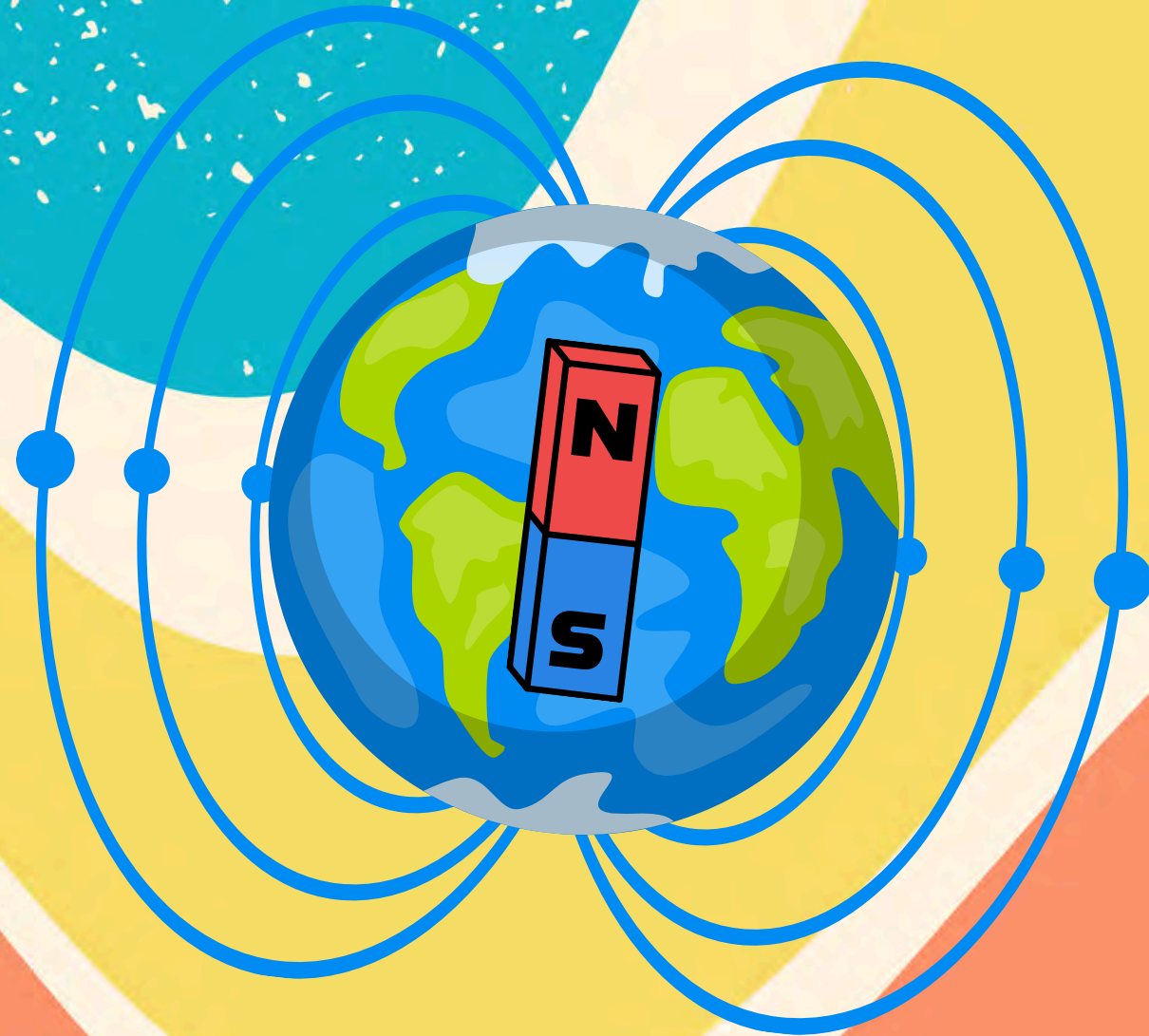
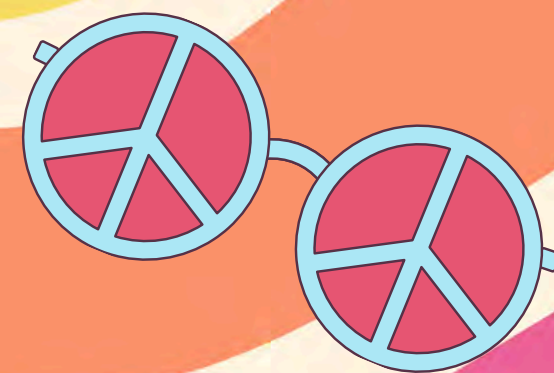
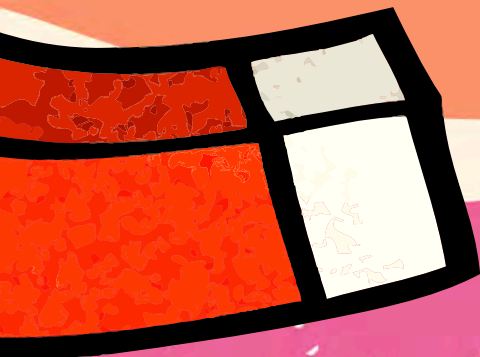


