Changes in Energy

Theme of the Lesson

In this lesson we look at what happens to the waste that goes into our recycling and compost bins. Mark investigates potential and kinetic energy in the studio experiment. The supersize experiment combines the science of energy with what we have already learned about waste. We will also be talking to storm chaser Mark Robinson about extreme weather.

Curriculum Links

Strand: Environmental Awareness and Care; Energy and Forces

Strand Unit: Electricity; Environmental Awareness; Caring for the Environment; Science and the Environment

Curriculum Objectives:

- Learn about electrical energy
- Explore the effects of static electricity
- Foster an appreciation of the ways in which people use the Earth's resources
- Come to appreciate the need to conserve resources
- Identify and discuss a local, national or global environmental issue
- Come to appreciate individual, community and national responsibility for environmental care
- Participate in activities that contribute to the enhancement of the environment
- Recognise the contribution of scientists to society
- Appreciate the application of science and technology in familiar contexts
- Recognise and investigate human activities which have positive or adverse effects on local and wider environments

Background Science

Waste

Many people don't think about what happens to our waste after we put in it the bin. When we are disposing of our waste, it is very important to put it into the right bin.

Some types of waste can go into our recycling bin but only if they are clean and dry. Any food residue should be washed out of bottles, cartons or tins before they are put in the recycling bin because they have to go to a recycling centre to be sorted and food waste would rot and contaminate the waste. Only certain types of waste can go into the recycling bin. Rigid plastic (no plastic bags, film or other soft plastics); paper and cardboard including cartons; food tins and aluminium cans can all be recycled.

Recycling is important for many reasons. First we need to think about how we use the Earth's resources. Plastic is made from oil which takes millions of years to form in the Earth. Making plastic releases large amounts of Carbon Dioxide which contributes to Climate Change and also causes a lot of air pollution which is bad for people's health. To get the metals for cans, tins and aluminium foil, rocks containing ore minerals need to be mined in the Earth. For paper and cardboard, we need to cut down trees.

Large amounts of energy and water are used in drilling for oil, mining and crushing rocks, smelting ore to create metal, and processing wood pulp to make paper. Lots of energy is also used in transporting these materials and finished products around the world. We also need to think about where the waste is going. If we don't recycle, a lot of our waste goes to landfill or is burned in an incinerator which can cause pollution of air, land and water.

Recycling means that some of the materials are reused, so we use less of the Earth's resources. It also takes a lot less energy and water to recycle metals and paper than it does to produce them from raw materials and if they are not going to landfill or being incinerated we can reduce pollution too.

If food or garden waste goes into landfill it rots to produce a gas called methane which acts as a greenhouse gas if it reaches the atmosphere and contributes to climate change. If food or garden waste is separated in a brown bin, it can instead be broken down to create compost which can be used to return nutrients to the soil in gardens. Otherwise, it can be processed to produce biogas which is collected and used as a fuel to generate heat energy for our homes. Usually brown bins are only available for people living in towns, but anybody with a garden can easily compost their own waste. There are lots of types of compost bins and wormeries that you can make or buy to help you do it.

Recycling and composting are a great way to protect the Earth's resources and to save energy and water. We can help even more by **Refusing** to buy unnecessary packaging and products we don't need; **Reducing** the amount of plastic and other materials we buy and **Reusing** objects and materials that we already own.

Studio Experiment

We have already talked about all of the energy involved in producing and processing our waste. In our studio experiment, Mark demonstrates two other forms of energy and how potential energy can be transformed into kinetic energy to make a catapult.

Kinetic energy is the energy of movement. We all have chemical energy in our bodies that came from the food we ate. When we move our bodies, that chemical energy is converted to kinetic energy. We can transfer some of that kinetic energy into other objects such as when we pull back the spoon on the catapult. When we hold the spoon in place, we are stretching the elastic band and storing energy in it. This is called potential energy which is the stored energy that an object has due to its position. Once we release the spoon, the potential energy is converted to kinetic energy and the spoon springs up and launches the ammunition.

If we add extra lollipop sticks to our stack, then the spoon can be pulled back further, increasing the amount of potential energy stored in the spoon. This extra potential energy will be converted to kinetic energy when it is released and the ammunition can travel further.

