

Grade **3** Invisible Forces

TEACHER'S GUIDE

Online version
and additional resources
available at
scholastic.ca/education/nlscience
Password:
Sci1nL2



SCHOLASTIC

Education

Invisible Forces

Table of Contents

- 3 Welcome to the *Invisible Forces* Unit
- 6 Planning Guide
- 9 Preparing for the Unit

Individual Teaching Plans

- 10 Exploring Invisible Forces
- 16 Creating Static Electricity
- 23 What Conditions Affect Static Electricity?
- 28 What Materials Are Attracted to Magnets?
- 34 Make Your Own Magnet
- 38 What Affects the Strength of Magnets?
- 44 What Happens When Two Magnets Meet?
- 49 Design Challenge: What Can You Make That Uses Invisible Forces?
- 53 Evaluating Personally Constructed Objects

Assessment

- 58 Specific Curriculum Outcomes Checklist
- 59 My Inquiry
- 60 Student Self-Assessment of Inquiry Process
- 61 Teacher Assessment of Inquiry Process
- 62 Inquiry Process Rubric
- 65 My Design
- 66 Student Self-Assessment of Design Process
- 67 Teacher Assessment of Design Process
- 68 Design Process Rubric

- 70 Additional Resources
- 72 Letter to Parents and Caregivers

Let's Do Science, Newfoundland and Labrador

Grade 3 Unit 3: Invisible Forces Teacher's Guide

Reviewers:

Catherine Phillips, NL

Janice Ryan, NL

Copyright © 2018 Scholastic Canada Ltd.
175 Hillmount Road, Markham, Ontario, Canada, L6C 1Z7.

Cover photo © Jeffrey Coolidge/Getty Images; cover inset: man with child: Katie Butt; cover inset: three children: Sundus Butt

Pages designated as BLMs or reproducibles may be reproduced under license from Access Copyright, or with the express written permission of Scholastic Canada, or as permitted by law.

All rights are otherwise reserved, and no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, scanning, recording or otherwise, without the prior written consent of the publisher or a license from The Canadian Copyright Licensing Agency (Access Copyright). For an Access Copyright license, visit www.accesscopyright.ca or call toll free to 1-800-893-5777.

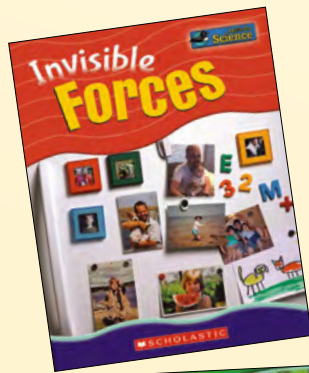
ISBN 978-1-4430-4766-1

Printed in Canada.

10 9 8 7 6 5 4 3 2 1 18 19 20 21 22

Welcome to the Invisible Forces Unit

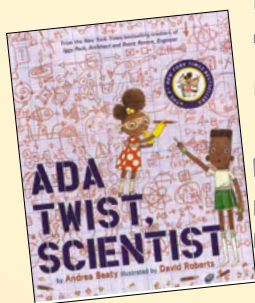
In this unit, students develop their understanding of invisible forces—static electricity and magnetism. Multiple program components will engage students and support learning of the specific science concepts.



Student Magazine

The Student Magazine will support students' exploration of invisible forces. The bright, colourful photographs, detailed illustrations, and different text features will engage students and give them multiple opportunities to explore a variety of concepts. A digital version of the magazine is available on the Teacher's Website to be used with an Interactive Whiteboard.





Science Read Alouds

Two Read Aloud texts allow you to introduce and engage students with science concepts. *The Golden Goose* (digital picture book version) by Barbara Reid is a wonderful introduction to the concept of invisible forces—forces which can't be seen but whose effects are all too clear. This picture book is available in digital format only and can be found on the Teacher's Website.

Ada Twist, Scientist by Andrea Beaty and David Roberts uses delightful rhyming text to reinforce the importance of asking questions in scientific inquiry and problem solving.



Anchor Video

The Anchor Video: *Invisible Forces*, found on the Teacher's Website, introduces students to essential questions about the invisible forces of static electricity and magnetism. The video gives a number of examples to activate students' thinking and to promote questions.

Posters

Two classroom posters—*What Is the Inquiry Process?* and *What Is the Design Process?*—will support students as they follow the steps for guided and open inquiries and learn to use the design process to create a solution to a problem.



Interactive Whiteboard Activities

There are 9 interactive activities for the Interactive Whiteboard (IWB) found on the Teacher's Website. These activities provide students with a variety of hands-on learning experiences and the opportunity to apply learning in a supported environment. The IWB Activities are tied to the teaching plans to ensure that the learning is done in context.





Science Library

The Science Library provides a collection of colourful and engaging non-fiction and fiction texts at a variety of reading levels. These texts support students as they explore various science concepts and skills. See the *Science Library Guide* in the Teacher's Guide Binder or online for general suggestions for using the Science Library titles along with summaries, ties to the curriculum, and suggested reading experiences (e.g., Independent Reading and Shared Reading).

Teacher's Guide

This guide provides detailed suggestions for using all of the program components including the Student Magazine, Anchor Video, reproducible Blackline Masters (BLMs), and IWB Activities with your students. Visual cues such as book covers, thumbnail images, and icons highlight the use of each component along with tools such as Science Folders and Journals, the Word Wall, and I Wonder Wall. Strategies and tools you need to assess students' learning, such as rubrics and checklists, are also included. Embedded within the teaching plans are connections to Guided and Shared texts from *Literacy Place for the Early Years*, Grade 3 that relate to the concepts explored in *Invisible Forces*.



Teacher's Website

In addition to the Student Magazine, Anchor Video, and IWB Activities mentioned above, this website provides a digital copy of the Teacher's Guide for this unit along with access to an image bank containing the variety of photographic images found in the Student Magazine and IWB Activities. These images may be used by teachers to create new IWB Activities or for students to incorporate into presentations. Find the Teacher's Website at

scholastic.ca/education/nlscience

Password: Sci1nL2



Planning Guide for *Invisible Forces*

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
Exploring Invisible Forces Students investigate the effects of forces when materials are touching and when materials are not touching.	Skills [GCO 2] • 1.0 • 2.0	<i>The Golden Goose</i> (Read Aloud, digital version) - Student Magazine, pages 2–3 - IWB Activity 1 - Anchor Video: <i>Invisible Forces</i>	- magic trick materials including an inflated balloon, a Ping-Pong ball, magnets, two magnetic coins - materials for the Curiosity Centre such as balloons, felt, foam plates, fur, silk, wool, plastic combs and rulers, electrostatic dusters and cloths, variety of magnets, magnetic and non-magnetic objects - students' Science Journals	
Creating Static Electricity Students explore the force of static electricity and identify static electricity and its effects in their everyday lives.	Skills [GCO 2] • 34.0 STSE/K [GCO 1/3] • 37.0 • 38.0	- Student Magazine, pages 4–7 - IWB Activity 2 - BLM <i>How Long Did It Stick?</i> - IWB Activity 3 - IWB Activity 4	- inflated balloons - fur or wool - polyester or plastic wrap - paper plates, salt, pepper - students' Science Journals - plastic comb and materials such as tissue paper, aluminum foil, paper - variety of objects such as inflated balloons, plastic combs, Ping-Pong balls, plastic rulers, foam plates, paper, string, fabric such as felt, cotton, polar fleece, silk, wool, and fur - students' Science Folders	<i>Felicity Discovers Electricity</i> (Guided Reading, Level M) <i>Make Electrostatic Slime</i> (Guided Reading, Level L)
What Conditions Affect Static Electricity? Students explore how varying conditions affect static electric charges.	Skills [GCO 2] • 2.0 • 10.0 STSE/K [GCO 1/3] • 39.0	<i>Ada Twist, Scientist</i> (Read Aloud) - Student Magazine, pages 8–11 <i>What Is the Inquiry Process?</i> poster	- variety of objects such as inflated balloons, plastic combs, Ping-Pong balls, plastic rulers, foam plates - fabric such as felt, cotton, polar fleece, silk, wool, and fur - humidifier or spray bottles - students' Science Journals - digital camera (optional)	

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
What Materials Are Attracted to Magnets? Students test a variety of materials to discover which materials are magnetic.	Skills [GCO 2] • 8.0 • 16.0 STSE/K [GCO 1/3] • 40.0 • 41.0	• Student Magazine, pages 12–15 • IWB Activity 5 • BLM <i>My Predictions</i> • IWB Activity 6	• box with a variety of objects such as paper clips, straws, tacks, rubber bands, pieces of paper • objects including cork, foil packet, staples, nuts and bolts, eraser, nails, binder clips, plastic comb, wooden blocks, washers, coated paper clips, aluminum can • variety of objects such as a pencil, spoon, key, marble, wooden block, aluminum foil, coins, cardboard, tissue, balloon, buttons, plastic ruler; also include some objects made of copper, brass, and aluminum • magnets • students' Science Folders • iron-fortified cereal (i.e., Total or Vector), zippered plastic bags • modelling clay, paint, and small magnets	
Make Your Own Magnet Students explore how to magnetize materials and follow a procedure to make their own temporary magnets.	Skills [GCO 2] • 21.0 STSE/K [GCO 1/3] • 42.0	• Student Magazine, pages 16–17	• magnet and paper clips • bar magnets (one per pair of students), a key, scissors, coins, a spoon, brass paper fasteners, aluminum foil, metal jar lid, iron nails, paper clips, washers, bolts, loose staples • variety of magnets of different types and sizes (e.g., bar, horseshoe, donut, ring) • students' Science Journals	
What Affects the Strength of Magnets? Students explore the strength of various magnets and design an investigation to test how different conditions affect the force of magnets.	Skills [GCO 2] • 14.0 STSE/K [GCO 1/3] • 43.0	• Student Magazine, pages 18–19 • BLM <i>Measuring the Strength of Magnets</i> • <i>What Is the Inquiry Process?</i> poster	• magnet, paper clip, glass of water • magnets of different shapes and sizes (e.g., bar, horseshoe, donut, ring) • variety of magnetic objects • various materials to act as barriers such as cardboard, paper, wood • various mediums such as sand or yogurt • humidifier or spray bottles • various craft materials to build magnetic racetracks and large pieces of cardboard (e.g., a pizza box)	<i>Magnetic Racetrack</i> (Shared Reading—Sequencing Strategy Unit)

Continued on next page...

Planning Guide for *Invisible Forces* (continued)

Teaching Plans	Specific Curriculum Outcomes	Components	Materials	Literacy Place Connections
What Happens When Two Magnets Meet? Students will discover that magnets have a north pole and a south pole, and that opposite poles attract each other while like poles repel. Students will also use iron filings to explore magnetic fields, and discover how a compass helps them find directions.	Skills [GCO 2] • 2.0 STSE/K [GCO 1/3] • 44.0	- IWB Activity 7 - Student Magazine, pages 20–25 - IWB Activity 8	- variety of magnets of different shapes and sizes (e.g., bar, horseshoe, donut, ring) - pieces of cardboard or paper plates - iron filings in a shaker - protective goggles - students' Science Journals - blunt sewing needles or unbent paper clips - containers of water - paper and wax crayons	
Design Challenge: What Can You Make That Uses Invisible Forces? Students demonstrate their understanding of invisible forces by designing and constructing a toy or game that makes use of attraction and/or repulsion.	Skills [GCO 2] • 28.0 • 29.0 • 30.0	- Student Magazine, pages 26–29 - IWB Activity 9 <i>What Is the Design Process?</i> poster	- buttons or coins to use as game pieces, dice - variety of games and toys using invisible forces for the Curiosity Centre - students' Science Journals - variety of materials such as balloons, plastic rods, plastic wrap, various fabrics - magnets of different shapes, sizes, and strengths - magnetic materials such as paper clips, magnetic tape, washers, screws, tin cans - various craft supplies - tools such as scissors, staplers, and tape	
Evaluating Personally Constructed Objects Students evaluate their created toys or games and consider other useful items they could make that use invisible forces.	Skills [GCO 2] • 17.0 • 35.0	- Student Magazine, pages 30–31 - BLM <i>Two Stars and a Wish</i>	students' Science Journals	

Preparing for the Unit

1. Curiosity Centre

The Curiosity Centre gives students an opportunity to investigate science ideas and tools through active participation, free exploration, and independent play. In this hands-on centre, students can explore objects related to invisible forces.

