

1 2 3 4

Magnets

Session 2: Building Anti-gravity Inventions

MATERIALS

For the leader:

whiteboard or chart paper and a marker*

- 1 paper clip
- 1 piece of string
- 1 ring magnet

For the whole group:

- 50 small paper clips
- 50 craft sticks
- 50 5" x 7" index cards
- 10 cardboard sheets
- 25 soft plastic cups
- 5 rolls of masking tape
- 20 pieces of string
- question cards for Sessions 1-2
- scissors*

For each child:

- 1 ring magnet

*Not included in the kit.

Overview

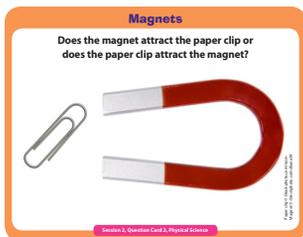
Question of the day: Can we make a string “hang” upward?

Pairs of children invent a simple device called an anti-gravity invention that uses magnets to make a piece of string “hang” upward, against the pull of gravity. The children remember that magnetism is when two objects attract, or pull together. Magnetic attraction is different than just sticking, because it works even when things aren’t touching. The children use creativity, cooperation, and problem-solving skills to create their inventions.

Engage: The leader reviews that magnets attract some things.	15 minutes
Explore: The children work in pairs to make anti-gravity inventions.	20 minutes
Make Sense: The children display inventions and share their designs.	10 minutes
Total	45 minutes

Preparation

1. Write the question of the day on the board or a large piece of paper: **Can we make a string “hang” upward?**
2. Place one piece of string, one paper clip, and two ring magnets near where you will gather the children for “Engage.”
3. Think about how you will set up your space for the session. Arrange the children’s work area and set out the materials they will use to make their inventions: paper clips, craft sticks, index cards, cardboard, plastic cups, masking tape, string, scissors, and magnets. You might organize all the materials on one central table, or you might divide the materials into smaller piles on each table where the children will be working.
4. Decide how you will divide the children into pairs for this activity.



5. Decide how you would like to use the question cards for this session. We suggest setting out the question cards, question side up, among the materials for the children to look at on their own.

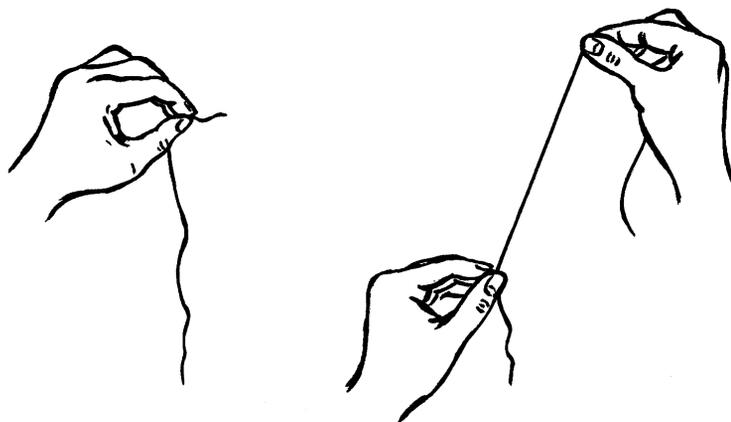
Engage

15 minutes

NOTE

Wait to hand out materials until “Explore.” The children are able to listen better when they’re not holding magnets or other distracting things.

1. Gather the children together. Hold the piece of string from one end, so that it hangs down. Point out the question of the day, **Can we make a string “hang” upward?** Use your other hand to lift the bottom end of the string up to demonstrate.



2. Ask:

Q How can you make this string “hang” up instead of down?

Have the children briefly share their ideas with someone sitting nearby. Then ask a few volunteers to share their ideas with the group. If the children don’t suggest it, ask them if they think a magnet could help make the string “hang” upward and how they think the magnet could help.

3. After some sharing, show how a magnet can make the string “hang” upward if the string is tied to a paper clip. Tie the paper clip to one end of the string. Hold the ring magnet near the paper clip, and slowly raise the magnet until the string is “hanging” upward. Demonstrate that this can work *even without the magnet actually touching the paper clip!* Even with a space between the magnet and the paper clip, the string will still “hang” upward.