Supersize Experiment

The supersize experiment also involves the conversion from kinetic to potential energy. When Clara runs forward, she uses the kinetic energy in her body to pull the bungee and store potential energy in the bungee cord. When the bungee can be stretched no further, it will be pulled back, converting that potential energy back into kinetic energy and pulling Clara backwards. While demonstrating potential and kinetic energy, Clara and John are also recapping on what they have learned about different waste types and trying to separate compostable and recyclable waste.

Equipment and Tips

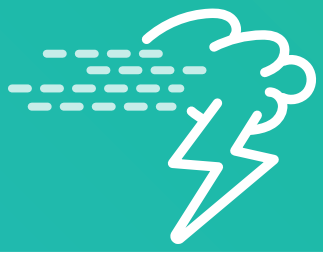
for conducting the Studio Experiment in your school

Mark will perform a simple studio experiment that can easily be carried out with your class. If you want to be ready to carry it out after watching the video you will need to collect the following equipment.

You will need:

- Lollipop sticks
- Elastic bands
- A spoon
- Something light to launch

Note: This can easily be done in the classroom as a group activity. In order to cut down on waste, make sure to use reusable spoons (metal or plastic) and not single use plastics. Another lollipop stick will work equally well as the catapult arm but it is more difficult to load the ammunition. Mark uses marshmallows as ammunition, but children can use balls of paper instead which may be easier to clean up in the classroom.



Tips for Further Investigations on Energy and Forces

Use the Lesson Plans to help your class with brainstorming ideas and coming up with a question. Remember that the children may start out with very broad ideas around questions but working through the steps in the lesson plans will help them to refine it down and come up with a testable question. Mark Robinson said that as a child he asked lots of questions, but they weren't always particularly scientific questions. Encourage the children to think about how they might answer their own questions.

The children will be more invested in their project if they are investigating a question that they developed as a class rather than one that was set by the teacher although you might want to narrow it down to ideas based on a particular theme. They may do some smaller investigations on the way towards refining their project idea and the finished project may be quite different from the original idea, but this is all part of the process. As Mark Robinson said, "The more I know, the more I realise I don't know". Finding an answer to one question can lead to another question. Remember that you don't need to know the answers in advance to be able to investigate a topic with the children. Ideally the teacher should learn something new from the project too.

There are lots of ways to carry out a project. It might involve a fair test investigation, some gathering of data or even a design and make project using waste materials. Remember to encourage the children to make predictions and to think about the best way to record and communicate their results.

The themes in this episode could provide lots of inspiration for project ideas:

- To generate some ideas for investigations on waste see **www.greenschools.ie** and **www.stopfoodwaste.ie**. Children might carry out surveys on the types of waste being generated in school, investigate composting, come up with new ways to reuse waste materials or design and make sustainable packaging.
- You will also find lots of ideas for investigations on energy and forces on www.primaryscience.ie including some other ideas for catapults and foam rockets which demonstrate the concept of potential energy in an elastic band. Mark Robinson mentioned lightning which is a form of static electricity and there are lots of ideas for investigations involving static and current electricity.
- We can't all chase storms like Mark Robinson, but there are plenty of investigations the children can carry out on weather and climate. Children might think about why hurricanes and tornados have always occurred in certain parts of the world and why these patterns are now changing. You will find lots of ideas for investigation around weather, climate and climate change at **www.seai.ie/schools** and also at **www.esero.ie/primary-level** and **www.esa.int/kids**.

Linkages

The children will obviously be spending some time on their ESB Science Blast project but remember that this is time well spent. They will not just be doing Science but depending on the project theme, it can cross over into lots of other subjects and become the focus for cross curricular work. There can also be linkages with other projects such as the SFI Discover Science and Maths Awards, Active Flag or Green Flag. Some possible linkages.

- **Language**: Written and oral language skills through recording and communicating about their project or discussion about waste and weather.
- **Maths**: Data collection, recording of results, tables, graphs, calculations
- **History**: Waste disposal in the past; history of mining and metal extraction, use of fossil fuels in the industrial revolution, first use of plastics.
- **Geography**: Weather patterns and climate zones around the world. Where and why do tornados occur? What causes lightning? Climate change and extreme weather events in Ireland.

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