The Curiosity Centre could have

- balloons, anti-static sheets, electrostatic dusters and cloths, felt, foam plates, fur, plastic wrap, silk, wool, plastic combs and rulers
- various types and sizes of magnets
- variety of magnetic objects (e.g., nails, scissors, thumb tacks, safety pins, paper clips, bolts, washers, magnetite)
- variety of non-magnetic objects (e.g., wood blocks, pencils, erasers, cork, keys, markers, modelling clay, aluminum foil, cardboard, paper, plastic)
- iron filings
- compasses
- toys and games using invisible forces

Check the centre frequently to ensure it is well stocked with items. Invite students to contribute to the centre by bringing in items or photographs related to static electricity and magnetism. Remind students to tidy up the materials when they are finished.

Note: You may choose to display new items every few days or introduce items one at a time throughout the unit.

2. Science Journals and Folders



Check that students are recording appropriately in their Science Journals, ensuring that they date each entry and record ideas using sketches with labels, lists of words, or sentences. Continue to encourage them to add new questions or ideas to their Journals as often as they like.

Remind students that they should store completed BLMs, drawings, stories, etc. that are related to the *Invisible Forces* unit in their Science Folders.

3. Word Wall



Add any relevant science terminology to the Word Wall throughout the unit. Emphasize the importance of using precise scientific words while explaining and expressing science concepts and when sharing science learning. Urge students to use the terms as often as possible as they work through the unit.

4. I Wonder Wall

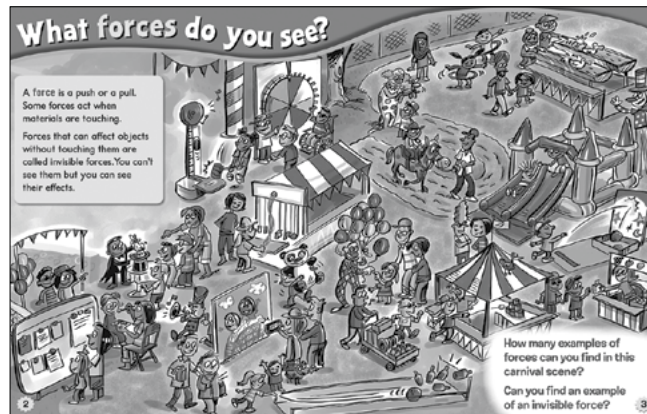


Build the I Wonder Wall throughout the unit by posting students' questions as they arise. Refer to the I Wonder Wall often and select questions that students may be ready to answer.

5. Reading Centre

Add texts (books, magazines, and photographs) relating to invisible forces to the Reading Centre. Or, you may choose to include these texts in the Curiosity Centre to stimulate discussion and questions. The titles in the Science Library will help start off a collection of books. Also refer to the list of non-fiction texts pertaining to *Invisible Forces* in the Additional Resources section of this guide (pages 70–71).

Exploring Invisible Forces



Focus: Students investigate the effects of forces when materials are touching and when materials are not touching.

Specific Curriculum Outcomes

Students will be expected to:

- 1.0 pose questions that lead to exploration and investigation [GCO 2]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- pose and post inquiry questions to the I Wonder Wall
- use scientific terminology to communicate their observations

NOTES:

Attitude Outcome Statements

Encourage students to:

- show interest in and curiosity about objects and events within their immediate environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- speak and listen to explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experiences [GCO 1]
- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>The Golden Goose</i> (Read Aloud, digital version) • Student Magazine, pages 2–3 • IWB Activity 1 • Anchor Video: <i>Invisible Forces</i>	• magic trick materials including an inflated balloon, a Ping-Pong ball, magnets, two magnetic coins • materials for the Curiosity Centre such as balloons, felt, foam plates, fur, silk, wool, plastic combs and rulers, electrostatic dusters and cloths, variety of magnets, magnetic and non-magnetic objects • students' Science Journals	• Prepare for the magic show by gathering the necessary materials. Charge the balloon immediately before the first trick. • Provide a variety of materials related to static electricity and magnetism at the Curiosity Centre. • Prepare a large KWLM chart. • Create and make copies of a Wordle using terminology from the unit.	• force • invisible force • push • pull • static electricity • magnet • magnetism

Safety

- If any students have a latex allergy, modify the materials or the activity accordingly to avoid the use of latex balloons.

Science Background

- A force is a push or pull that starts something moving, changes the direction of a moving object, changes the speed of a moving object, or causes a moving object to stop.
- Some forces are invisible. We can see the effect, but not what caused it. Static electricity and magnetism are examples of invisible forces.
- If you include coins in the Curiosity Centre for student explorations, note that nickels minted after 2000 and pennies minted since 2002 are mainly steel and so are magnetic. Including pennies and nickels that offer different

results when tested for magnetic attraction may generate more questions about the types of metals attracted by magnets.

Possible Misconceptions

- Students may think of a magnet sticking to or moving towards a magnetic object but they may not recognize this as the effect of a pull or force. Likewise, students may have rubbed a balloon on their hair and stuck it to a wall but they are unlikely to think of this as involving forces.
- Students may think that wind is an example of an invisible force. Explain that while wind is invisible, it is actually a contact force—the air is pushing against an object.

ACTIVATE

Invisible Forces Magic Show

Before the show, blow up a balloon and collect a Ping-Pong ball, a couple of magnets, and two magnetic coins. Perform some simple magic tricks involving invisible forces. You may choose to “look the part” of a classic magician by wearing a top hat. Say the magic word “Abracadabra” as you perform each trick.

Charge a balloon just before the show or charge it out of sight from the students immediately before performing the first trick. Be dramatic as you say:

- **Watch as I use this balloon to move this ball without touching it!**
- **For my next trick, I will make this balloon stick to the wall!**

Hold one of the magnets in your hand, out of sight of the students, and use it to repel another magnet. Say:

- **Watch as I move this magnet without touching it!**

Keeping the magnet hidden in your hand, pick up a coin between your thumb and index finger ensuring it is in contact with the magnet. Then use the coin to attract another coin. For dramatic effect, spin the second coin with your finger. Introduce the trick by saying:

- **For my next trick, I will use this coin to pick up a second coin!**

ACTIVATE

Read Aloud: *The Golden Goose* (digital version)



Summary

Rupert helps a stranger and is rewarded with a golden goose—but everyone who touches it gets stuck together! What can be done to break the spell?

Note: This text is available in digital format only and can be found on the Teacher’s Website: scholastic.ca/education/nlscience

Before Reading



Remind students that a force is a push or a pull. Invite volunteers to name a few examples of a force. Add the words “force,” “push,” and “pull” to the Word Wall.

Explain to students that the story you are going to read is based on a traditional fairy tale. Invite students to share examples of fairy tales they know. Ask:

- **Does everything that happens in a fairy tale happen in everyday life?**

Set a focus for listening by asking students to identify the force being used in this story.

During Reading

As you read the story aloud, pause to discuss the text and illustrations. Clarify any vocabulary as necessary. Prompts for discussion could include:

- **Why are the people sticking to the goose and to each other?**
- **Do you think there is glue or another adhesive on the goose?**
- **Do you think the force is strong or weak?** (It must be strong to link so many people together.)
- **Is the force a push or a pull?**
- **Why do you think the train of people can't get “unstuck”?**
- **Is there an invisible force at work here?**
- **What happens when Gwendolyn sees the crazy train of people?**
- **Why did her laughter allow everyone to go free?** (It broke the spell.)

After Reading

Tell students that this book is fiction but that there are real invisible forces that can make things attract or “stick together.” Explain that an invisible force can't be seen but we can see the effects of the force, such as things being “stuck” together. Ask:

- **What invisible forces do you know that make things stick together?**

If necessary, prompt students by asking:

- **Have you ever used a magnet to pick up other objects? The objects seem to stick to the magnet. This is called magnetism.**
- **Have you ever noticed that sometimes clothes stick to each other when they come out of a hot dryer? This is called static electricity.**



Invite students to share instances when they have experienced invisible forces. Add the term “invisible forces” to the Word Wall.

Push and Pull

Invite students to experiment and then list how many ways they can move an object such as a pencil. Have students sort their actions as pushes and pulls. Ask:

- **What is a force?**
- **Can you always see a force?** (Sometimes we can only see the effect of a force.)
- **How can you see that a force has been exerted?**

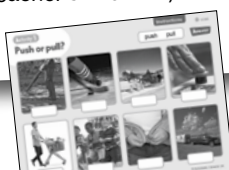
Introducing Invisible Forces

Introduce the Student Magazine to students. Have them review the Contents page and remind students that the words in bold, red font throughout the magazine are defined in the Glossary.

Have students examine the illustration on pages 2–3 of the Student Magazine. Challenge them to identify pushes and pulls shown in the image. Ask students if they can identify a push or pull resulting from an invisible force (papers held to a magnetic board by magnets).

IWB Activity:

- Have students label images as a push or a pull using Activity 1: *Push or pull?* (see the Teacher's Website).



CONNECT

Curiosity Centre

Invite the students to explore freely at the Curiosity Centre using magnetic and/or potential static electric materials. Have students briefly report something that they learned about the materials and how they interact. Ask:

- **Were any results surprising?**
- **Why do you think that happened?**



Students can record questions they may have on sticky notes or index cards at the Curiosity Centre and add them to the I Wonder Wall.

Anchor Video

Play the Anchor Video: *Invisible Forces* which is located on the Teacher's Website. Set a focus for viewing by asking students to note the examples of static electricity and magnetism shown and to think about those they have experienced. You may choose to pause the video to allow students to answer questions or to discuss any questions which students may have.

KWLM Chart

Begin a class KWLM chart (Information we **know**; what we **wonder** or want to know; information we **learned**; **more** questions) for invisible forces. Include any specific invisible forces terminology students know.



Invisible Forces Words

Create and make copies of a Wordle, using terminology from the unit such as force, static electricity, magnetism, electrostatic charge, magnet, attract, repel, magnetize, north pole, south pole, compass, push, pull. Have students circle any words they don't know, and tell them that they'll learn about these words during this unit. Invite students to play Charades using any unit terminology they are familiar with.

CONSOLIDATE

New Trick

Referencing their explorations at the Curiosity Centre, students can create an invisible forces magic trick that could be added to the Magic Show. The trick must show the effect of an invisible force (static electricity or magnetism). Allow students to explore and choose a variety of items (such as those at the Curiosity Centre) that can be used to attract or repel objects or materials. Have students work in small groups to create and then perform their trick. After performances are complete, have each group describe how their trick showed the effect of an invisible force, or ask other class members to describe what the trick showed about invisible forces.

