ROYAL AIR FORCE

STEM AMBASSADORS

BUILDING ROLLERCOASTERS

PREP PACK FOR VOLUNTEERS

Suitability:
This activity would suit volunteers who have experience of supporting STEM sessions in schools.

EXPERIENCED

★★

Objective

The object of this activity is to **introduce science and physics principles of forces, motion and engineering.**

Information to share with teachers

This session reinforces aspects of the KS2 National Curriculum around:

- ★ Scientific method
- ★ Design and testing
- ★ Forces, motion and engineering
- ★ Measurement
- ★ Evaluation

National Curriculum: science KS2

Promoting links between the school and the RAF (things to say)

- How the activity can help dispel myths about the RAF and illustrate available opportunities.
- Broaden horizons about careers and options.
- Help to enthuse and engage students.
- Raise teacher awareness of what the RAF do.
- How this activity can help the school develop closer links with RAF volunteers.

Activities in schools

Preparing to run the activity in a school

Typically teachers work to a lesson plan. Lesson plans detail the basic structure of the session, timings for each section and contingency plans for more and less able pupils. An example lesson plan is included in this pack.

Preparing yourself and agreeing timings, level of involvement for the school, for you and your colleagues

Make sure you get to the school in good time, allowing plenty of time for preparation and setting the room and your materials out. Check with your school link on what materials are provided and what you need to bring. If you require worksheets or photocopying, agree this with your school link well in advance of the session. Allow plenty of time to clear up at the end and make sure you have thought about a contingency plan if anything goes wrong. Identify the year group and level to pitch the activity at.

Most STEM Ambassador activity would typically be with years 5 – 9 (ages 9 – 13) and would cover aspects of the National Curriculum for Key stages 2 and 3.

The school science curriculum, part of the National Curriculum is detailed and schools would not expect you to know about this. However, you might like to take a look at some of its content to familiarise yourself with the areas covered.

National curriculum in England: science programmes of study

Schools run dedicated 'Career Day' events. You may be asked to incorporate a STEM session into these events. Take along career-linked resources where possible to hand out after the activity.

Planning this activity

The object of this activity is to introduce science and physics principles of forces, motion and engineering.

This activity requires planning in terms of securing the materials for the session and ensuring that it runs to time. It is designed for STEM Ambassadors with experience of running activities in schools.

RESOURCES REQUIRED

+Large space to build the rollercoasters.
+Marbles (one per pupil or group).
+Masking tape.
+Paper cups.
+Scissors.
+Pipe lagging (cut in half length-ways to make the rollercoaster 'track').
+Cocktail sticks.
+Blue tack.
+Roll of string.
+Pencils.
+Papers.
+Rubbers.
+Timer.
+Prizes (optional) (for best layout etc).

Powerpoint presentation 'Rollercoasters' that accompanies this Prep Pack.

Although not essential for this activity, you can download a simple assessment/construction grid for designing the rollercoasters.

Rollercoaster design considerations

Assessing risks associated with the activity

The organiser (typically the school or other host organisation) of the activity is responsible for the health and safety of the young people on their site or property. However, because you as the STEM Ambassador also have a duty of care you may be asked by the teacher or organiser to contribute to their risk assessment. Discuss the activity with the organiser (school) and ask them to provide a copy of their risk assessment.

Risk assessment examples

Your school contact should be aware of other risk assessments used for activities in school, which could be adapted for this activity. If they are unsure of the risks involved in running practical STEM activities in school you could direct them to relevant resources produced by experts in the field. STEM Learning have lots of resources/templates and guidance on this. The link below provides details of actions they can take to manage risk in their school, along with some templates for STEM-related activities.

A balanced approach to risk

As this STEM Ambassador Prep Pack details your activity and all the resources required, the school may find the pack useful in helping them to construct an appropriate risk assessment.

