5th Grade Physics-Race Car CMQ

Question:

How can electromagnetism be used to power a toy car?

Objective:

Design a car that runs with electromagnetic.

Standards:

Mechanics	3.2.5. B1
Thermodynamics	3.2.5. B2.
Electromagnetism	3.2.5. B4

Materials:

1. Cardboard
   - Cardstock
   - Shoeboxes
   - Cereal boxes
2. Wheels
   - CD's (See Mrs. Kahl)
   - Soda/water bottle tops
   - Lifesavers
   - Lego Wheels
   - Cardboard circles (precut sets of 4 with various diameters)
3. Magnets
   - 2 bar magnets
   - 5-10 button magnets
   - Magnetic wands
4. Axels: (Pairs in various lengths)
   - Wooden dowels 0.25 diameter or smaller
   - Straws
   - Wooden skewers
5. Popsicle sticks
6. Hot glue
7. Tape
8. Timer
9. Balance
10. Ruler
11. Calculator
12. Racetrack

Video Resources:

Magnetic Powered Car: https://www.youtube.com/watch?v=qxZKLUAzQ7g
How to Move Plastic Cars: https://www.youtube.com/watch?v=Uj6N_w-h-OU
Build a Self-Propelled Magnet Car: http://www.popsci.com/build-super-simple-car-in-minutes
Magnetic Car: http://www.primaryscience.ie/media/pdfs/col/magnetic_car.pdf

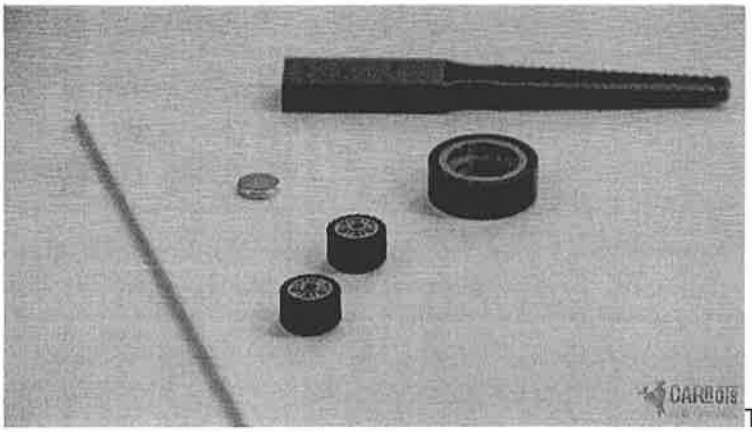
Time: (4 – 40 minute class periods)

- Allow 2 full class periods to build (80 minutes)
- Allow 1 period for testing
- Allow 1 period for data sheet completion

***Note**: Students with extended time will be allotted 3 class periods to build, 1.5 class periods for testing, and 1.5 class periods to complete data sheet.*

How to Build a Simple Magnetic Car

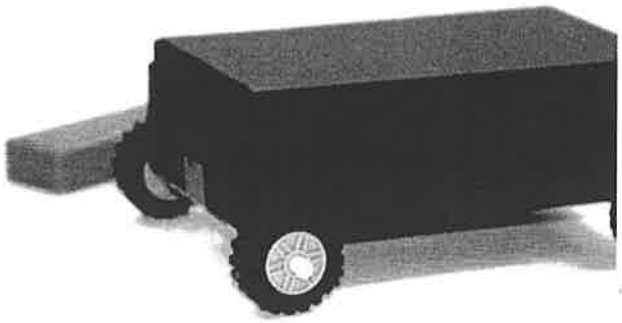
Materials Needed for Magnetic Car

- 

Two magnets (you can use two bar magnets, or in our case we used a round magnet and a magnetic wand)
- Small box
- Straw or Dowel
- Clay
- Tape
- Toothpicks (not needed if you use a wooden dowel)
- Wheels (we used Lego wheels but you can use cardstock cut into circles, too)

Procedures

1. Tape a magnet inside the small box



2. Cut the straw or the dowel into two pieces to match the size of the box
3. Tape down to the outside of the box
4. If you are using cardstock to create the wheels, cut out four circles at this point, then push the toothpicks through the straw and attach the cardstock wheels onto the ends
5. We used Lego wheels so we attached the wheels to the dowel
    - Wheels must spin freely around the dowel
6. Place the car onto a flat surface and use your second magnet to pull and push the car

Modifications:

- Try attaching both magnets to make the car self-propel
- Build a simpler lighter body structure
- Add weight to one end

Race Car Data Sheet

Name: _____ **5th Science**

Date: _____ **Physics CMQ Project**

1. What material did you use to build your car?

2. What is the mass of your car?

   _____ grams

3. Is your car self-propelled?

   _____ YES _____ NO

4. What is the distance between the two magnets used for movement?

   _____ cm

5. Keeping the distance consistence between magnets, test the speed of your car.
   (Speed = Distance divided by Time. Use the distance of the Race Track in the formula)
   - 1st Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 2nd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 3rd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - Average speed:_____ cm/s(add all 3 and divide by 3)

6. Observations during testing:

7. Explain how the magnets caused movement:

8. Adjust the distance between the magnets. What is the new distance?

_____ cm

9. Using the new distance between magnets, test the speed of your car.
(Speed = Distance divided by Time. Use the distance of the Race Track in the formula)
   - 1st Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 2nd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 3rd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - Average speed:_____ cm/s(add all 3 and divide by 3))

10. Observations during testing:

11. Change the sizes of your magnets and run the test again. Explain how did you change the size of your magnets?

12. Keeping the distance consistence between magnets, test the speed of your car.
(Speed = Distance divided by Time. Use the distance of the Race Track in the formula)
   - 1st Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 2nd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - 3rd Attempt: _____ cm ÷ _____seconds = _____cm/s
   - Average speed:_____ cm/s(add all 3 and divide by 3)

13. Observations during testing:

14. Adjust the distance between the magnets. What is the new distance?

_____ cm

15. Using the new distance between magnets, test the speed of your car.
(Speed = Distance divided by Time. Use the distance of the Race Track in the formula)
    - 1st Attempt: _____ cm ÷ _____seconds = _____cm/s
    - 2nd Attempt: _____ cm ÷ _____seconds = _____cm/s
    - 3rd Attempt: _____ cm ÷ _____seconds = _____cm/s

16. Average speed:_____ cm/s(add all 3 and divide by 3)

17. Observations:

18. Explain what was constant (*did not change*) in each testing situation.

19. Explain how the speed of your car varied in each testing situation and identify what was the variable that caused the speed to change. (*Hint: What changed in each situation?)*

20. If you used a different materials to build your car, how would it effect the speed of your car? (*Identify an alternative material and explain your answer*)