



Lesson Plan: Recover, Grade 4 Science and Technology

Activity

Force: Removing metals at the Durham York Energy Centre

Introduction

The DYEC allows the Region to recover additional recyclable materials from the garbage and to convert non-recyclable waste materials into an energy source. In this lesson, students will explore how magnetic force is used at the DYEC to recover the metals remaining in our household garbage, while exploring common household items made of ferrous and non-ferrous metals.

Curriculum Connections

Science and Technology, 2022 (revised)

Grade 4

- Strand A: STEM Skills and Connections
- Strand C: Matter and Energy

Learning Objectives

1. Define Recover and explain why it is beneficial
2. Investigate how garbage is managed in Durham Region
3. Describe practical uses of magnetic energy in everyday life
4. Explore how magnetic force works
5. Define and explain force, magnetism, ferrous and non-ferrous metals, repel and attract

Resources Provided (available in the resource file)

- Video: What happens to your garbage when it leaves the curb?

Materials Required

- Several magnets for students to share
- Several examples of metal objects for students to explore such as paper clips, nuts, bolts, screws, nails, metal food cans, keys, kitchen utensils, aluminum drink cans, copper wire, springs and door handles
- Several examples of non-magnetic objects such as plastic wrap, candy wrappers, chip bags and scrap pieces of fabric

Activity Instructions

1. Ask the class to raise their hand if they know where their garbage goes once it is thrown away.

The Regional Municipality of Durham - Waste Management Services

If this document is required in an accessible format, please contact schoolprograms@durham.ca

2. Select several students to provide their answers.
3. Explain that in Durham Region (Ajax, Brock, Clarington, Oshawa, Pickering, Scugog, Uxbridge and Whitby), the garbage created within households is sent to the DYEC. Here, garbage is burned at high temperatures (making sure to protect the environment and the community) to reduce the volume of garbage being sent to landfill and to create electricity. The DYEC can safely process household garbage after waste diversion programs (including reuse, recycling and composting) have been maximized.
4. Play the video provided in the resource file: What happens to your garbage when it leaves the curb?
5. As a class, discuss how metal gets into our garbage bags. Where do students think this metal comes from?

The video mentions that some of the remaining waste is valuable metals like steel and aluminum. Despite our best efforts, sometimes items like pop cans, metal food cans and other metal items make it into our garbage bags. This may be because the items were not sorted properly at home by using other options like the Blue Box program, or because an item is a mix of metal and other materials that don't have another home outside the garbage when we no longer need or want them. A stapler is an example of an item that is often made of both plastic and metal.

6. **Recover** is the last "R" in the Region's Waste Management Hierarchy, and it is the final step prior to disposal. We can use the DYEC to recover metal from the garbage for proper recycling.

Recovery:

- Decreases the amount of waste going to landfill
- Converts non-recyclable waste materials into electricity, heat or fuel
- Offsets the consumption of other fuels needed to produce energy
- Reduces the amount of methane produced by landfill sites
- Reduces overall greenhouse gas emissions

7. Introduce the focus of today's lesson – we are going to look at how magnetic force is used to separate and collect metals from the garbage at the DYEC.

A **force** is the push or pull that makes an object start to move, speed up, slow down, change direction, stop or change shape.

8. Explain magnetism and magnetic force.

Magnetism is the ability to attract objects made of iron without even touching them. All magnets have a North and a South pole. The **magnetic force** in a magnet flows from the North to the South pole and it creates a magnetic field around the magnet. When you place one magnet's South pole to another magnet's North pole, they will stick together. The opposite happens if you put two South poles together or two North poles together. They will repel each

other and push each other away. The closer the objects are to the magnet, the stronger the magnetic force is.

9. Explain that magnets are attracted to metal, but not all metal. Magnets are not attracted to non-magnetic materials such as glass, plastic, fabric and paper.
10. Discuss how technology at the DYEC uses magnetic force to separate metals that remain in the garbage. Illustrate how science and technology can reduce the amount of waste by recovering metals that would otherwise end up in a landfill as a lost resource.

The DYEC uses magnetic force to separate metals out of the garbage. Magnetic force is used to **attract** (pull metals closer) ferrous metals. **Ferrous metals** contain iron and are magnetic. Examples of ferrous metals include steel and iron. Magnetic force is used to pull ferrous materials away from other materials into another separate area for recycling.

A strong magnetic force is used to **repel** (push away) non-ferrous metals. **Non-ferrous metals** are non-magnetic and do not contain iron. A machine at the DYEC creates a strong, rapidly changing magnetic field, which makes things that are non-magnetic metals act like they are magnetic for a short period of time. This process causes the non-ferrous metals to jump away from the other materials into a separate area for recycling. Examples of non-ferrous metals include aluminum, copper, lead, zinc, tin, gold and silver.

11. Divide the class into small working groups and provide each of these groups with a magnet, several common metal objects (include ferrous and non-ferrous objects), and several non-magnetic items.
12. Students will use their magnets to help determine if each of their objects are made of ferrous metal (these are magnetic and will be attracted by their magnets, non-ferrous metals (these objects are metal but are non-magnetic and will not be attracted by their magnets), or if the items are metal-free (these objects are not made of metal and will not be attracted by their magnets).
13. The completed activity demonstrates how magnet force is used at the DYEC every day to recover valuable material from our garbage.

Summary

The best way to manage garbage is by not creating it in the first place. After maximizing our waste diversion, Recover can help take care of what is left. By adding Recover to the Region's waste hierarchy, we are recovering value from the waste that cannot be reused or recycled in our current diversion programs. The DYEC allows the Region to recover additional recyclable materials from the garbage and to convert non-recyclable waste materials into an energy source.

Expanded Curriculum Connections

Grade 4, Science and Technology, 2022 (revised)

A: STEM Skills and Connections

A1. STEM Investigation and Communication Skills

- A1.1 use a scientific research process and associated skills to conduct investigations
- A1.2 use a scientific experimentation process and associated skills to conduct investigations
- A1.3 use an engineering design process and associated skills to design, build, and test devices, models, structures and/or systems
- A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing, and safely using tools, instruments and materials
- A1.5 communicate their findings using science and technology vocabulary and formats that are appropriate for specific audiences and purposes

A3. Applications, Connections, and Contributions

- A3.1 describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems
- A3.2 investigate how science and technology can be used with other subject areas to address real-world problems

C: Energy and Matter

C2. Exploring and Understanding Concepts

- C2.1 describe different types of contact forces and non-contact forces
- C2.2 describe different ways a force can be exerted on an object
- C2.3 describe how different forces applied to an object, including forces of varying magnitude, can cause the object to start, stop or change its direction, speed or shape
- C2.4 identify ways in which forces are used in their daily lives