Forces from a Distance:



Kar Out - Gravity and Magnetism!



Teacher's Pet



Non-Contact Forces

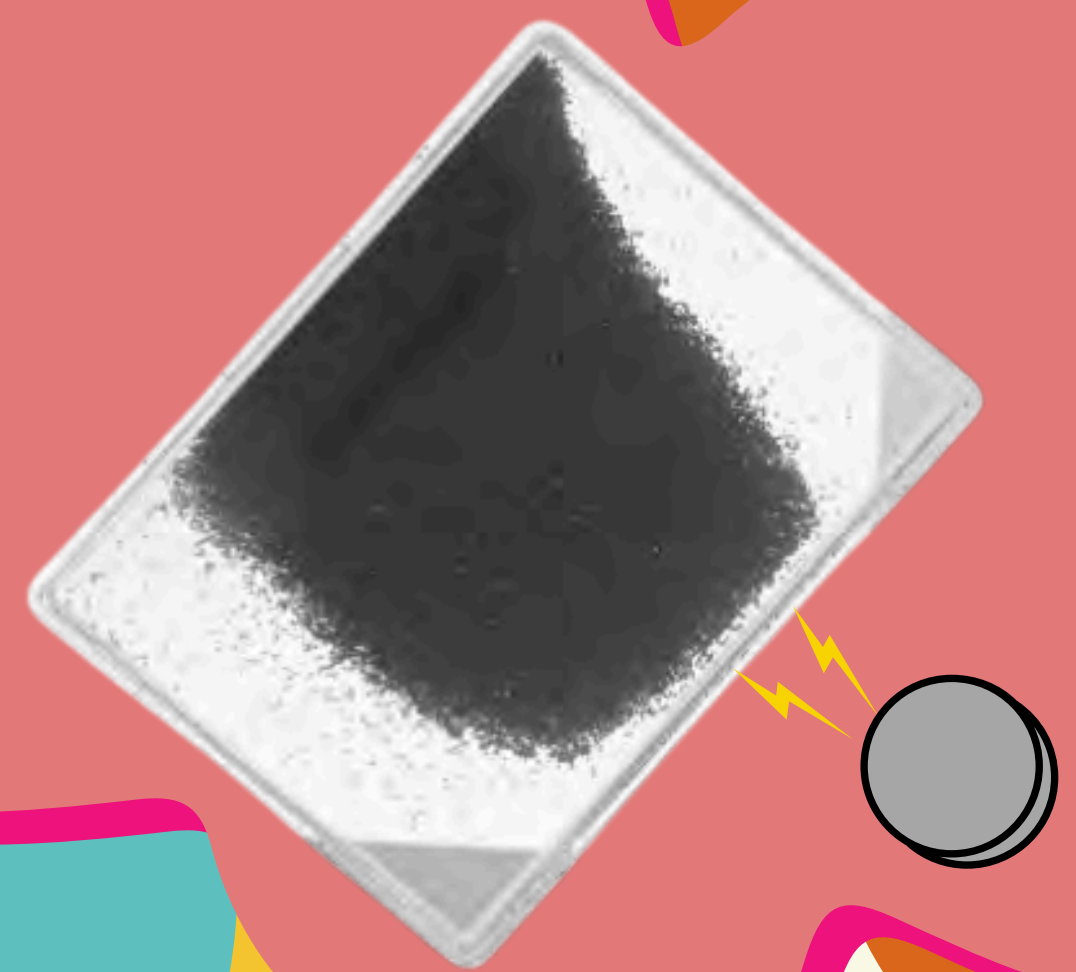
- **Non-contact Forces are INVISIBLE forces that can affect objects, materials and substances at a DISTANCE**
- **Non-contact forces occur between objects that are not in direct contact**



