Magnetism and Magnetic Fields
Day 1:

Warm Up: How do trains work? What are some different types of trains?

LT: I can communicate my ideas about how the world’s fastest train works.
Maglev Train


Stop at 0:40 seconds

“World’s fastest train takes you a mile in 10 seconds”
How is the train traveling so fast?

- Write explanation
- Draw diagram

IN YOUR JOURNAL

- Discuss ideas
**Big Question:** What are magnets? What do you already know about magnets?

- DISCUSS with your group
- DRAW explanation on your whiteboard
- Class DISCUSS

Write your ideas your journal and include your diagram!
Big Question: Can magnets push or pull without touching? Why or why not?

- DISCUSS with your group
- DRAW explanation on your whiteboard
- Class DISCUSS

Write your ideas your journal and include your diagram!
Day 2:

Warm Up: What are some different objects that use magnets?

LT: I can use a variety of materials to investigate magnetism.
Review yesterday’s discussion

- What are magnets? What do you already know about magnets?
- Can magnets push or pull without touching? Why or why not?
Magnet Investigation

Instructions:

- Pick up a bucket of materials
- Test which objects are attracted to magnets and which are not
- Test which magnets are attracted to each other and which are not
- Record observations in your journal
Discuss results

Record your answers in your journal and be prepared to share them with the class:

- What were some patterns you saw during this investigation?
- What are some conclusions you can draw about magnets and magnetic objects?
- What are some questions you still have
HOW MAGNETS WORK

- **Definition:** a material or object that produces a magnetic field
- All about NORTH and SOUTH POLES
- Most objects have the ability to be charged
- When those charges move to different areas (positive and negative) they create magnetic fields and POLES which cause object to attract or repel other charged objects
- There are different types of magnets
Opposite poles attract
Same poles repel
Brainstorm: What objects use magnets?

- Compasses
- Generators
- Stereos and Speakers
- Door Bells
- TV and Computer screens
- Junkyard sorter
- Telephone and tape recorders
- Cranes
- Magnetic Pain Therapy
- Microwaves
- Headphones
- Computer disks
- Magnetic sweepers
- Industrial separators and sorters
- Credit cards and ID cards
- TV and Computers

Write your TOP 3 topic choices on a piece of paper, turn in on your way out!
Day 3:

Warm Up: How do magnets work?

LT: I can research and present about an object that uses magnets.
Brainstorm: What objects use magnets?

- Compasses
- Generators
- Stereos and Speakers
- Door Bells
- TV and Computer screens
- Junkyard sorter
- Telephone and tape recorders
- Cranes
- Magnetic Pain Therapy
- Microwaves
- Headphones
- Computer disks
- Magnetic sweepers
- Industrial separators and sorters
- Credit cards and ID cards
- TV and Computers

FIND YOUR GROUP AND SIT WITH THEM
Your Task:

Work with your group to research your topic and answer the following prompts:

- How does your object use magnets and/or electromagnetism?
- Where is the magnet located?
- A brief explanation of how your object works.

Record your ideas in your journal and on your whiteboard. Use your time wisely! You only have 15 min to research!
Day 4:

Warm Up: How do compasses work?

LT: I can explain how magnetic fields exert force on objects around them.
Magnetic Field Demo 1
Magnetic fields

Magnetic fields are produced by moving charges (a current)

- Magnetic field units: Tesla
- Tool used to describe how magnetic forces are distributed around magnets
- Vectors (has direction and magnitude)
- Drawn using field lines: never cross, never start/stop
Magnetic Field Demo 2

Visible magnetic field lines
Bill Nye Magnetism + Magnetic Fields

https://www.youtube.com/watch?v=8PyqL9y7VZo
Earth as a magnet!

