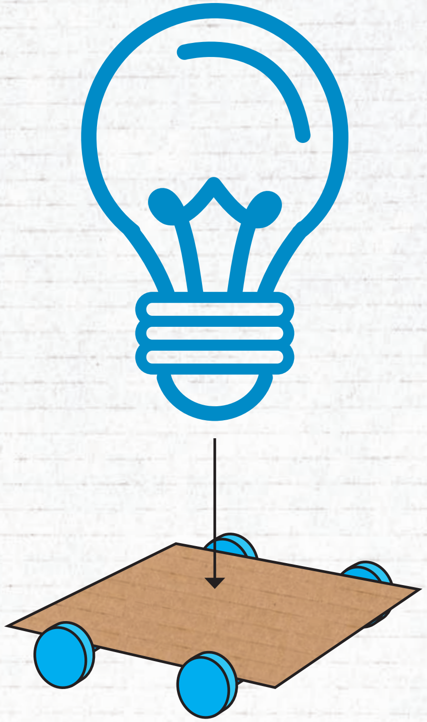
2.

Make your wheelbase, it's important that your "axle" can freely spin so thread a wooden stick through a straw which is stuck to the bottom of your base.



3.

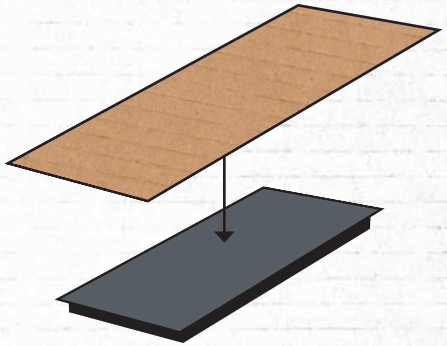
Attach your wheels to your axle – it's best to use something already round like bottle tops but if you are cutting them out of cardboard make sure they are as round as possible.

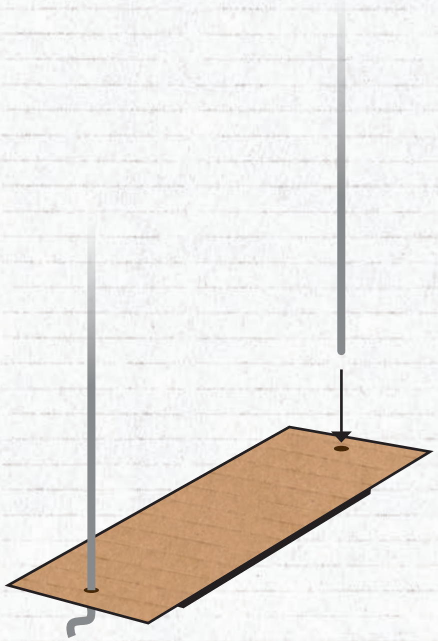


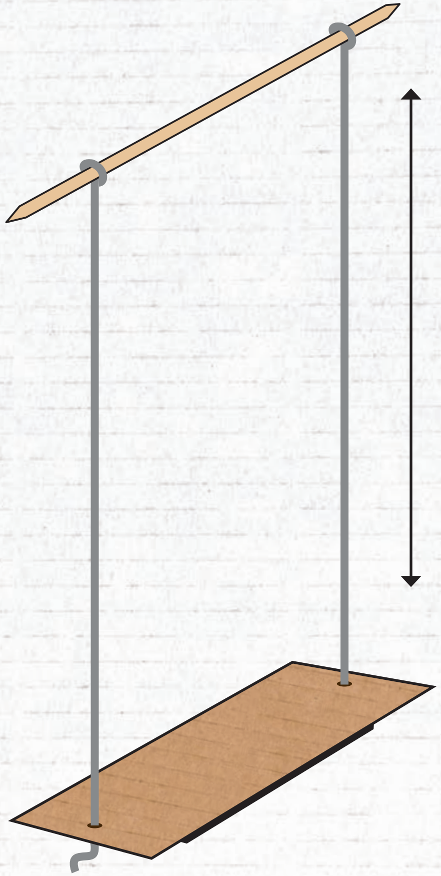
4.

Time to make the body now, use your imagination! Make it look however you like: the mars rover; humanoid; an animal.

BUILDING STAGE 2 OF 2







5.

If you're using a winch to pick up objects, then attach your magnet to a strip of cardboard.

6.

Attach string to the end of the cardboard (so it looks like a swing).

7.

Connect the string to a stick that is that is attached to your robot (maybe using a straw like the wheels) which can freely turn when you want to wind your magnet up or down.

TESTING STAGE

Each team will test their robot. What items can you pick up?

ROBOT DATA

	Description	Weight	Result
Item 1			
Item 2			
Item 3			

EVALUATION STAGE 1 OF 2

Evaluate your team's results, complete the evaluation worksheet, and present your findings to the class.

Use this worksheet to evaluate your team's results in the Robot Challenge.

1. **Did you succeed in creating a robot?**

2. **Which materials did you use for your robot?**

3. **How many items did you manage to pick up with your robot**

4. **Which was the hardest item to pick up with your robot?**

5. **Did you decide to revise your original design or request additional materials while in the construction phase? Why?**

6. **If you could have had access to materials that were different than those provided, what would your team have requested? Why?**

EVALUATION STAGE 2 OF 2

7. Do you think engineers have to adapt their original plans during the construction of systems or products? Why might they?

8. If you had to do it all over again, how would your planned design change? Why?

9. What designs or methods did you see other teams try that you thought worked well?

10. Do you think you would have been able to complete this project easier if you were working alone? Explain...