**How do
non-contact
forces affect
objects?**

Gravity and Magnetism!

- **DEMO: Iron Filings Plate**
- **Gravity pulls the iron filings DOWN**
- **Magnetism pulls the iron filings UP**
- **Iron filings display the magnetic field**






Activity 1: Gravity is Groovy!

How does gravity affect different objects?

**Table 1:
Gravity is
Groovy**



1. Drop a flat piece of paper from a height of 150 cm.
2. Using the timer, record the time it takes the paper to hit the floor. Complete 3 trials if time permits.
3. Repeat the experiment with folded paper and a scrunched paper ball.

Falling Object	Trial 1 Drop Time (sec)	Trial 2 Drop Time (sec)	Trial 3 Drop Time (sec)
Flat Paper 			
Folded Paper 			
Scrunched Paper Ball 			

Prediction:

Circle the paper shape you think will fall the fastest below.

Flat

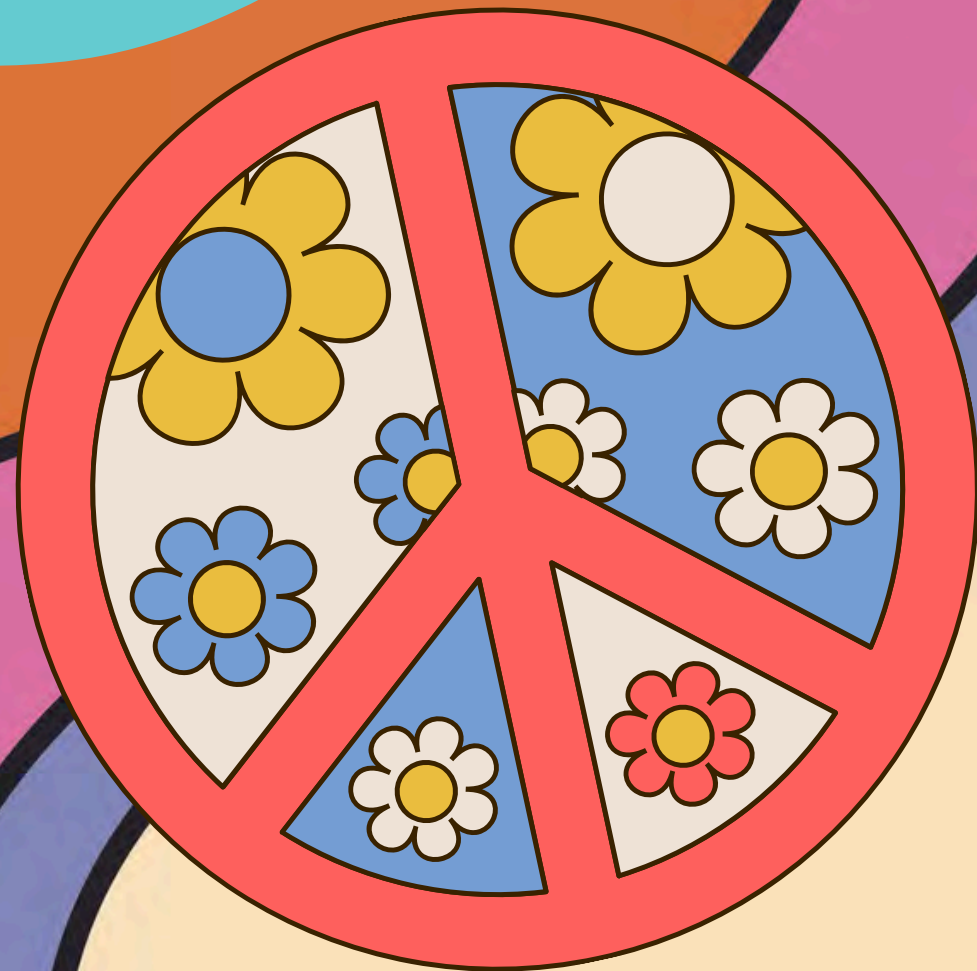
Folded

Ball

Testing Gravity in NASA's Vacuum Chamber

GRAVITY VIDEO

<https://youtu.be/lkAjLM8ReEw?si=GGm-x5vV1Zy1Ub6->



Activity 1: Gravity is Groovy!

- Gravity on Earth is an **INVISIBLE** non-contact force that pulls objects towards the ground
- We demonstrated the effect of gravity on many objects
 - Gravity is a constant **FORCE** on earth
 - As gravity acts on objects from a **DISTANCE**, drag (air resistance) will slow them down



Activity 2: Magnetism is Magnificent!

How does magnetism affect objects?

**Iron Fidget
Spinner**



**Zinc Fidget
Spinner**



Activity 2: Magnetism is Magnificent!



**Table 2:
Magnetism is
Magnificent!**

- 1. Prediction:** At what **DISTANCE** (cm) will each object attract to the magnetic wand? Record your predictions in the table below. Use a "X" if you think the object **WILL NOT ATTRACT** to the magnet.