Question List



Invite students to generate a personal list of questions that they would like to explore and investigate throughout the unit. Students can record their inquiry questions and any reflections in their Science Journals.

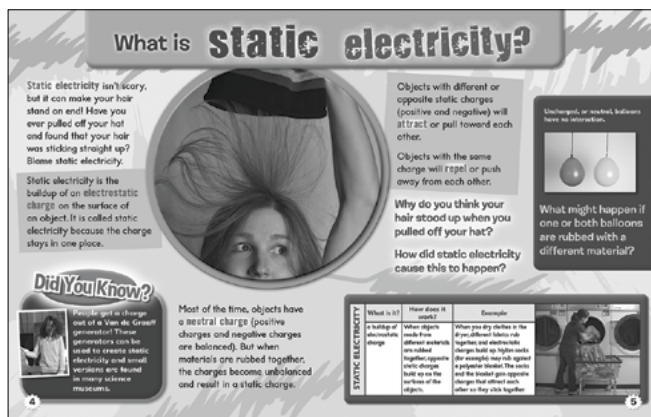
EXPLORE MORE

Describing Forces



Students can record in their Science Journals how contact forces can be used to move objects directly. Then they can record any explorations they undertook to use pushes and pulls to move objects without directly touching them (magnetic and electrostatic explorations).

Creating Static Electricity



Focus: Students explore the force of static electricity and identify static electricity and its effects in their everyday lives.

Specific Curriculum Outcomes

Students will be expected to:

- 34.0 pose new questions that arise from what was learned [GCO 2]
- 37.0 describe and demonstrate ways to use everyday materials to produce static electric charges, and describe how charged materials interact [GCO 1/3]
- 38.0 describe examples of the effects of static electricity in their daily lives and identify ways in which static electricity can be used safely or avoided [GCO 1/3]

Performance Indicators

Students who achieve these outcomes will be able to:

- use different materials to statically charge various objects, and describe their interactions with other charged and uncharged materials
- identify ways to stay safe during a thunderstorm

NOTES:

Attitude Outcome Statements

Encourage students to:

- work with others in exploring and investigating [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- collect first-hand data and organize it using charts to answer questions [3SP1]

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 4–7 • IWB Activity 2 • BLM <i>How Long Did It Stick?</i> • IWB Activity 3 • IWB Activity 4 Literacy Place: • <i>Felicity Discovers Electricity</i> (Guided Reading, Level M) • <i>Make Electrostatic Slime</i> (Guided Reading, Level L)	• inflated balloons • fur or wool • polyester or plastic wrap • paper plates, salt, pepper • students' Science Journals • plastic comb and materials such as tissue paper, aluminum foil, paper • variety of objects such as inflated balloons, plastic combs, Ping-Pong balls, plastic rulers, foam plates, paper, string, fabric such as felt, cotton, polar fleece, silk, wool, and fur • students' Science Folders	• Inflate and tie off balloons (one per pair of students).	• static electricity • electrostatic charge • positive charge • negative charge • neutral charge • attract • repel

Safety

- If any students have a latex allergy, modify the materials or the activities accordingly to avoid the use of latex balloons.

Science Background

- Without touching them, an object that has been electrically charged pulls on other uncharged objects and may either push or pull other charged objects.
- Static electricity does not need contact to apply a force. It can make lightweight objects such as tissue paper or pieces of paper “jump” or “stick.”

- When two materials are rubbed together, electrons (i.e., negatively charged particles in atoms) move from one material to the other. The materials will gain opposite charges due to an excess of electrons in one material (negative charge) and a reduction of electrons in the other (positive charge). If two similar objects are rubbed with the same material, they will both gain the same charge and will repel each other.

Note: Teachers should avoid using the term “electron” with students.

Students are not expected to be able to explain the buildup of static charges as the transfer of negative particles/charges or electrons.

- Electrostatic Series (when any two of the following materials are rubbed together, the one higher in the list becomes positively charged and the one lower becomes negatively charged):
 - dry human skin
 - glass
 - human hair
 - nylon
 - wool
 - fur
 - silk
 - paper
 - cotton
 - hard rubber
 - polyester
 - styrene (Styrofoam)
 - plastic
- Lightning is caused by static electricity. Sparks jump between two areas of opposite and built-up electrical charges. Some charges jump from one part of a cloud to another. Others jump from a cloud to the ground and then return back to the cloud. These two strokes appear as one lightning bolt and take place in less than a second.

ACTIVATE



Introducing Static Electricity

Introduce pages 4–5 of the Student Magazine to the class. Provide time for students to examine this spread and read the question: *What is static electricity?* Read the text with the students then invite them to share any experiences they have had with static electricity in their daily lives. For each situation mentioned, briefly explain how the static electricity may have caused the situation to happen. Add the term “static electricity” to the Word Wall.

Demonstrating With Statically Charged Objects

Demonstrate for students how statically charged balloons and uncharged balloons interact when they are brought near to each other. Tell the students that you are going to bring close two uncharged or neutral balloons. Bring the balloons together and ask:

- **What did you observe?**
- **What happens when uncharged materials are placed together?** (Nothing.)

Now rub one of the balloons with a piece of fur or wool and explain to students that this balloon has been statically charged. Bring the charged balloon close to the uncharged balloon and ask:

- **What did you observe this time?**
- **What happens to an uncharged material when a statically charged material is placed near it?** (It is attracted to the charged material.)

Rub one balloon with the fur or wool and rub the second balloon with a different material such as polyester or a piece of plastic wrap. Explain that these balloons are both charged. Bring the balloons close together and ask:

- **What happens when two statically charged materials are placed near to each other?** (They attract one another if they have different charges and repel if they have the same charge.)



Define the terms “electrostatic charge,” “attract,” and “repel” and add these terms to the Word Wall.

CONNECT

Salty Pepper



Students can work in pairs or small groups to investigate using a charged balloon to try to attract salt and pepper. Thoroughly mix a teaspoon of both salt and pepper on a plate for each group. Have students predict which materials will be picked up by the charged balloon. Students can record their predictions in their Science Journals.

Students can charge a balloon by rubbing it on their hair and then bring it slowly closer to the materials on the plate. Students should record their observations in their Science Journals. Discuss the results as a whole group. Ask:

- **Were your predictions supported?** (Pepper will be picked up first because it is lightest, and salt will be picked up if the balloon is brought very close to the plate.)



Explain that by rubbing the balloon on their hair, the balloon was given a negative electrical charge. The salt and pepper both have a neutral charge, and because charged objects attract neutral objects, the pepper and then the salt rose from the plate and stuck to the balloon. This is static electricity! Invite students to add new questions based on their observations to the I Wonder Wall.

Charge It!

Provide each student with an inflated balloon or a plastic comb. Invite them to explore rubbing different materials on the object to charge it and see what it will attract (e.g., tissue paper, aluminum foil, paper, etc.), or how long it will cling to something.

Producing Static Electricity

Students can work with a partner or in a small group to explore using a variety of materials (balloons, plastic comb, Ping-Pong balls, plastic rulers, foam plates, paper, string, fabric such as felt, cotton, polar fleece, silk, wool, and fur) to produce static electricity.

- **How can you produce static electricity?**
- **What materials are most effective for producing static electricity?**
- **How might we safely discharge or get rid of the static electricity?**

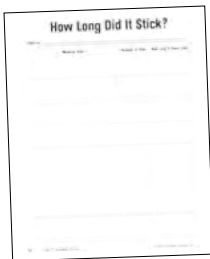


Ask students if they have new questions. Any new questions should be recorded on the I Wonder Wall.

- **IWB Activity:**
- Challenge students to
- use Activity 2: *Is it static electricity?* (see the
- Teacher's Website) to
- sort the effects shown as
- those caused by static
- electricity and those
- not caused by static
- electricity.



CONSOLIDATE



Sticking Time

Students can work in pairs to select the three materials they predict will work best to create electrostatic charges. Have them investigate to see if increasing the number of times a balloon is rubbed will increase how long it will stick to the wall. Students can use BLM *How Long Did It Stick?* to record their observations.

- **Did certain materials make the balloon stick to the wall for a longer time?**
- **Did increasing the number of rubs make the balloon stick longer?**



Invite the pairs of students to share the procedure they followed and their results with the class. Have students store their completed BLMs in their Science Folders.



Class Competition

Have a class competition to see which group can move an object the farthest using only the force of static electricity. Have students record in their Science Journals how to produce a static charge.

Scavenger Hunt

Challenge students to go on a scavenger hunt to find helpful uses of electrostatic forces in the school environment, e.g., cleaning products (Swiffer dusters, dust mitts) and plastic wrap. Challenge students to add examples from home to the list.

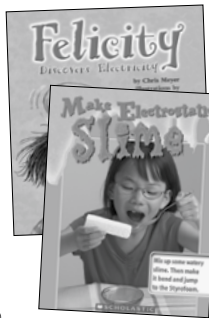


Lightning Safety

Share pages 6–7 of the Student Magazine with the class. Read the title question aloud: *How can you stay safe in a thunderstorm?* Give students time to examine this spread by reading the text and looking at the images. Have students participate in a Think-Pair-Share strategy by deciding which actions they should and should not do during a thunderstorm. Students can then share their reasoning with a partner before sharing their ideas with the whole class.

IWB Activity:

- Students can identify safe locations using Activity 3: *Which places are safe in a lightning storm?* (see the Teacher's Website).



Literacy Place Connection:

Read or revisit *Felicity Discovers Electricity* (Guided Reading, Level M) and *Make Electrostatic Slime* (Guided Reading, Level L) with students. Read each investigation aloud, pausing before the explanation is given. Invite students to explain the results and then confirm or revise their ideas by reading the explanations in the text. Invite students to try any of the investigations that interest them.

EXPLORE MORE

Static Around Us

Invite students to research the uses of static electricity in the world around us (e.g., ink-jet printers, air purifiers, photo copiers, car painting, and some screen protectors for mobile devices). Ask:

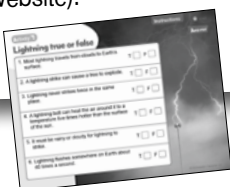
- How do static forces affect your life?

Lightning Count

Share with students, or have them research, the method for estimating the distance of lightning from the viewer by counting the number of seconds between the lightning flash and the sound of the thunder. The longer the time between, the further away the lightning. Encourage students to use the method during a thunderstorm.

IWB Activity:

- Challenge students to identify true facts about lightning using Activity 4: *Lightning true or false* (see the Teacher's Website).

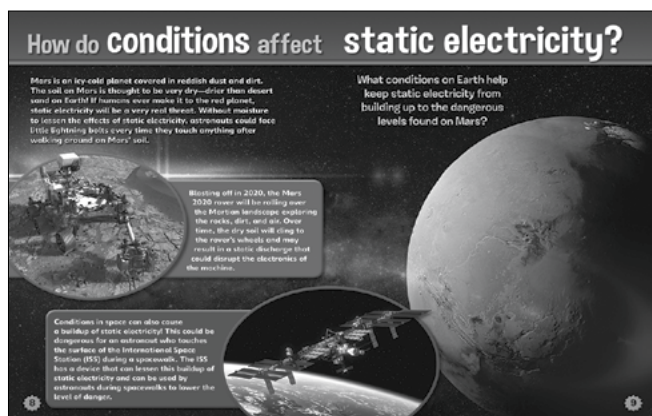


How Long Did It Stick?