- Earth’s core is molten iron
- Iron is a magnetic material
- Creates huge magnetic field around earth (North POLE and South POLE)
- This magnetic field protects Earth from space radiation, solar wind, and other particles

https://www.youtube.com/watch?v=lxWBlJ1kB7Q

Discovery HD: https://www.youtube.com/watch?v=yEYy_nVC4L0
Compasses

- Compasses have magnetic properties, which line up with earth’s magnetic fields (Point N)
- Part of a compass: needle (thin piece of magnetic metal), dial and housing. Needle is magnetized and then points N with Earth’s magnetic field
- In 12th century, people began using Lodestone (form of magnetite) to magnetize pieces of iron by rubbing lodestone along iron needle magnetized
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<th>Tilt of magnetic axis</th>
<th>Offset of magnetic axis</th>
<th>Field at equator</th>
<th>Magnetosphere</th>
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Maglev Train


Stop at 0:40 seconds

“World’s fastest train takes you a mile in 10 seconds”
Using what you now know about magnets and magnetic fields, **revise** your model and explanation about **How the train is traveling so fast**...

- Write explanation
- Draw diagram

IN YOUR JOURNAL

- Discuss ideas
Day 5:

Warm Up: What are magnetic fields? How do they exert forces?

LT: I can gather data about the strength of electromagnetic fields.
Electromagnet Demo 1
What are electromagnets?

- Type of magnet
- Magnetic field is produced by an electric current
- Magnetic field disappears when current is turned off
- Are widely used and important in our world today

https://www.youtube.com/watch?v=QGytW_C6hR8
How Are Electromagnets Made?

- Usually made of insulated wire wound into a coil around a magnetic core material (ex: iron)
- Need a complete CIRCUIT
- Current runs through wire and creates magnetic field
- Magnetic field is concentrated in hole in center of the coil

- Can increase the strength:
  - Increasing number of loops around iron core
  - Increasing current or voltage

Bill Nye:
https://www.youtube.com/watch?v=sFC7-WVNUP8
How Electromagnets Work

When electric current runs through a wire it generates a magnetic field around it. The magnetic field around a single wire is very weak.

By winding the wire into a coil and concentrating the magnetic field it produces a stronger field. More electrical current produces a stronger magnetic field.

The magnetic field can be made even stronger by placing an iron bar in the centre of the coil. This has a big effect on the electromagnets power.

Try it yourself by coiling a copper wire around a nail. Then connect the wire to a 1.5V battery. See how many staples you can pick up by changing the number of loops. You can also see what happens if you connect it to two batteries.
Advantages Electromagnets

- Magnetic field can be quickly changed or controlled
- Magnetic field can be increased or decreased or turned off
- Disadvantage: needs power and continuous current to maintain magnetic field
Uses of Electromagnets

- Widely used in electrical devices
  - Motors
  - Generators
  - Loudspeakers
  - MRI machines
  - Scientific instruments
  - Magnetic separation equipment
  - Picking up and moving heavy objects
  - Magnetic levitation
  - Induction heating
Electromagnet lab activity
Day 6:

Warm Up: What are electromagnets? How do they work?

LT: I can use a model to explain how the maglev train is going so fast.
Maglev Train


Stop at 0:40 seconds

“World’s fastest train takes you a mile in 10 seconds”
Using what you now know about magnets, magnetic fields, and electromagnets, revise your model and explanation about **How the train is traveling so fast**...

- Write explanation
- Draw diagram

IN YOUR JOURNAL

- Discuss ideas
Maglev Train explanation

https://www.youtube.com/watch?v=alwbrZ4knpg

Documentary: https://www.youtube.com/watch?v=n-oWqFlyxGk

https://www.youtube.com/watch?v=iaElPV0FWJ0

What’s Next with Maglev technology...Maglev Rocket!!![

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


Using what you now know about magnets, magnetic fields, and electromagnets and technology that uses them, take some time to REVISE your rocket landing system.

- Meet with your group and discuss new technology options
- Would you change anything now that there are new technology options? Why or why not?
- How could this new technology change space travel?
- Write ideas on whiteboard and report back to class