Magnetism and Electricity Storyline

**Prepared Graduate Competency**
Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable.

**Big Idea**
Magnetism and Electricity are parts of a single force → Electromagnetic Force
Energy exists in various forms.

**Grade Level Expectations and Enduring Understandings**
Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical.
- Magnets attract and repel each other; iron objects stick to magnets.
- An electric circuit is a complete pathway through which current travels.
- Components can be added to a circuit as long as the complete pathway remains.
- Electromagnets can be created by current flowing through a conductor.
- Technology is using science knowledge to solve problems or improve existing objects.

**Essential Questions**
- How are magnetism and electricity related?
- How do we know that energy exists within a system such as in an electrical circuit?
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<td>• What kind of materials do magnets stick to?</td>
<td>• How do magnets interact with other objects?</td>
<td>• How can we measure the force of attraction between two magnets?</td>
<td>• Can you figure out where two magnets are taped in a box without looking?</td>
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<td>• What happens when you bring two or more magnets together?</td>
<td>• Does an iron object have to touch a magnet to become a temporary magnet?</td>
<td>• Does magnetic force go through all materials?</td>
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**Learning Outcomes:**

- Only iron sticks to a magnet.
- Two magnets attract or repel when they interact.
- The magnetic force causes magnetic interactions.
- A force is a push or a pull.

**Science Story:**

- Magnets Get Stuck
- Magnificent Magnetic Models
- How Magnets Interact & Make a Compass
Investigation 2: Making Connections

Part One: Lighting a Bulb 1 day

Inquiry Questions:
- How can you get electricity from a source to a receiver?
- Where do connections need to be made?
- How does electricity flow through a circuit?

Learning Outcomes:
- A D-cell is a source of electric energy.
- A bulb is an energy receiver that produces light.
- A circuit is a pathway through which electric current flows.

Formative Assessment

Part Two: Making a Motor Run 1 day

Inquiry Questions:
- How can you get electricity from a source to a receiver?
- How is the motor circuit like the light bulb circuit? How is it different?
- What does a switch do in a circuit?

Learning Outcomes:
- A motor is an energy receiver that produces motion.
- A switch is a device that opens and closes a circuit.
- A schematic diagram is a representation of a circuit that is used for recording and communicating with others.

Formative Assessment

Part Three: Finding Conductors and Insulators 1 day

Inquiry Questions:
- Can any of the test objects complete a circuit?
- How much of the classroom environment is made of conductors?

Learning Outcomes:
- Materials that allow the flow of electricity are conductors.
- Materials that do not allow the flow of electricity are insulators.
- All metals are conductors.

Formative Assessment

Part Four: Investigating Mystery Circuits

Embedded Performance Assessment 1 day

How can you identify and explain the hidden connections on the mystery circuit boards?

Content from each part of the investigation is assessed.

I Check Investigation 2 – Making Connections 1 day

Science Story: Two Reference Sources about Edison

Science Story: Making Static and A Fictional Interview with Benjamin Franklin

Science Home Page
Investigation 3: Advanced Connections

Part One: Building Series Circuits
1 day

Inquiry Questions:
- Can you get two bulbs to light at the same time?
- Can you make two lights bright in a series circuit?

Learning Outcomes:
A circuit with only one pathway for current flow is a series circuit.
Components in a series circuit “share” the electric energy.
Cell in series must be oriented in the same direction in order to work.

Science Story:
Illuminating Teamwork: A Story of the Edison Pioneers

Part Two: Building Parallel Circuits
1-2 days

Inquiry Questions:
- Can you light two bulbs brightly with just one battery?
- How many different ways can you wire a parallel circuit?

Learning Outcomes:
A parallel circuit splits into two or more pathways before coming back together at the battery.
Components in a parallel circuit each have a direct pathway

Part Three: Solving the String of Lights Problem

Embedded Performance Assessment
1-2 days

Which design is better for manufacturing long strings of tree lights – series or parallel?
Content from each part of the investigation is assessed.

I Check
Investigation 3 – Advanced Connections
1 day
Investigation 4: Current Attractions

Part One: Building an Electromagnet
1 day

Inquiry Questions:
- Can you make a magnet that turns on and off?

Learning Outcomes:
A magnet can be made by winding an insulated wire around an iron core and running current through the wire.

The magnetism produced by an electromagnet can be turned on and off.

Science Story:
From Rags to Science: A Story of Michael Faraday

Part Two: Changing Number of Winds
1-2 days

Inquiry Questions:
- How does the number of winds of wire around a core affect the strength of the magnet?

Learning Outcomes:
The greater the number of winds of wire around the iron core, the stronger the magnetism produced.

A graph can be used to make predictions.

Science Story:
How Electromagnetism Stopped a War

Part Three: Investigating More Electromagnets

Embedded Performance Assessment
2 days

How can the strength of an electromagnet be changed?

There are many ways to change the strength of an electromagnet, including tighter coils, number of D-cells, different wire gauge.

Wire used to make an electromagnet must be insulated.

All wire coils must be wound in the same direction.

Science Story:
Magnets and Electricity in Your Life

Formative Assessment

I Check
Investigation 4 – Current Attractions
1 day

Formative Assessment

Summative Assessment
Investigation 5: Click It

Part One: Reinventing the Telegraph
1 day

Inquiry Questions:
• Can you use your knowledge of electricity and electromagnetism to reinvent the telegraph?

Learning Outcomes:
People learn about the natural world through scientific practices and use that knowledge to meet human needs (such as communication).

A code is a symbolic system used for communication.

Science Story:
Morse Gets Clicking: A Story of Samuel Morse

Part Two: Sending Messages Long-Distance
1-2 days

Inquiry Questions:
• Can you connect two telegraph systems to send messages back and forth to another group?

Learning Outcomes:
Connecting two telegraphs for two-way communication requires two complete circuits.

Apply electricity and electromagnetism concepts.

Part Three: Choosing Your Own Investigation

Embedded Performance Assessment
4-6 days

Students ask their own questions and plan investigations or research to answer them.

Apply electricity and electromagnetism concepts.

Formative Assessment

Summative Assessment

I Check
Investigation 5 – Click It
1 day