Name: _____

Material Used	Number of Rubs	How Long It Stuck (min)

What Conditions Affect Static Electricity?



Focus: Students explore how varying conditions affect static electric charges.

Specific Curriculum Outcomes

Students will be expected to:

- 39.0 identify conditions that affect the force of static electric materials [GCO 1/3]
- 10.0 make and record observations and measurements [GCO 2]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- plan an investigation to test how a variety of charged materials interact in various conditions
- record and communicate observations and results of their investigation

NOTES:

Attitude Outcome Statements

Encourage students to:

- willingly observe, question, and explore [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- respond personally to a range of texts [GCO 6]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>Ada Twist, Scientist</i> (Read Aloud) • Student Magazine, pages 8–11 • <i>What Is the Inquiry Process?</i> poster	• variety of objects such as inflated balloons, plastic combs, Ping-Pong balls, plastic rulers, foam plates • fabric such as felt, cotton, polar fleece, silk, wool, and fur • humidifier or spray bottles • students' Science Journals • digital camera (optional)		• observe • question • problem • predict • explore • inquire • investigate • measure • record • conclude

Science Background

- A charged object is surrounded by an electric field which exerts electrical force on other things within the field.

ACTIVATE

Read Aloud: *Ada Twist, Scientist*



Summary

Ada Twist is a young girl with endless curiosity. She conducts scientific investigations in an attempt to understand the things she observes around her. Ada comes to realize that her questions might not always lead to answers, but rather to more questions.

Before Reading

Show students the cover of the book and read aloud the title. Ask:

- What does the word “scientist” suggest?
- What do you think this story might be about?

Involve students in a Think-Pair-Share strategy. After providing time for students to ponder the questions, have them turn to the person next to them

and share their thinking. After students have had a chance to share their thinking with a partner, invite a few students to share their ideas with the class. Ask students to listen as you read to discover what traits or characteristics Ada had that made her a great scientist.

During Reading

As you read the story to students, pause to discuss the text and illustrations. Clarify vocabulary as necessary. Alternate by asking students to respond in a whole group or with a partner. Prompts for discussion could include:

- **What does it mean to look all around and observe the world?**
- **How can our observations lead to questions?**
- **How did Ada follow up on her questions?** (research, hypothesis/prediction, testing, thinking, more questions)
- **What did Ada do when her first prediction or hypothesis didn't work out?** (She turned to her second prediction to investigate.)
- **Why do you think it's important to record our thinking while we explore and investigate?**

After Reading

Review the traits or characteristics Ada had that made her a great scientist. If students don't suggest the following, you might introduce the traits of:

- curiosity (She asked questions about everything she observed around her.)
- imagination (She came up with more than one hypothesis to investigate for each question.)
- determination (She didn't give up when her first idea didn't work out. She decided to test out another idea.)

Discuss with students why asking questions about what we observe is the first step in exploring and investigating to find answers.

I Remember

Hold a class discussion about how conditions affect static electricity. Encourage students to think about what they have observed. Prompts for discussion might include:

- **When have you observed the effects of static electricity? What were you doing?**
- **What did you see, feel, or hear?**
- **Was the weather warm or cold?**
- **Was it humid or dry?**
- **Was it inside or outside?**
- **Is there more static electricity in winter or in summer? Why do you think so?**

Make a class list of the various conditions that could affect static electricity such as:

- distance a charged object is held from another object
- humidity in the air (moisture)
- material used to charge the object
- how many times the object is rubbed to charge it

CONNECT

Changing Conditions

Tell students they will be working in small groups to plan an investigation to see how a variety of charged materials interact in various conditions. Students can refer to the class chart of conditions that could affect static electricity and choose one condition to test at a time. Prompt their thinking by asking:

- **What conditions affect static charges?**
- **How could you test one of these conditions?**

Review the *What Is the Inquiry Process?* poster with the students. Remind students to make and record observations and measurements in their Science Journals. Students may choose to record through writing, drawing, charts or tables, or by taking digital images or video.

Groups can share their investigations with the whole class by stating the question they investigated, the procedure they followed, and the results they obtained. Invite students to identify any new questions that arise from their investigations.

Static Electricity in Space

Introduce pages 8–9 of the Student Magazine to the class. Have students examine the images and then share-read the text together. Ask:

- **What are the conditions on Mars that affect static electricity?** (extreme dryness; lack of humidity on Mars; extreme cold)
- **How might a static discharge damage electrical equipment in space?**
- **How can the static electricity be safely discharged on the ISS (International Space Station)?**
- **What are the conditions on Earth that help to stop the buildup of dangerous levels of static electricity?**

CONSOLIDATE

Static Stan

Have students examine pages 10–11 of the Student Magazine. Invite students to explore the adventures of Static Stan to discover how static electricity can be avoided or reduced in their own lives. Discuss the positive uses of static electricity shown. Students can create their own comic strip or continue the adventures of Static Stan in other situations.



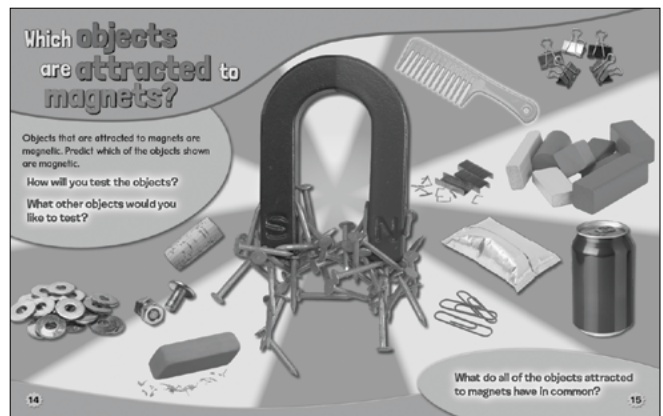
Static Electricity Foldable

Students can create a foldable for static electricity terms.

EXPLORE MORE

Poster Power

Students can create a poster showing how to reduce or avoid harmful effects of static electricity in daily life.



Specific Curriculum Outcomes

- 40.0 identify familiar uses of magnets [GCO 1/3]
- 41.0 investigate and identify materials that are attracted by magnets and distinguish from those materials that are not affected by magnets [GCO 1/3]
- 8.0 sequence or group materials and objects [GCO 2]
- 16.0 predict based on an observed pattern [GCO 2]

Students who achieve these outcomes will be able to:

- NOTES:**

Attitude Outcome Statements

Encourage students to:

- show interest in and curiosity about objects and events within their immediate environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 12–15 • IWB Activity 5 • BLM <i>My Predictions</i> • IWB Activity 6	• box with variety of objects such as paper clips, straws, tacks, rubber bands, pieces of paper • objects including cork, foil packet, staples, nuts and bolts, eraser, nails, binder clips, plastic comb, wooden blocks, washers, coated paper clips, aluminum can • variety of objects such as a pencil, spoon, key, marble, wooden block, aluminum foil, coins, cardboard, tissue, balloon, buttons, plastic ruler; also include some objects made of copper, brass, and aluminum • magnets • students' Science Folders • iron-fortified cereal (i.e., Total or Vector), zippered plastic bags • modelling clay, paint, and small magnets	• Create a fishing pole by attaching a magnet to one end of a length of string and the other end to a metre stick.	• attract • magnet • magnetic • non-magnetic

Safety

- Ensure that students know that a magnet should never be held near electronic devices such as computers; radios; debit, credit, and security cards; and televisions. Magnets disrupt electronic components and can cause permanent damage.

Science Background

- There are three kinds of magnets:
 - Natural magnets are rocks that contain a lot of iron and are magnetic when they are found (e.g., lodestone—a form of the mineral magnetite).
 - Permanent magnets are usually made from hard iron.

- Temporary magnets can be made from magnetic materials; however, they are weak and their magnetic force lasts only a short time.
- Magnets need to be stored properly (with opposite poles together) to ensure they stay strongly magnetized. If magnets become de-magnetized, remagnetizers are devices that can be purchased through science supply stores.
- Only a few metals (iron, nickel, and cobalt) are attracted to magnets.

Possible Misconceptions

- Some students may think magnets attract all metals and perhaps even shiny (metallic-looking) objects.
- Students may believe that all magnetic materials are magnets. Their explorations will demonstrate that magnets attract magnetic materials but these materials are not magnets.

ACTIVATE

Magnet Facts

Have students work individually, then with a partner, to list what they know about magnets. Have pairs of students share with the whole class and add information to the class KWLM chart for *Invisible Forces*. Students may be aware of uses such as in toys, as fasteners, and to keep things closed. Add the word “magnet” to the Word Wall.



Magnet Scavenger Hunt

Challenge pairs of students to go on a scavenger hunt around the classroom, and/or the school, to find ways magnets are used. Students could take digital images to share their observations.

Uses of Magnets

Direct students to pages 12–13 of the Student Magazine and have them examine the images showing where magnets may be used. Ask:

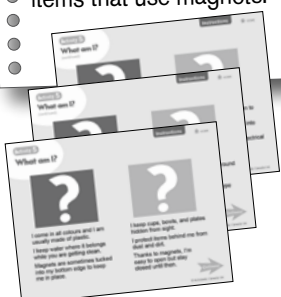
- **How are magnets used in everyday life?**
- **Where else can you find magnets?**

Students may wish to research some less familiar uses of magnets such as cow magnets, maglev trains, and magnets in electronic devices (e.g., microwaves).



IWB Activity:

- Students can use Activity 5: *What am I?* (see the Teacher's Website) to predict and identify the items that use magnets.



CONNECT

Gone Fishin'

Set up a box filled with a variety of items such as paper clips, straws, some tacks, rubber bands, and pieces of paper. Provide a “fishing pole” with a magnet tied to one end of a string and the other end tied to a metre stick. Invite students to “fish” in the box. Once students have caught all the items they can, ask:

- **What is similar about the items you caught?**
- **How did the magnet affect them?** (It attracted them.)

Magnetic Attraction

Have students examine pages 14–15 of the Student Magazine and predict which objects are magnetic and which are not. Ask:

- **How will you test the objects?**
- **What other objects would you like to test?**

Students will explore this actively in the following activity and can support or revise their predictions.

Testing the Attraction

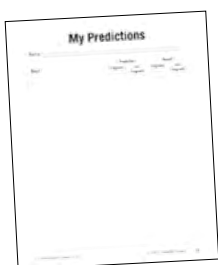
Explain that some items are magnetic (affected by a magnet) and some are non-magnetic (not affected by a magnet). Provide students with magnets and a variety of objects to test including the objects shown on pages 14–15 of the Student Magazine (i.e., cork, foil packet, staples, nuts and bolts, eraser, nails, binder clips, plastic comb, wooden blocks, washers, coated paper clips, aluminum can). Be sure to include metals such as copper, brass, and aluminum which are not magnetic. Other objects could include a pencil, spoon, key, marble, aluminum foil, coins, cardboard, tissue, balloon, buttons, and a plastic ruler.

Students should predict which objects will be attracted to the magnet and then test to check their predictions. Students can use BLM *My Predictions* to record their predictions and results. Share results as a class and discuss any discrepancies between their predictions and observations. Ask:

- **What do all the objects attracted to magnets have in common?** (They are made of metal.)

Explain to students that only items made from iron, steel (which contains iron), nickel, and cobalt are magnetic. Remind students to store their completed BLMs in the Science Folders.

Have students group the objects according to whether they are magnetic, non-magnetic, or contain both magnetic and non-magnetic materials. Add the words “magnetic” and “non-magnetic” to the Word Wall.