- 2. Test:** Using the magnetic wand and a ruler, test the distance of the magnetic force.

Object	Predict If the Object is Magnetic or Not	Test #1 Distance of Magnetic Force (cm)	Test #2 Distance of Magnetic Force (cm)	Test #3 Distance of Magnetic Force (cm)
button magnet				
toy				
pipe cleaner				
cloth				
aluminum foil				
burger				
coin				
paper clip				
feather				
key				
magnet wand				

BONUS TIME ACTIVITY:
Place other materials
between the objects and the
magnetic wand (eg. wood,
ruler, cloth).

Does the magnetic force act
through these other
materials? Why?

- 3. Place PAPER** between each object and the magnetic wand. Circle the objects above that still **ATTRACT!**



Record the
distance
where
each object
attracts to the
magnetic
wand.

Activity 2: Magnetism is Magnificent!

**Table 2:
Magnetism is
Magnificent!**

- Prediction:** At what **DISTANCE** (cm) will each object attract to the magnetic wand? Record your predictions in the table below. Use a "X" if you think the object **WILL NOT ATTRACT** to the magnet.
- Test:** Using the magnetic wand and a ruler, test the distance of the magnetic force.

Object	Predict If the Object is Magnetic or Not	Test #1 Distance of Magnetic Force (cm)	Test #2 Distance of Magnetic Force (cm)	Test #3 Distance of Magnetic Force (cm)
button magnet	Note: Answers may vary for predictions and distances measured			
toy		X	X	X
pipe cleaner				
cloth		X	X	X
aluminum foil		X	X	X
burger				
coin				
paper clip				
feather		X	X	X
key				
magnet wand				

BONUS TIME ACTIVITY:

Place other materials between the objects and the magnetic wand (eg. wood, ruler, cloth).

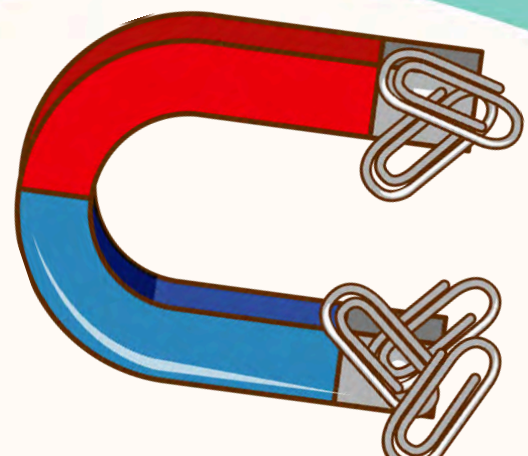
Does the magnetic force act through these other materials? Why?