4. Add the second magnet to the first one. Demonstrate that two magnets stuck together make the trick work more easily because they pull more strongly on the paper clip.
5. Tell the children that you want them to **invent** an anti-**gravity** device that will keep the piece of string “hanging” upward without the children touching either the string or the magnet. The string can be “hanging” diagonally upward and does not need to point straight up. The children should understand from your demonstration that the trick is to tie the string to a paper clip and use magnets. Emphasize that the children should not be touching the invention to make it work. Challenge them to have the string “hang” upward without the paper clip touching the magnet.

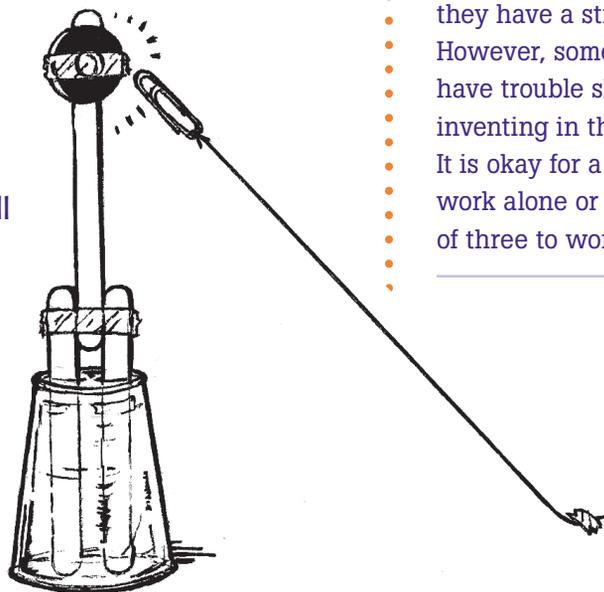
NOTE

The goal of the kit is for the children to explore magnets and not to study gravity. If the children are confused by the term *anti-gravity*, you can let them make up their own names for their inventions. You also can explain that *anti* means opposite or against and say, “Gravity pulls things down, and we’re going to try to make the string go up; that’s why we call it an anti-gravity invention.”

Explore

20 minutes

1. Divide the children into pairs and show them the work area and the materials that they may use.
2. Distribute one magnet to each child (two to a pair) and have partners begin inventing. Most successful inventions are made by securing the end of the string without a paper clip with tape to a tabletop or piece of cardboard, then building some kind of tall structure and securing a magnet at the top to attract the end of the string with the paper clip. Some children may not know exactly what to do until they see a successful anti-gravity invention. Give the children some time to work and watch each other before you give too much advice.



LOOK HERE

Boldfaced words are defined in the glossary on page 17 of the *Magnets Handbook*.

NOTE

Encourage the children to work in pairs; two magnets make the invention work better because they have a stronger pull. However, some children have trouble sharing the inventing in this activity. It is okay for a child to work alone or for groups of three to work together.



See the *Encouraging Curiosity* video clip for ways to help the children make discoveries.



LOOK HERE

For information about the benefits of teamwork, see page 5 of the *Magnets Handbook*.

3. Move around the room and ask questions to encourage exploration and teamwork, such as:

- Q What materials are you using? How are you using them?
- Q How close does the magnet have to be to the paper clip? Why do you think so?
- Q Will the string stay up if you shake the table or poke the invention? (If “No”) How will you fix that?
- Q How are you working together to build the invention?

Sometimes it can be good for a pair of children who are not succeeding to borrow a successful idea from other pairs, and then change or adapt it to incorporate their own ideas. Let the children know that it’s okay to share ideas this way. Scientists borrow ideas and learn from each other.

4. Before you move to “Make Sense,” have the children tidy their work areas, leaving their inventions intact and where they are. Have the children clean up everything else, throwing out or recycling scraps of paper and string, and saving and organizing materials that can be used again.

Make Sense

10 minutes

1. Gather the children somewhere away from the inventions. Tell them they are going to take a tour of the different anti-gravity inventions.
2. Walk around the room as a group and be an audience as pairs of children display and explain their inventions. Ask pairs:

- Q Did you have any problems? How did you solve them?
- Q How did you work together to make your invention?

If a pair’s invention is unfinished, ask the children to explain what it would be like if it were complete. As you walk around, you can comment on how the children thought of different ways to use the materials.

3. Have the children take apart their inventions. Collect all the magnets. Materials that can be used again should be saved, and the rest should be thrown away or recycled.



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