Ask students what they still want to know about magnets and magnetism. Add these questions to the I Wonder Wall. Ask:

- **How could you find out what you want to know?**

IWB Activity:

- Challenge students to
- identify the magnetic
- objects using Activity 6:
- *Will a magnet attract it?*
- (see the Teacher's
- Website).



CONSOLIDATE

Magnets Around Us

Students can create a poster illustrating the different uses of magnets in everyday life and explaining how the magnet works in each instance.

EXPLORE MORE

Eating Iron

Students can conduct an experiment to find out if iron-fortified cereal is magnetic. They can place cereal such as Total or Vector in a zippered plastic bag. Then they add water to the bag and seal it. As the cereal dissolves, small particles of iron are released. Students will observe that the iron content is attracted to a strong magnet.

Animal Magnets

Students can create an animal magnet for use at home by making an animal shape out of modelling clay, painting it, and gluing a small magnet to the back.

My Predictions

Name: _____

Object	Prediction		Result	
	magnetic	non-magnetic	magnetic	non-magnetic

Make Your Own Magnet



Focus: Students explore how to magnetize materials and follow a procedure to make their own temporary magnets.

Specific Curriculum Outcomes

Students will be expected to:

- 21.0 follow a simple procedure [GCO 2]
- 42.0 investigate how to magnetize magnetic materials [GCO 1/3]

Performance Indicators

Students who achieve these outcomes will be able to:

- predict and identify objects which can be magnetized
- follow a procedure to make a temporary magnet

NOTES:

Attitude Outcome Statements

Encourage students to:

- appreciate the importance of accuracy [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 16–17	• magnet and paper clips • bar magnets (one per pair of students), a key, scissors, coins, a spoon, brass paper fasteners, aluminum foil, metal jar lid, iron nails, paper clips, washers, bolts, loose staples • variety of magnets of different types and sizes (e.g., bar, horseshoe, donut, ring) • students' Science Journals		• magnetic • magnetize

Science Background

- The materials that magnets attract are also the materials that make good magnets. Iron, cobalt, or nickel (or their alloys) are used to make permanent magnets.
- When a magnetic metal object is attracted to a permanent magnet, it also becomes a magnet. It can attract other magnetic objects but only while it is touching a permanent magnet. This is called induced magnetism.
- Magnetic materials can be magnetized to acquire the properties of magnets temporarily.

Possible Misconceptions

- Students may think that all metal objects can be magnetized. Testing a variety of metal objects will allow students to recognize that this isn't the case.

ACTIVATE

Induced Magnetism

Demonstrate how magnetic materials act as temporary magnets when they are in contact with a magnet. Use a magnet to attract a paper clip (or another magnetic item), then use that paper clip to attract another until there is chain

of several paper clips hanging from the magnet. Ask:

- **Why are the paper clips attracted to each other?** (each paper clip becomes a temporary magnet, but they get weaker the longer the chain grows/the further away they are from the magnet)
- **Do you think a magnetic object can act as a magnet without staying in contact with a magnet?**
- **Do you think you could make a magnet?**

CONNECT



What Can Be Magnetized?

Introduce pages 16–17 of the Student Magazine and read the introductory text with the students. Ask them to predict which of the materials shown can be magnetized. Students will explore this actively in the following activity and can support or revise their predictions. Ask:

- **Can all metal objects be magnetized?** (No, only magnetic metals can be magnetized.)

Add the word “magnetize” to the Word Wall.

Testing Objects

Provide pairs of students with a bar magnet and various objects (such as a key, scissors, coins, a spoon, brass paper fasteners, aluminum foil, a metal jar lid) including some that have been identified previously as being magnetic (such as iron nails, paper clips, washers, and bolts). Invite students to explore whether they can magnetize the objects (turn them into magnets) to attract other magnetic items (without staying in contact with a magnet). After testing, students can report their findings to the class. Prompts for discussion might include:

- **Were you able to magnetize any or all of the objects?**
- **What materials can be magnetized?**
- **Why can only certain materials be magnetized?**
- **What procedures did you use?**
- **What procedure worked best?**
- **What would you do differently next time?**
- **What did you notice about the strength of the magnetic attraction for the objects?**

Make a Magnet

Have students follow the procedure on page 17 of the Student Magazine to magnetize a paper clip and turn it into a temporary magnet. Provide students, working individually or in pairs, with a bar magnet and some paper clips.

Step 1: Have students drag a magnet down the length of the paper clip. This is one stroke. Dragging in the same direction each time, have students stroke the paper clip 20 times.



Step 2: Students can test the paper clip to see if it has become a magnet and record their observations in a manner of their own choosing (e.g., using a graphic organizer, a checklist, or creating a digital video). Ask:

- **Will it pick up other objects (e.g., loose staples)? If yes, how many?**

Step 3: Have students stroke the paper clip 10 more times and then test the strength of the paper clip again. Remind students to record their observations. Ask:

- **How strong can you make your magnet?**



Invite students to repeat the procedure using an increasing number of strokes. Ensure they continue to record their observations. Ask students to record any new questions they may have on the I Wonder Wall.

CONSOLIDATE

Altering Aspects

Invite students to investigate any new questions they may have by altering aspects of the procedure used to magnetize the magnetic objects, for example:

- using a different type or size of magnet
- using a different magnetic object to see if all magnetic materials magnetize equally
- increasing or decreasing the number of strokes used



Remind students that it is important to record their observations and results in their Science Journals.

EXPLORE MORE

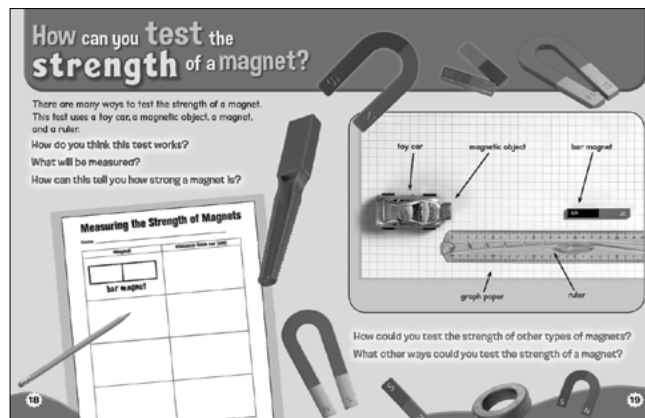
How To

Students can create a “How to” procedure (written or as a video) to teach others how to magnetize objects.

Does Closeness Count?

Students can design a process to determine if an object can become magnetized from being placed near a magnet using a strong permanent magnet and a magnetic object such as a paper clip.

What Affects the Strength of Magnets?



Focus: Students explore the strength of various magnets and design an investigation to test how different conditions affect the force of magnets.

Specific Curriculum Outcomes

Students will be expected to:

- 43.0 identify conditions that affect the force of magnets [GCO 1/3]
- 14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- plan an investigation to identify and test one condition that affects the strength of magnets

NOTES:

Attitude Outcome Statements

Encourage students to:

- be open-minded in their explorations and investigations [GCO 4]
- consider their own observations and ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- construct, label, and interpret bar graphs to solve problems [3SP2]

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imagination [GCO 8]

Art

Students will be expected to:

- explore a range of art materials, processes, and vocabulary to develop art making skills [1.3.4]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 18–19 • BLM <i>Measuring the Strength of Magnets</i> • <i>What Is the Inquiry Process?</i> poster Literacy Place • <i>Magnetic Racetrack</i> (Shared Reading–Sequencing Strategy Unit)	• magnet, paper clip, glass of water • magnets of different shapes and sizes (e.g., bar, horseshoe, donut, ring) • variety of magnetic objects • various materials to act as barriers such as cardboard, paper, wood • various mediums such as sand or yogurt • humidifier or spray bottles • various craft materials to build magnetic racetracks and large pieces of cardboard (e.g., a pizza box)	• Gather craft materials and large pieces of cardboard (e.g., pizza boxes) for students to build magnetic racetracks.	• magnetic force

Science Background

- An important aspect of scientific investigation is to ensure that a test is fair—this is done by limiting tests to changing only one variable at a time.

Possible Misconceptions

- Many students believe that bigger magnets are always stronger than smaller ones. Provide a large, weak magnet and a small, strong magnet for students to test.

ACTIVATE

Change of Medium

Demonstrate using a magnet to lift a magnetic object, such as a paper clip, from the tabletop. Then repeat the demonstration using the same magnet to pull the same magnetic object from a glass of water. Invite students to observe any differences in the attraction between the magnet and the object in the two instances.

Class List

Remind students that because magnetism either pushes (repels) or pulls (attracts), it is a force. As a class, compile a list of conditions that might affect the magnetic force, or strength, of magnets. If not suggested by students, introduce the following conditions:

- the size or shape of the magnet
- type of magnetic material
- barriers between the magnet and the magnetic material (an object or material placed between the two)
- distance between the magnet and the magnetic material
- medium (e.g., air, water, yogurt, sand) surrounding the magnetic material
- humidity (moisture in the air)
- temperature (e.g., inside vs. outside)

CONNECT



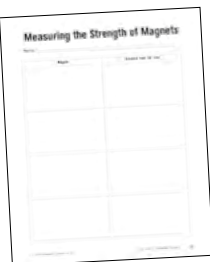
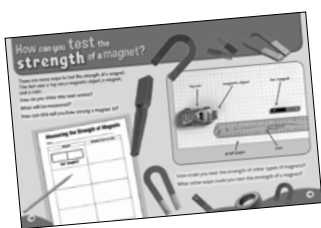
Investigation Set-Up

Have students examine pages 18–19 of the Student Magazine and clarify that this spread shows a set-up for an investigation. Ask:

- **What is this set-up testing?** (the strength of a magnet)
- **What condition is being tested?** (the distance at which the magnet attracts the car with the magnetic object attached)
- **How can this test reveal how strong a magnet is?**
- **Would this test work to test the strength of other types of magnets?**
- **What other ways could you test the strength of a magnet?**

Strong or Weak?

Provide a variety of magnets of different shapes and sizes. Invite students to design a procedure to test the strength of the different magnets. Have them record their results as they test the magnets. Students could create a



bar graph of their results. Encourage students to sequence the magnets from weakest to strongest.

If any students require assistance with this activity, have them follow the investigation shown on pages 18–19 of the Student Magazine and record their observations on BLM *Measuring the Strength of Magnets*.

Discuss students' observations and results in a whole-group discussion. Prompts might include:

- **Do all magnets have the same strength?**
- **How could you tell if one magnet was stronger than another?**
- **Which magnet was the strongest?**
- **Is the largest magnet always the strongest?**
- **Is the smallest magnet always the weakest?**

CONSOLIDATE



Testing Different Conditions

Challenge pairs or small groups of students to pose a question about how any one condition affects the strength of magnets. Questions will vary but they should be testable.

Students can refer to the list of conditions for ideas and plan an investigation. Review the *What Is the Inquiry Process?* poster with students. You may also display the following steps for students who need more assistance:

Step 1: Pose a question.

Step 2: Record your prediction.

Step 3: Draw a diagram to help you set up the investigation.

Step 4: List the materials you will need.

Step 5: Do your investigation and record the results in any way you'd like (e.g., sketches and jot notes or take digital photos).

Step 6: Draw a conclusion by answering the question you posed in the beginning.

As a class, discuss the various results and make conclusions about how each of the different conditions affects the force of magnets.