- Place **PAPER** between each object and the magnetic wand. Circle the objects above that still **ATTRACT!**

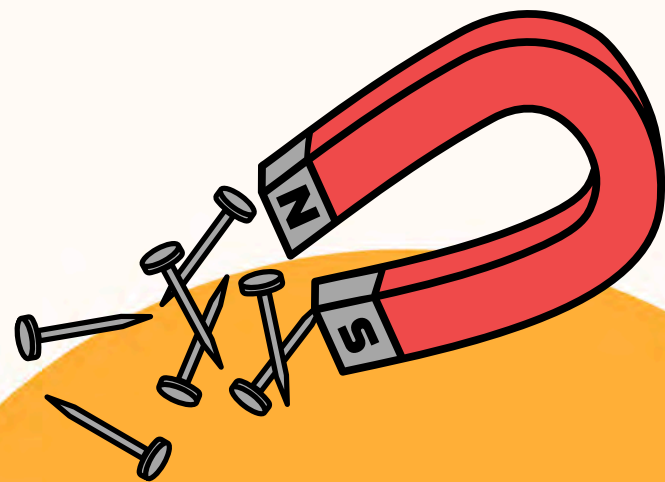
Activity 2: Magnetism is Magnificent!

What have we discovered?

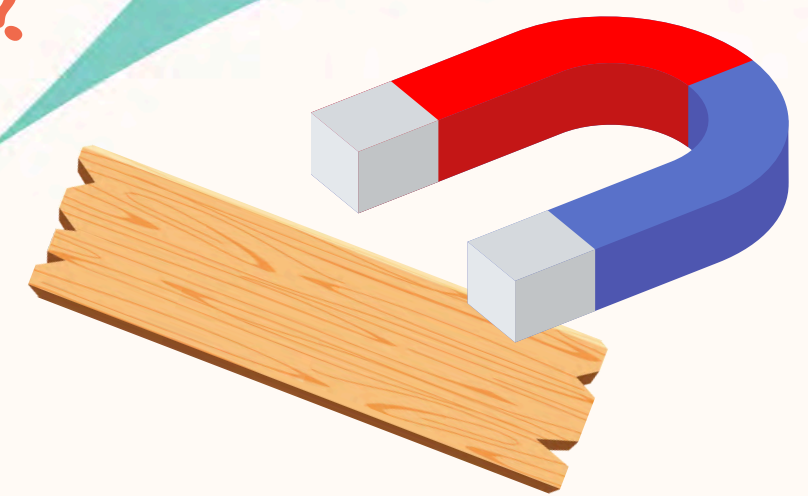
Magnetic force is a non-contact force that attracts or repels magnetic materials.



Strength of non-contact forces increase as objects get closer together.



Non-contact forces act through some materials like paper, wood, rulers & cloth.