Logistics

Schools are secure sites and access may be restricted. Ask your school contact before you visit about getting onto the site, where to park and where to report to. Schools may not provide lunch so it may be advisable to bring your own refreshments and snacks.

Parking at some schools can be difficult. Check with your schools contact about the availability of visitor parking.

Handouts for pupils

Rollercoaster design considerations

Additional resources

If you are interested in adapting or enhancing this activity we've identified some additional online resources to help you with this. Click the weblinks below to find out more.

Marble rollercoaster STEM project
60 minute physics: forces and motion
How to build a rollercoaster YouTube

ID on the day

Visitors to schools may be asked for their current DBS Certificate or the corresponding Certificate Number. Schools may also ask for some form of current photo identification if a DBS Certificate is not produced. Schools will typically issue a visitor ID at reception for each separate visit to the school. Visitor ID if issued, must be worn at all times whilst on site. You should always expect to be working alongside a member of school staff where children are involved. It is not good practice for a visitor to be left alone with a group or individual children. STEM Ambassadors are reminded that the use of student personal data, photographs, videos or other information about students is not permitted and must not be put on social media.

Differentiation for more able and less able pupils:

More able

Encourage more complex design adding more complexity with loops and hills.

Less able

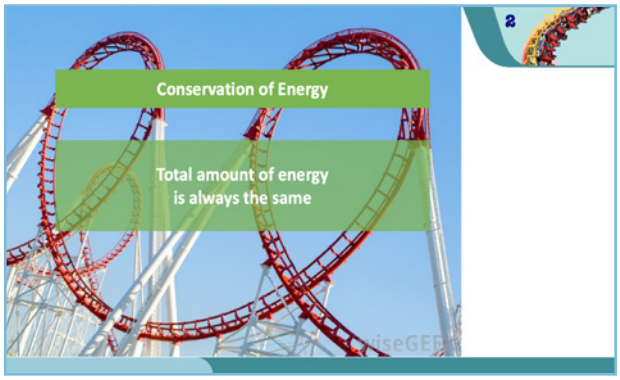
Simplified designs with pictures of examples to follow and a focus on speed and direction.

Running the activity: lesson plan

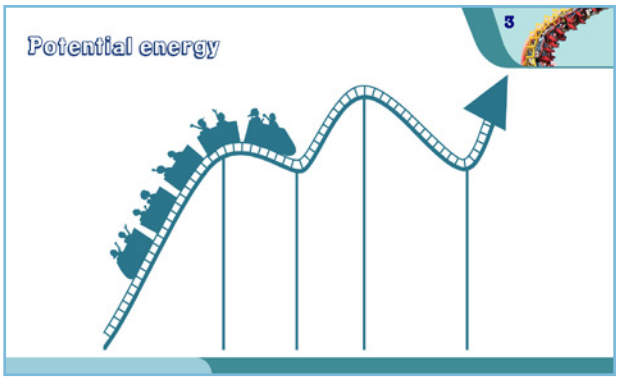
Session length: 50 minutes

10 minutes

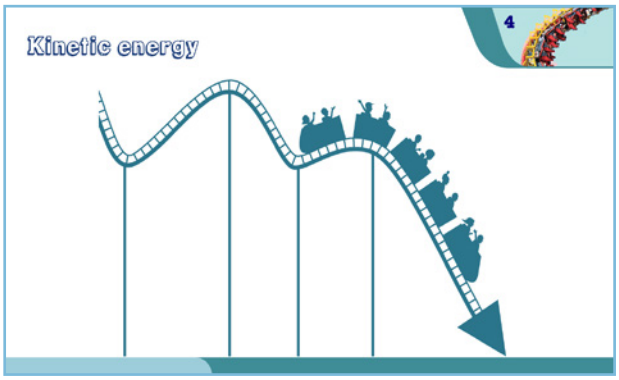
Introduction to the forces at play when riding on a rollercoaster. Ask pupils if they've been on a rollercoaster and what kinds of forces are being demonstrated? (G-force, energy transfer, speed, friction etc).