Literacy Place Connection:

Read or revisit *Magnetic Racetrack* with students. Discuss the activity together, then ask:

- Will the magnet work through the cardboard of the track to pull or push the car?
- What other materials could be used for the track (e.g., paper, wood, plastic, aluminum foil)?
- Do you think any of these materials would affect the strength of the magnet? Would the magnet still be able to pull or push the car along the track?
- How could we find out?

Start Your Engines!

Invite students to use what they have learned about affecting the strength of magnets to build their own magnetic racetrack and race their cars to the finish.

EXPLORE MORE

Magnetic Art

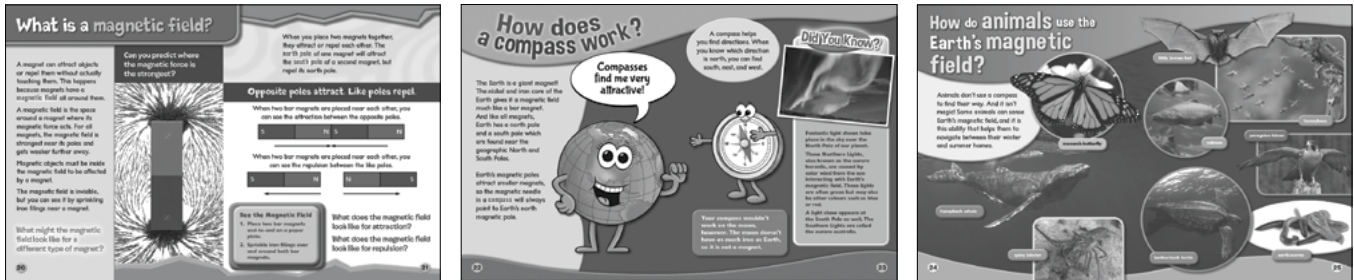
Students create art by placing a small amount of tempera paint on a sheet of construction paper. They then place a paper clip or other small magnetic object such as a metal nut or washer in the paint and move the object from below with a magnet.

Measuring the Strength of Magnets

Name: _____

Magnet	Distance from car (cm)

What Happens When Two Magnets Meet?



Focus: Students will discover that magnets have a north pole and a south pole, and that opposite poles attract each other while like poles repel. Students will also use iron filings to explore magnetic fields, and discover how a compass helps them find directions.

Specific Curriculum Outcomes

Students will be expected to:

- 44.0 investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel [GCO 1/3]
- 2.0 communicate using scientific terminology [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- determine the polarity of an unlabelled magnet using a labelled bar magnet
- use iron filings to identify magnetic fields

NOTES:

Attitude Outcome Statements

Encourage students to:

- recognize the role and contribution of science in their understanding of the world [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Social Studies

Students will be expected to:

- demonstrate an understanding of the geographic location of Newfoundland and Labrador—use the concept of location (cardinal directions) [SCO 1.10]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• IWB Activity 7 • Student Magazine, pages 20–25 • IWB Activity 8	• variety of magnets of different shapes and sizes (e.g., bar, horseshoe, donut, ring) • pieces of cardboard or paper plates • iron filings in a shaker • protective goggles • students' Science Journals • blunt sewing needles or unbent paper clips • containers of water • paper and wax crayons	• Set up stations with differently shaped magnets (with poles marked) at each station. • Prepare badges, half indicating north pole and half indicating south pole (one badge per student).	• polarity • poles • north pole • south pole • attraction • repulsion • compass • magnetic field

Safety

- Ensure students wear protective goggles and take precautions when working with iron filings.

Science Background

- All magnets have a north and south pole. If a bar magnet were broken in half, each half would have a north and south pole, and so on. No matter how small a magnet is, it has a north pole and a south pole.
- The space around a magnet is called the magnetic field. It's the area where the force of a magnet acts or can be felt.

- A magnet's shape determines the area where the magnetic force is the strongest. The greatest force is at the poles of the magnet.
- Earth can be compared to a giant magnet because the Earth has two poles and a magnetic field. Earth's magnetic north pole attracts the magnetic needle of a compass.
- Earth's magnetic north pole and its geographic North Pole are not at the same spot. They are currently approximately 1600 kilometres apart and the location of the magnetic north pole shifts over time.

Possible Misconceptions

- Students equate north and south poles with positive and negative charges because attraction and repulsion can be seen with both. Like poles and like charges will both repel. Unlike poles and unlike charges will both attract. However, students should be made to understand that these are different processes and they are not interchangeable.

ACTIVATE



Exploration Stations

Set up several stations with differently shaped magnets (with the poles marked) at each station. Students can explore the properties of the various types of magnets by bringing two magnets together in as many ways as they can (e.g., end to end, side by side, perpendicular). Have students draw the magnets in each case in their Science Journals and indicate the attraction or repulsion observed (or felt).

Students can rotate through the stations to note the similarities and differences among the different types of magnets. Hold a class discussion and encourage students to share their observations. Prompts for discussion might include:

- **Did all the magnet shapes behave the same way?**
- **How were the magnets the same? How were they different?**
- **What did you notice about the north (or red) ends and the south (or blue) ends of the magnets?**



Ensure students understand that opposite poles attract and like poles repel. Introduce and reinforce unit vocabulary with the students as appropriate including: north pole, south pole, attraction, repulsion. Add these terms to the Word Wall.

IWB Activity:

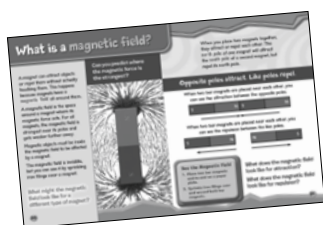
- Have students use
- Activity 7: *Attract or*
- repel?* (see the Teacher's
- Website) to identify
- whether two magnets
- will attract or repel on
- another.



North or South?

Take students outside or to the gym and provide half the students with a badge identifying them as a north pole and the other half with a badge identifying them as a south pole. Students should mingle and interact appropriately with each student they meet, either attracting to an opposite pole or repelling from a like pole.

CONNECT



Magnetic Fields

Introduce pages 20–21 of the Student Magazine to the class. Provide time for students to examine this spread and read the question: *What is a magnetic field?* Read the text with the students and reinforce that a magnetic field is strongest at the poles of a magnet. This is true for all shapes and sizes of magnets. Ask students to suggest what the magnetic field would look like for a horseshoe magnet. Add the term “magnetic field” to the Word Wall.

Direct students to examine the diagrams showing how the magnets react when two bar magnets are placed near each other, and reinforce the fact that opposite poles attract and like poles repel.

Making It Visible

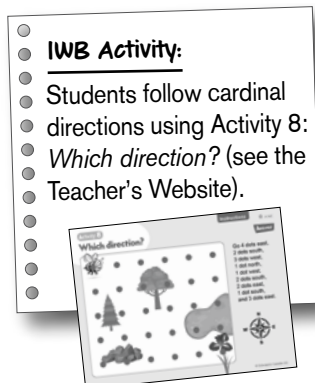
Tell students that they will be exploring a magnet’s magnetic field by using iron filings to make the invisible force around a magnet visible. Provide small groups with a piece of cardboard or paper plate, iron filings in a shaker (or you may pour the filings for each group), and different types and shapes of magnets (e.g., bar, horseshoe, donut). Have students place the magnet on the cardboard or paper plate and then carefully sprinkle the iron filings over and around the magnet. Students can draw what they observe in their Science Journals. Then have students explore to answer the following questions:

- **What do you call the pattern made by the iron filings?** (the magnetic field)
- **How does the magnetic field change when you place the north and south poles of two magnets together?** (lines flow toward each other)
- **What is this showing?** (attraction)
- **What about when you place the north and north poles together or south and south poles together?** (lines flow away from each other)
- **What is this showing?** (repulsion)

How a Compass Works

Share pages 22–23 of the Student Magazine with students. Explain that the Earth acts as though it has a giant bar magnet at its core—it has a north magnetic pole and a south magnetic pole. Give students time to read the text





and then discuss how we can use this knowledge to help us always know where we are going.

Display a compass and explain that the needle of the compass is a small magnet that always points north to Earth's north magnetic pole. Add the word "compass" to the Word Wall.

Make a Compass

Students can make a compass by magnetizing a blunt sewing needle or unbent paper clip and floating it on the surface of the water in a container. The needle will rotate to point north. To make the rotation of the needle more obvious, the magnetized needle or paper clip can be used as a tail for a paper turtle (or other animal). Have students draw, cut out, and colour their turtle with wax crayons to make it water resistant. The "tail" can be attached to the paper turtle and floated in the water. The magnetized needle or paper clip will turn to point north, making the turtle rotate in the water.

CONSOLIDATE



Determining Polarity

Using their knowledge of magnetic poles, challenge students to design a process to determine the orientation of unmarked magnets and/or of homemade temporary magnets. Students can create diagrams in their Science Journals during their investigation. When finished, they can label the diagrams and write a brief description of what is happening in each instance.

Magnetism Foldable

Students can create a foldable for magnetism terms.

EXPLORE MORE



Animal Navigation

Have students turn to pages 24–25 of the Student Magazine. Discuss the various animals shown and ask:

- **Why do some animals migrate (move) between winter and summer homes?** (for more favourable living conditions, to breed, to find food sources)
- **How might the Earth's magnetic field help them to navigate?**

Explain that some other animals, like earthworms, don't migrate but use the Earth's magnetic field to navigate underground to help them find food sources.

Invite students to research one of these animals that uses the Earth's magnetic field to navigate and to create a report of their findings.

Age Group	Percentage
18-24	45%
25-34	35%
35-44	25%
45-54	15%
55-64	10%
65-74	8%
75-84	6%
85+	5%



Specific Curriculum Outcomes

- 28.0 identify problems to be solved [GCO 2]
- 29.0 identify materials and suggest a plan for how they will be used [GCO 2]
- 30.0 respond to the ideas and actions of others and acknowledge their ideas and contributions [GCO 2]

Students who achieve these outcomes will be able to:

- ## NOTES:

Attitude Outcome Statements

Encourage students to:

- show concern for their safety and that of others in carrying out activities and using materials [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- speak and listen to explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experiences [GCO 1]
- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 26–29 • IWB Activity 9 • <i>What Is the Design Process?</i> poster	• buttons or coins to use as game pieces, dice • variety of games and toys using invisible forces for the Curiosity Centre • students' Science Journals • variety of materials such as balloons, plastic rods, plastic wrap, various fabrics • magnets of different shapes, sizes, and strengths • magnetic materials such as paper clips, magnetic tape, washers, screws, tin cans • various craft supplies • tools such as scissors, staplers, and tape	• Arrange for a group of kindergarten or grade 1 students to visit the classroom to act as a focus group.	• attraction • repulsion

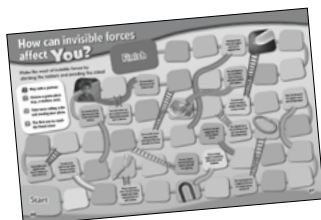
Safety

- If any students have a latex allergy, modify the materials or the activity accordingly to avoid the use of latex balloons.
- Reinforce classroom safety rules for handling tools.

ACTIVATE

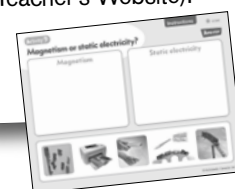
Slides and Ladders

Share pages 26–27 of the Student Magazine with the class. Invite students to play the game in partners or small groups to review information about static electricity and magnetism.



IWB Activity:

- Challenge students to identify instances of magnetism or static electricity using
- Activity 9: *Magnetism or static electricity?* (see the Teacher's Website).



Game On!