Electromagnetic Crane



Magnetic Resonance Imaging

MRI



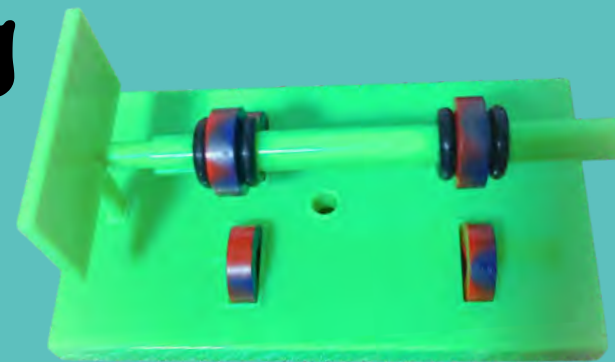
Maglev Train



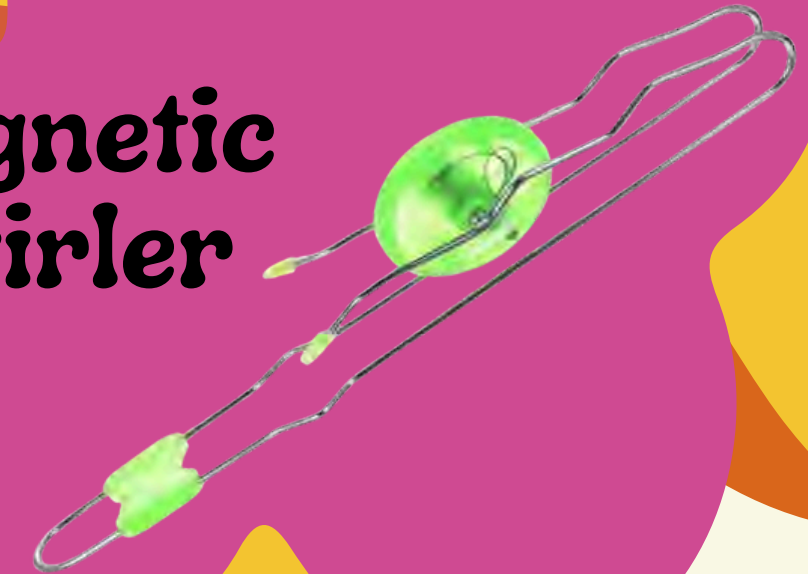
Activity 3: Far Out! Opposites Attract!

How do magnets interact with each other?

Levitating Pen



Magnetic Twirler



Magnetic Disc Spring



MagLev Spinner


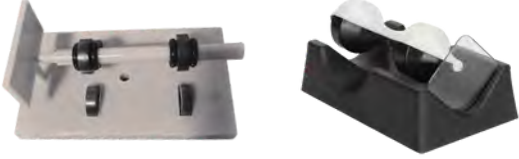




Magnetic Cars



Table 3: Far Out! Opposites Attract!

Record your observations and explanation in the table below.

MagLev Experiment	Observations What do you see and feel?	Explanation How do magnetism and gravity interact?
Magnetic Disc Spring 		
Levitating Pen/MagLev Spinner 		
Magnetic Cars 		
Magnetic Twirler 		

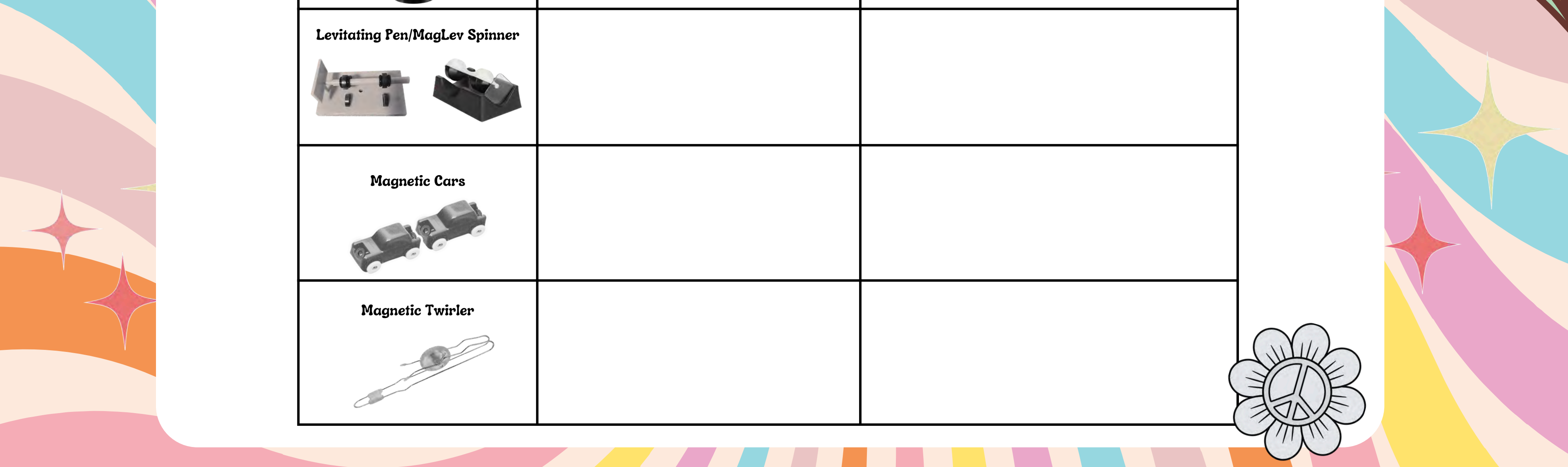
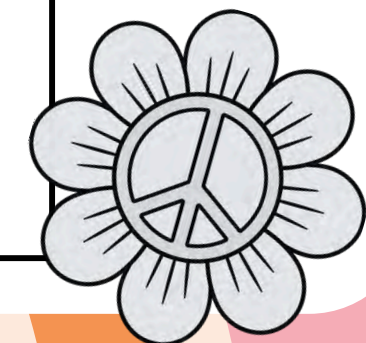