One of the fundamental laws of nature is that energy cannot be made or destroyed, just converted from one form into another. Energy, as used by rollercoasters focuses on potential and kinetic. Rollercoasters use energy - which is transferred in different ways.



Potential energy – the energy in a rollercoaster that is at the beginning of the first big drop. Often referred to as energy of position (as the coaster gets higher in the air, gravity can pull it down a greater distance).



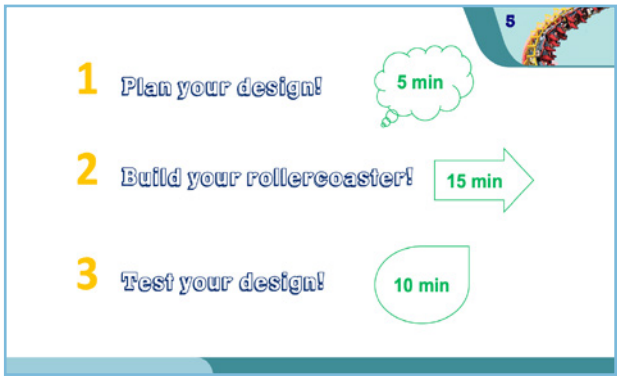
Kinetic energy that exists when you begin the first drop. It is the energy of motion that takes you down the hill and around the rest of the track.

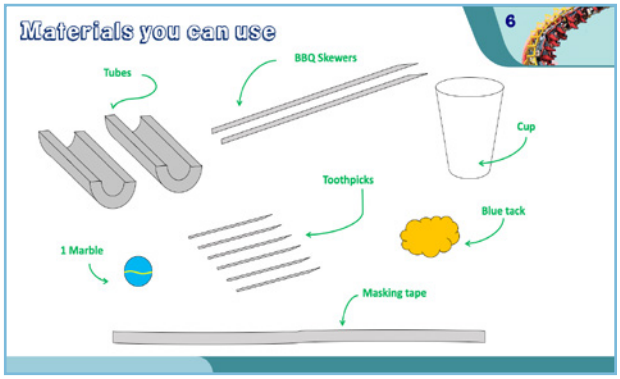
On a rollercoaster, energy is constantly being converted (hills and drops) from potential to kinetic – and some of its might be wasted friction of the wheels etc... that's why the rides don't last forever!

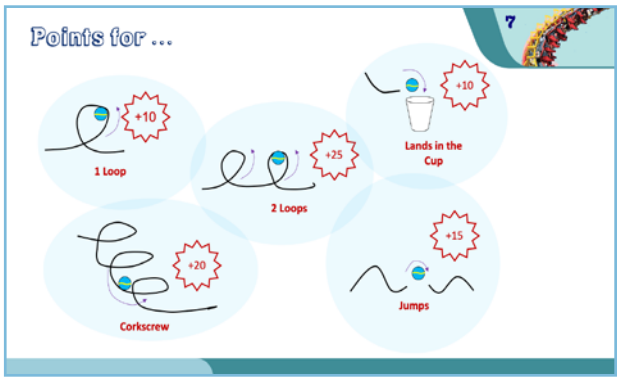
30 minutes

Pupils to work in groups to design and build a marble rollercoaster with objectives of:

- ★Designing and redesigning.
- ★Getting their marble to make it to the end of the track and end up in the cup.
- ★Increasing levels of complexity by adding loops or hills.







10 minutes

Plenary – discussing students' designs and hand out prizes.

Handouts for pupils

Rollercoaster design considerations

Step 1: Design

How will you build your roller coaster? Draw your idea in the box below.

Step 2: Build

Build your roller coaster. How does it look now? Draw it in the box below.

Step 3: Test and make adjustments

Get a marble and test your roller coaster. Make changes until the marble makes it all the way into the cup. Draw the finished roller coaster.

Created by Lindsay Drewes for Simply Kinder