Invite students to bring in toys and games from home which use invisible forces to work. In addition, provide a variety of games and toys with magnets at the Curiosity Centre. Encourage students to play with the toys and games in order to explore how the invisible forces work.

CONNECT

Introduce the Challenge

Explain to students that they are going to work in small groups to design and build a toy or game that uses an invisible force (magnetism or static electricity) and appeals to younger students.

Direct students to read pages 28–29 of the Student Magazine. Students should examine the photos of toys and games that use an invisible force and discuss how they work. Invite students to share any experiences they have had with these or similar toys and games.

Focus Group Research

If possible, invite a group of kindergarten or grade 1 students to visit the classroom as a focus group representing the “consumer” to discuss what they feel makes the best toys and games. Students can elicit what younger students think make games fun. Encourage students to note ideas they feel are important or helpful and which could be used to develop criteria for designing a toy or game that will appeal to younger students.

Display the *What Is the Design Process?* poster and review the steps with students. You may also use this time to review safety procedures for working with various tools.

Design Process

Step 1. Identify a problem. Think of a solution. Make a plan.

Have students form small groups and begin the design process. Give students time to brainstorm possible games and toys individually and to gather information and ideas from approved websites. Students should use their Science Journals to make notes (e.g., noting the problems they must solve with their design and listing the materials they will need). Students should also include detailed sketches labelled with the design components and possible materials.

Emphasize the need for students to listen to and acknowledge every group member’s ideas and contributions. Once each group has discussed all the possible products and collaboratively decided on one design, ask them to sketch their final toy or game idea in their Science Journals and explain how it will apply an invisible force.

Step 2. Gather materials. Build your solution.

Groups can now decide on the materials and tools they will need to build their toy or game. Materials may include items to create static electricity



(e.g., balloons; plastic rods, plastic wrap; fabric such as satin, silk, felt, and fur); magnets of various shapes, sizes, and strengths; and magnetic materials such as paper clips, magnetic tape, washers, screws, and tin cans. Additional craft supplies may also be provided. Tools may include scissors, staplers, and tape.

As each group gathers the tools it will need, encourage students to repeat any safety rules associated with the tools. Give students time to build the first prototype version of their toy or game. As they carry out their plans, encourage students to make changes or modifications as necessary.

CONSOLIDATE

Make It Fun!

Students can work with their group to consider the feedback from the focus group to see if the suggestions for making the game fun have been addressed with their design plan and prototype toy or game.

EXPLORE MORE

Create an Assessment Checklist

Encourage students to collaborate with classmates to create a peer/self-assessment checklist to reflect on how well the group has collaborated in the design process. Students might consider:

- how well they understood the problem,
- whether they actively participated in brainstorming ideas,
- if they contributed to the development of design criteria,
- whether they worked co-operatively, and
- if they shared group responsibilities.

Evaluating Personally Constructed Objects



Focus: Students evaluate their created toys or games and consider other useful items they could make that use invisible forces.

Specific Curriculum Outcomes

Students will be expected to:

- 35.0 compare and evaluate personally constructed objects [GCO 2]
- 17.0 communicate procedures and results [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- test, evaluate, and modify their toy or game to meet established criteria
- give useful feedback to others
- explain how their toy or game works using invisible forces

NOTES:

Attitude Outcome Statements

Encourage students to:

- be sensitive to the needs of other people, other living things, and the local environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- use a range of strategies to develop effective writing and representing and to enhance their clarity, precision, and effectiveness [GCO 10]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 30–31 • BLM <i>Two Stars and a Wish</i>	• students' Science Journals	• Arrange for the original focus group of kindergarten or grade 1 students to revisit the classroom to test prototype toys and games. • Invite focus group students and members of the school community to participate in the culminating Toy Invention Convention.	

ACTIVATE

Criteria for Fun!

Students can develop a criteria checklist for an appealing toy or game to ensure that the original focus group suggestions are all addressed in their product design.

CONNECT

Design Process Continued

Step 3. Test your solution. Evaluate your solution.

Groups continue to follow the design process by testing, evaluating, and modifying their prototype toy or game as necessary. Encourage students to test their toy or game so that they have an opportunity to consider how to modify and improve it. Prompts for discussion might include:

- Which invisible force does your toy or game use?
- Did your game work the way you intended?
- Did your toy perform as well as you planned?
- Is your toy or game fun to play with?
- Are there things you could do better?



Remind students to take notes on their actions and observations in their Science Journals. Encourage students to add any new questions they may have to the I Wonder Wall.



Product Review

The original focus group can be invited back to the classroom to view and evaluate the new games and toys. Class members and focus group members can provide feedback using BLM *Two Stars and a Wish*. You may wish to have volunteers available to help the focus group students evaluate the toys and games. Comments could be given orally and recorded on the BLMs by the volunteers.

Feedback Review

Groups can consider the feedback they received and decide whether to make further adjustments to their toy or game. Students should record in their Science Journals what they might do differently the next time based on their experiences throughout the design process.



CONSOLIDATE

Step 4. Share your solution and what you learned.

Hold a Toy Invention Convention and invite the original focus group and members of the school community to the classroom for an opportunity to play with the newly created toys and games. During the convention, students should demonstrate how their products work and be ready to answer questions about their toy or game and the process they used to develop it.

How It Works

Students can create an instruction guide for using their toy or game and include information about the invisible forces that make it work. Alternatively, or in addition, students could create a commercial or advertisement for their toy or game that explains its features. The toys and games could be donated to the classroom of the focus group students.

EXPLORE MORE



More to Make

Share pages 30–31 of the Student Magazine with students and have them examine the images of other useful objects which use an invisible force.

Ask:

- Which object would you consider making? Why?
- What other ideas for products do you have?



Students could record their ideas with sketches in their Science Journals.

WRAPPING UP THE UNIT



Revisit any remaining questions posted on the I Wonder Wall and have students discuss answers in small groups or with a partner. If there are questions that cannot be answered, these can remain on the wall to be discussed and researched further.

Discuss with students what they have learned about the ways static electric charges and magnetism work, what helpful uses they provide, and their potential negative effects.

Two Stars and a Wish

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____

Specific Curriculum Outcomes Checklist

Name: _____ Date: _____

Rating: 1 – not evident; 2 – with assistance; 3 – mostly on own; 4 – on own consistently

Specific Curriculum Outcomes	Rating and Observations
37.0 describe and demonstrate ways to use everyday materials to produce static electric charges, and describe how charged materials interact [GCO 1/3]	
38.0 describe examples of the effects of static electricity in their daily lives and identify ways in which static electricity can be used safely or avoided [GCO 1/3]	
39.0 identify conditions that affect the force of static electric materials [GCO 1/3]	
40.0 identify familiar uses of magnets [GCO 1/3]	
41.0 investigate and identify materials that are attracted by magnets and distinguish from those materials that are not affected by magnets [GCO 1/3]	
42.0 investigate how to magnetize magnetic materials [GCO 1/3]	
43.0 identify conditions that affect the force of magnets [GCO 1/3]	
44.0 investigate the polarity of a magnet, determine the orientation of its poles, and demonstrate that opposite poles attract and like poles repel [GCO 1/3]	
1.0 pose questions that lead to exploration and investigation [GCO 2]	
2.0 communicate using scientific terminology [GCO 2]	
8.0 sequence or group materials and objects [GCO 2]	
10.0 make and record observations and measurements [GCO 2]	
14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]	
16.0 predict based on an observed pattern [GCO 2]	
17.0 communicate procedures and results [GCO 2]	
21.0 follow a simple procedure [GCO 2]	
28.0 identify problems to be solved [GCO 2]	
29.0 identify materials and suggest a plan for how they will be used [GCO 2]	
30.0 respond to the ideas and actions of others and acknowledge their ideas and contributions [GCO 2]	
34.0 pose new questions that arise from what was learned [GCO 2]	
35.0 compare and evaluate personally constructed objects [GCO 2]	

My Inquiry

Name: _____

My question:

My plan:

My results:

My conclusion:

How I will share what I learned:

Student Self-Assessment of Inquiry Process

Name: _____

Check the box that applies to each statement.

	I'll do better next time	Okay	Awesome
Step 1			
I asked a question.			
I made a plan.			
Step 2			
I followed my plan.			
I recorded my results.			
Step 3			
I thought about my results.			
I made a conclusion.			
Step 4			
I shared what I learned.			

Teacher Assessment of Inquiry Process

Name: _____ Date: _____

	1	2	3	4
Initiating and Planning				
• poses a question that leads to exploration or investigation				
• makes a prediction based on an observed pattern				
• makes a simple plan				
• identifies materials and suggests a plan for how they will be used				
Performing and Recording				
• carries out the plan/follows a simple procedure				
• uses appropriate tools				
• makes and records observations				
• estimates and records measurements				
• uses a variety of sources of science information and ideas				
• follows safety procedures and rules				
Analyzing and Interpreting				
• sequences or groups materials and objects				
• identifies the most useful method of sorting for a specific purpose				
• constructs and labels concrete-object graphs, pictographs, or bar graphs				
• identifies and suggests explanations for patterns and discrepancies in objects and events				
• distinguishes between useful and not useful information when answering a science question				
• proposes an answer to the initial question and draws a simple conclusion				
• poses new questions that arise from what was learned				
Communicating and Teamwork				
• communicates while exploring and investigating				
• communicates using scientific terminology				
• communicates procedures and results				
• responds to ideas and actions of others and acknowledges their ideas and contributions				

Comments:

Inquiry Process Rubric

	Level 1	Level 2	Level 3	Level 4
INITIATING AND PLANNING	talks about things that are of interest makes guesses about the outcome of an inquiry with prompting, offers ideas for a procedure with prompting, identifies some materials which could be used to carry out the plan	asks simple questions about objects and events that are observable makes simple predictions about the outcome of an inquiry, but they may be hoped-for outcomes contributes ideas for a procedure but they may not be complete identifies some materials and describes how they could be used to carry out the plan	uses observations to ask questions to investigate, but questions are not always realistic makes simple predictions about the outcome of an inquiry based on prior observations provides ideas for a simple procedure selects materials and describes how they will be used to carry out the plan	uses observations and prior knowledge to ask questions to investigate makes thoughtful predictions about the outcome of an inquiry based on prior observations and knowledge provides clear, sequential steps for a simple procedure selects appropriate materials to carry out the plan and explains reasons for choice
PERFORMING AND RECORDING	carries out the plan/ follows a simple procedure with prompting with prompting, uses some appropriate tools with assistance makes simple observations using senses and, with prompting, records observations in provided charts or in drawings needs help to estimate measurements and, with prompting, records simple measurements gets information from a teacher-chosen science source needs help to follow safety procedures and rules	carries out the plan/ follows most of a simple procedure selects and uses common tools makes some relevant observations using senses and records observations in provided charts or in drawings estimates measurements but units may not be appropriate, and records measurements which may be incomplete uses some relevant information from familiar science sources needs occasional prompting to follow safety procedures and rules	carries out the plan/follows a simple procedure selects and uses some appropriate tools makes relevant observations using appropriate senses and records observations using suitable method estimates measurements using appropriate units and records measurements accurately uses relevant information from science sources of the same type follows most safety procedures and rules	carries out the plan/ follows a simple procedure, making adjustments as necessary selects and uses all appropriate tools makes relevant, detailed observations using appropriate senses and chooses an effective method for recording observations consistently estimates measurements using the most appropriate units and records measurements accurately in a variety of ways uses relevant information from a variety of science sources follows all safety procedures and rules and explains why they are needed

