Grades 3–5
Go, Go, Go Around New York
Magnetic Subway

New York City’s subway system is one of the largest in the world. How can you build your own smooth running train cars?

What Will You Learn?

- How magnetism works
- The difference between a magnet and a magnetic object
- The effects of like forces and opposite forces meeting

Materials:

- Wheels
- Straws
- Cardboard strips
- Magnets
- Toothpicks
- Popsicle sticks
- Subway car worksheet

Instructions:

1. Firmly tape a magnet perpendicularly to the front of the cardboard.
2. Cut the straw in half. Take only one half and cut it in half. You should have three pieces; one half, and two quarters.
3. Tape the small straws far apart and on the underside of the cardboard. Trim/cut the straws so they are only as wide as the cardboard.
4. Place one eraser flat on the table. Push the toothpick all the way down through the middle of the eraser to create holes where your wheel axles will go through.
   a. Push and twist until the eraser is fully on the toothpick. Take the eraser off and repeat three more times, for a total of 4 erasers with axle holes.
5. Slide one wheel onto the toothpick. Then, slide the toothpick through the straw.
6. Add the other wheel. Holding the sides of one eraser, push and twist the other eraser onto the toothpick.
7. Repeat steps 6 & 7 for the other set of wheels.
8. Cut out the subway car from the template and decorate.
9. Place the subway car on top of the cardboard and secure it with tape.
10. Tape your second magnet onto the end of your leftover half straw.
11. Place the car on a smooth surface. Bring the straw magnet close to the magnet on the subway car without touching. Watch the subway car move!

**Reflection Questions:**
- How did the subway car move without touching it?
- What would happen if you turned the magnet on your straw around? How might this affect how the subway moves?
Explanation:

- Magnets repel each other when like poles are facing each other because of the interaction between their magnetic fields. When two positives or two negatives face each other, this creates a situation where the magnetic field lines are pushing against each other, resulting in a repulsive force between the magnets which creates enough force to make the car move.

Further Reading Recommendations:

Lost in NYC
Magnets Push, Magnets Pull
The Great New York Subway Map

Borrow these books and more: borrow.nypl.org