Science Grade 8: Physical Science Engineering Design Process
Force and Motion- "The Louder the Better"

Desired Outcome	Lesson Delivery (Learning Plan)
Standard(s): **(ONLS) Content Statement** Forces between objects act when the objects are in direct contact or when they are not touching. **Cognitive Demands** DEMONSTRATING SCIENCE KNOWLEDGE (D) **(Yogurt Cup Speakers-Activity)** Requires student to use scientific inquiry and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather and organize data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments. (Slightly altered from National Science Education Standards) DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS (T) **(Speaker Challenge)** Requires student to solve science-based engineering or technological problems through application of scientific inquiry. Within given scientific constraints, propose or critique solutions, analyze and interpret technological and engineering problems, use science principles to anticipate effects of technological or engineering design, find solutions using science and engineering or technology, consider consequences and alternatives, and/or integrate and synthesize scientific information. **Overarching Essential Question:** What does Electricity and Magnetism have to do with Music? How can an electrical current produce magnetic fields that can cause movement of matter (kinetic energy) to produce sound? **Guiding Questions:** What causes a magnetic field? How does electrical current flow?	**Context: (describe "the why" for this lesson)** Electricity is related to magnetism. In some circumstances, magnetic fields can produce electrical currents in conductors. Electric currents produce magnetic fields. Electromagnets are temporary magnets that lose their magnetism when the electric current is turned off. Building an electromagnet to investigate magnetic properties and fields can demonstrate this concept. Electric motors convert electrical energy into mechanical energy. Motors are in blenders and washing machines. Both motors and generators have magnets (or electromagnets) and a coil of wire that creates its own magnetic field when an electric current flows through it. Note 1: Magnetic poles are often confused with electric charges. It is important to emphasize the differences. **Introduction/Hook: (Day 1)** Pre-Activity Collaborative Sharing Sheet Break Dancing to Music(Speaker)- How do you think Speakers Work? (Discussion) Why Music Loud is Better!! (Discussion) Follow- the Yogurt Cup Speakers Activity Bring In Old Speakers to make observations. How to Make Speakers (Optional- Will Show Exact Method Used in this Activity) **(Day 1-2)** Background Information on Speakers(Optional) 1. Follow Yogurt Cup Speakers lesson. During-Post Activity Collaborative Sharing Shee **(Day 2-4)** 2. Engineering Design Process lesson. (2-4 Periods) Loudest Speaker Challenge Template **(Day 5-7)** Communicating Results- Google Presentation / Electronic Tool **Engineering Design Process LSC Template** Louder is Better-- Who can make the loudest speaker?

How can electricity and magnetism work together?
How does Kinetic Energy produce sound?

Learning Objectives:

1. Create an electromagnetic field by running current through a wire coil.
2. Explain that electric currents produce magnetic fields. The stronger the current, the more intense the magnetic field.
3. Explain how electricity and magnetism are related concepts.
4. Describe properties and characteristics of magnets:

- Magnets can be permanent or temporary.
- Magnets and electromagnets exert forces at a distance through magnetic fields.
- Explain how Electromagnets can cause Kinetic energy.

Student Tasks:
Pre-Activity Collaborative Sharing Sheet
During-Post Activity Collaborative Sharing Sheet
Loudest Speaker Challenge Template
Loudest Speaker Challenge EDP Rubric
Communicating Results- Google Presentation / Electronic Tool

Differentiated Strategies:

Accommodations /Prior Knowledge:

Identify the north and south poles of a magnet.

Understands a series circuit.

Extensions / Acceleration *(Some Will Become Design Challenge)*

Make another coil with more windings to wrap around the cell battery.

Dissect a real speaker and compare to the one created in this activity.

Observe the interaction between two electromagnets.

Connect multiple round magnets to the yogurt cup.

Content Resources

Vocabulary:
magnet, electromagnet, magnetic field, magnetic force, current

Interdisciplinary Connections:
(Science Integrations)
Music / Math - TBD

Materials
Yogurt Cup Speakers (Teacher Pre-Read)
Sound Meter- Amazon.com

Each group needs:

- 2 round magnets (½ to ¾ inch diameter)
- 15 ft, 20-24 gauge coil wire (enamel-coated transformer coil wire)
- 1 plastic container (such as from yogurt, whip topping, butter)
- 1 D-cell battery
- sandpaper
- electrical tape
- Decible Sound Meter (EDP Challenge Only)

Assessment Evidence

Rubric/Scoring Guide: Embedded in Yogurt Cup Speakers

CATEGORY	4	3	2	1
Participation	Attraction and repelling forces of magnets were discovered. Coils were made and the windings were counted.	Attraction and repelling forces of magnets were discovered. Coils were made, but the windings were not counted.	Attraction and repelling forces of magnets were not discovered or the coils were not made.	Coils were not made and nothing was observed in reference to magnets.
Variables	All variables are clearly described with all relevant details.	All variables are clearly described with most relevant details.	Most variables are clearly described with most relevant details.	Variables are not described OR the majority lack sufficient detail.
Analysis	The relationship between the variables is discussed and trends/patterns logically analyzed. Predictions are made about what might happen if part of the lab were changed or how the experimental design could be changed.	The relationship between the variables is discussed and trends/patterns logically analyzed.	The relationship between the variables is discussed but no patterns, trends or predictions are made based on the data.	The relationship between the variables is not discussed.

Performance Tasks
Embedded in Yogurt Cup Speakers Activities and Student Tasks

To share with the entire class: • radio with detachable speakers and output of at least 20 watts **Links:(Teacher Must Load To Google Docs)** Yogurt Cup Speakers (Pre- Read-Teacher) Electromagnetic Videos- Background and Hook (Optional) Pre-Activity Collaborative Sharing Sheet During-Post Activity Collaborative Sharing She (Teacher Set Up Prior to Unit) Loudest Speaker Challenge Template (Teacher Sets Up for Each Group) Google Docs- Presentation Tools	Loudest Speaker Challenge Template Sound Meter- Amazon.com Loudest Speaker Challenge EDP Rubric Google Docs- Presentation Tools
Technology Tools: Pre-Activity Collaborative Sharing Sheet During-Post Activity Collaborative Sharing She Loudest Speaker Challenge Template Loudest Speaker Challenge EDP Rubric Google Docs- Presentation Tools	

Adapted from Understanding By Design (Wiggins & McTighe, 2005), Digital Learning Day