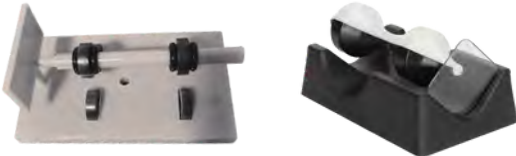
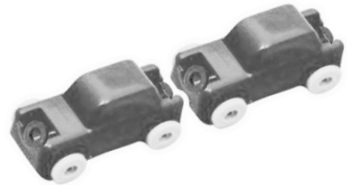
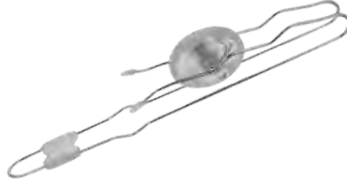
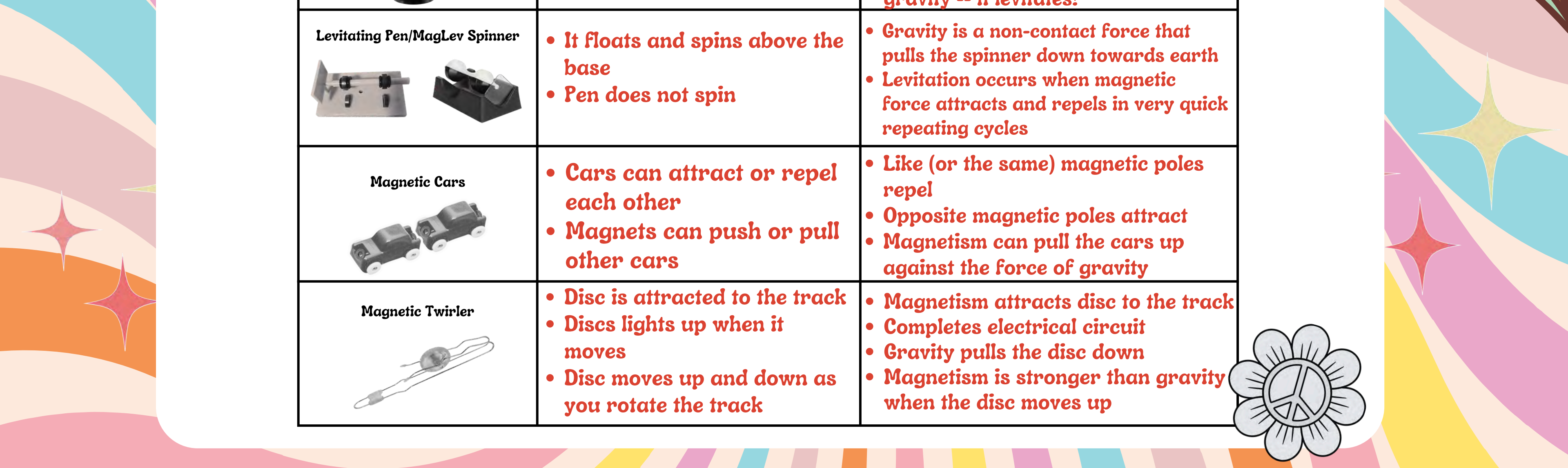
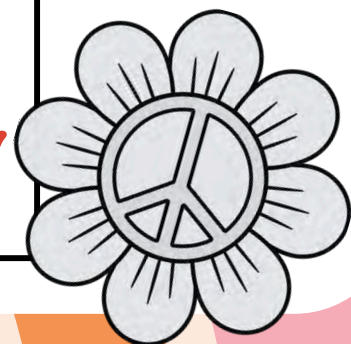