Inquiry Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
ANALYZING AND INTERPRETING	sequences or groups materials and objects based on simple teacher-chosen attributes needs help to sort materials according to simple criteria with prompting, constructs a concrete-object graph, pictograph, or bar graph with prompting, identifies some patterns and discrepancies in objects and events with prompting, distinguishes between some useful and not useful information when answering a science question describes what happened with prompting, identifies some new questions but they may not be about this inquiry	sequences or groups materials and objects based on a few simple attributes sorts materials according to some of the criteria constructs a concrete-object graph, pictograph, or bar graph but title and labels may be missing or inappropriate identifies and suggests simple explanations for some patterns and discrepancies in objects and events distinguishes between some useful and not useful information when answering a science question but not all information may be relevant draws a simple conclusion based on observations but may not link conclusion to the initial question identifies some simple new questions on the topic of this inquiry	sequences or groups materials and objects based on multiple attributes identifies a method of sorting materials according to the criteria constructs a concrete-object graph, pictograph, or bar graph with appropriate title and labels identifies and suggests explanations for most patterns and discrepancies in objects and events focuses on relevant information and distinguishes between useful and not useful information when answering a science question draws a conclusion based on observations which link to the initial question identifies some new questions on the topic of this inquiry that could be investigated	accurately sequences or groups materials and objects based on multiple attributes identifies the most useful method of sorting materials according to the criteria constructs a concrete-object graph, pictograph, or bar graph with appropriate title and labels to accurately reflect results identifies and suggests clear explanations for patterns and discrepancies in objects and events consistently distinguishes between useful and not useful information by focusing on strictly relevant information when answering a science question draws a conclusion based on observations and states if it supports or refutes their prediction identifies new questions on the topic of this inquiry and suggests how they could be investigated

Continued on next page...

Inquiry Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
COMMUNICATING AND TEAMWORK	willingly asks for help and accepts help from other group members understands some scientific terminology but rarely uses it with prompting, describes the result and some of the procedures listens to others and learns from their observations	makes suggestions to group members as to what should be done understands simple scientific terminology but does not always use it correctly communicates basic information about the result and most of the procedures listens to others and learns from their observations, and draws on their language use	communicates with group members, sometimes with problems usually uses scientific terminology appropriately communicates most of the information about the result and procedures considers and responds to the ideas of others and learns from their observations and descriptions	communicates and works effectively with group members consistently uses scientific terminology appropriately accurately communicates the information about the result and procedures considers and responds to the ideas of others and applies the observations and descriptions to their own ideas and understandings

My Design

Name: _____

The problem:

My solution and my plan:

How I will test my solution:

How my solution worked:

How I will share my solution and what I learned:

Student Self-Assessment of Design Process

Name: _____

Check the box that applies to each statement.

	I'll do better next time	Okay	Awesome
Step 1			
I identified the problem.			
I chose a solution and made a plan.			
Step 2			
I built my solution.			
Step 3			
I tested my solution.			
I evaluated my solution.			
Step 4			
I shared my solution and what I learned.			

Teacher Assessment of Design Process

Name: _____ Date: _____

	1	2	3	4
Initiating and Planning				
• identifies a problem to be solved				
• thinks of a possible solution to the problem and makes a simple plan				
• identifies materials and suggests a plan for how they will be used				
Performing and Recording				
• carries out the plan/follows a simple procedure				
• uses appropriate tools				
• makes and records observations				
• estimates and records measurements				
• constructs a prototype				
• follows safety procedures and rules				
Analyzing and Interpreting				
• proposes an answer to the initial problem				
• identifies and suggests explanations for patterns and discrepancies in objects and events				
• poses new questions that arise from what was learned				
• compares and evaluates personally constructed objects				
Communicating and Teamwork				
• communicates while exploring and investigating				
• communicates using scientific terminology				
• communicates procedures and results				
• responds to ideas and actions of others and acknowledges their ideas and contributions				

Comments:

Design Process Rubric

	Level 1	Level 2	Level 3	Level 4
INITIATING AND PLANNING	works on a problem set by the teacher or group suggests a solution to the problem and, with prompting, offers ideas about procedure with prompting, identifies some materials which could be used to carry out the plan	identifies a problem to solve but it may not be practical suggests a solution to the problem and makes a simple plan identifies some materials and describes how they could be used to carry out the plan	identifies a practical problem to solve suggests several possible solutions to the problem and chooses one; makes a simple plan selects appropriate materials and describes how they will be used to carry out the plan	identifies a practical problem to solve and gives some criteria for solving it suggests several possible solutions to the problem that address the criteria; chooses the best solution and makes a simple plan selects appropriate materials to carry out the plan and explains reasons for choice
PERFORMING AND RECORDING	with prompting, carries out the plan/follows a simple procedure with prompting, uses some appropriate tools with assistance makes simple observations using senses and, with prompting, records observations in provided charts or drawings needs help to estimate measurements and, with prompting, records simple measurements constructs a prototype but does not follow the plan needs help to follow safety procedures and rules	carries out the plan/follows most of a simple procedure selects and uses common tools makes some relevant observations using senses and records observations in provided charts and drawings estimates measurements but units may not be appropriate and records measurement which may be incomplete constructs a prototype according to the plan but the device may not be usable needs occasional prompting to follow safety procedures and rules	carries out the plan/follows a simple procedure selects and uses some appropriate tools makes relevant observations using appropriate senses and records observations using a suitable method estimates measurements using appropriate units and records measurements accurately constructs a usable prototype according to the plan follows most safety procedures and rules	carries out the plan/follows a simple procedure, making adjustments as necessary selects and uses all appropriate tools makes relevant, detailed observations using appropriate senses and records observations and chooses an effective method for recording observations consistently estimates measurements using the most appropriate units and records measurements accurately in a variety of ways constructs a usable prototype according to the plan with modifications for improvement follows all safety procedures and rules and explains why they are needed

Design Process Rubric (Continued)

	Level 1	Level 2	Level 3	Level 4
ANALYZING AND INTERPRETING	with prompting, says whether or not a solution works with prompting, identifies some patterns and discrepancies in objects and events with prompting, identifies some new questions but they may not be on the same topic with prompting, makes simple suggestions for changes to improve the device/solution	says whether a solution works in terms of some simple criteria identifies and suggests simple explanations for some patterns and discrepancies in objects and events identifies some new questions on the same topic suggests some practical changes to improve the device/solution	evaluates and explains the effectiveness of a solution in terms of simple criteria identifies and suggests explanations for most patterns and discrepancies in objects and events identifies some new questions that arise from the solution suggests and makes practical changes to improve the device/solution	evaluates and explains the effectiveness of a solution in terms of a broad range of criteria identifies and suggests clear explanation for patterns and discrepancies in objects and events identifies new questions that arise from the solution and suggests how they could be solved makes effective changes to improve the device/solution
COMMUNICATING AND TEAMWORK	willingly asks for help and accepts help from other group members understands some scientific terminology but rarely uses it with prompting, describes the solution and some of the procedures listens to others and learns from their observations	makes suggestions to group members as to what should be done understands simple scientific terminology but does not always use it correctly communicates basic information about the solution and most of the procedures listens to others and learns from their observations, and draws on their language use	communicates with group members, sometimes with problems usually uses scientific terminology appropriately communicates most of the information about the solution and procedures considers and responds to the ideas of others and learns from their observations and descriptions	communicates and works effectively with group members consistently uses scientific terminology appropriately accurately communicates the information about the solution and procedures considers and responds to the ideas of others and applies the observations and descriptions to their own ideas and understandings

Additional Resources

Non-fiction Books

Magnets:

A Look at Magnets by Barbara Alpert (Capstone Press, 2011)

Magnets [AlphaWorld] by Hannah Reed (Scholastic Canada Ltd., 2005)

What Magnets Can Do by Allan Fowler (Children's Press, 1995)

Fiction Books

Magnets:

Amazing Magnetism [Magic School Bus Chapter Book #12] by Rebecca Carmi (Scholastic, 2002)

Websites for Students

Magnets:

9 Amazing Magnet Gadgets

<https://www.youtube.com/watch?v=XvkEEExdl-w4>

Bill Nye—Magnetism (full episode)

<https://www.youtube.com/watch?v=Viml1smEBks>

Introduction to Magnets

<https://www.youtube.com/watch?v=DR9w4koW2EA>

Magnet Man—Variety of Magnetic Toys

www.coolmagnetman.com/magtoys.htm

Science Made Easy—Magnets

<https://www.youtube.com/watch?v=5C-RM4fh5Xg>

Studyjams—Magnetism

<http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/magnetism.htm>

Wonderopolis—How Are Magnets Used?

<https://wonderopolis.org/wonder/how-are-magnets-used>

Static Electricity:

9 Awesome Tricks Using Static Electricity

<https://www.youtube.com/watch?v=ViZNgU-Yt-Y>

Bill Nye—Static Electricity (full episode)

<https://www.youtube.com/watch?v=BRiXfomxVoc>

How Does Lightning Work?

https://www.youtube.com/watch?v=Cz_uYBx1G5s

School for Champions—Reducing or Preventing Static Electricity Shocks

www.school-for-champions.com/science/static_shocks_reducing.htm#.WeY4-495y70

Websites for Teachers

Steve Spangler Science—Is there really iron in your breakfast cereal?
<https://www.stevespanglerscience.com/lab/experiments/eating-nails-for-breakfast/>

Weather WizKids—Lightning
www.weatherwizkids.com/weather-lightning.htm

Wonderopolis—What Is Static Electricity?
<https://wonderopolis.org/wonder/what-is-static-electricity>

Magnets:

Fact Monster—Search “Magnets” or “Magnetism”
www.factmonster.com

How Magnets Work
www.howmagnetswork.com

How Stuff Works—How Compasses Work
<https://adventure.howstuffworks.com/outdoor-activities/hiking/compass.htm>

How Stuff Works—How Magna Doodle Works
<https://entertainment.howstuffworks.com/magna-doodle.htm>

How Stuff Works—How Magnets Work
<https://Science.howstuffworks.com/magnet.htm/printable>

Magnet Man—A variety of information and experiments relating to magnets
www.coolmagnetman.com

Static Electricity:

Science Made Simple—What Is Static Electricity?
www.sciencemadesimple.com/static.html

Dear parents and caregivers,

We are about to start a new unit in science in which we will be exploring the invisible forces of static electricity and magnetism. Through a variety of hands-on activities and investigations, your child will be learning about such concepts as conditions that affect static electricity, what objects are attracted to magnets, which materials can be magnetized, and how a compass works. Your child will conclude the unit by creating a toy or game that makes use of invisible forces.

You can talk to your child at home about how static electricity and magnetism affect your daily lives.

- You might point out the helpful uses of static electricity (e.g., cleaning products such as electrostatic dusters and plastic wrap to preserve foods).
- Invite your child to identify some of the negative results of static electricity and methods to avoid them (e.g., adding moisture to the air in your home with a humidifier, and using anti-static sprays and dryer sheets to reduce static cling in clothing).
- You might also discuss some common uses of magnets (e.g., in shower curtains and cupboard doors, in refrigerator magnets, and holding bags and jewellery closed). Encourage your child to identify the many different ways magnets are used in your home.

To ensure a wide range of experiences and make connections between this topic and your child's world, he/she may choose to bring one or more personal items to school for exploration during in-class activities. These items will be returned home once explorations are completed. To determine whether the item(s) is appropriate please contact me, your child's teacher.

Sincerely,