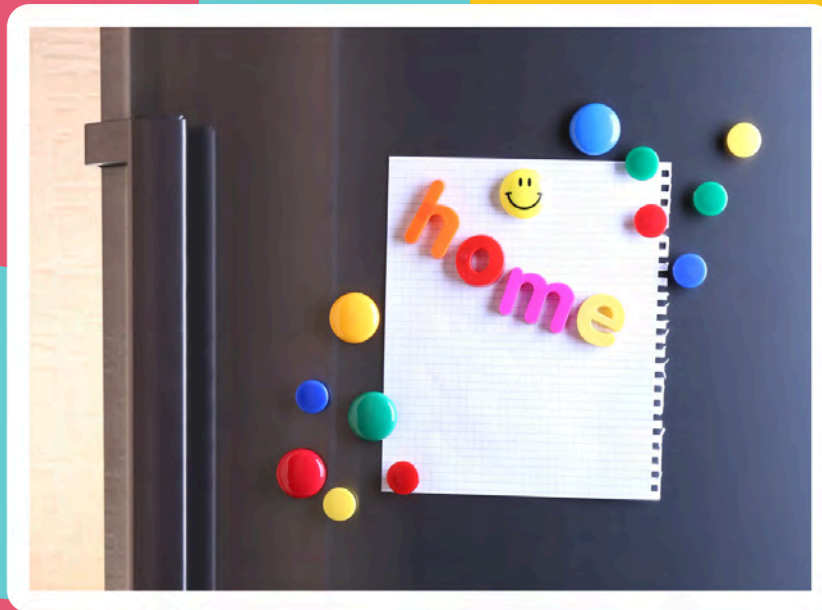
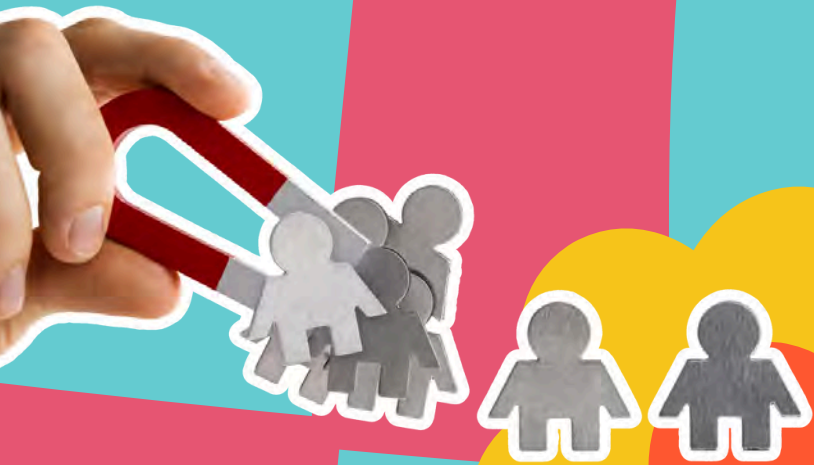
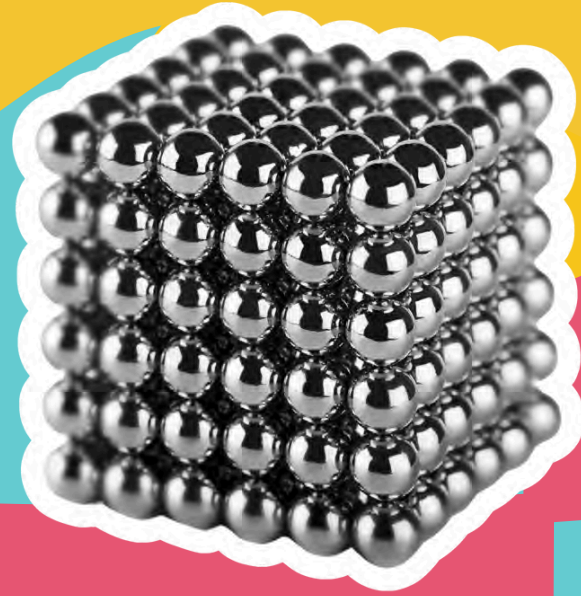
Table 3: Far Out! Opposites Attract!

Record your observations and explanation in the table below.

MagLev Experiment	Observations What do you see and feel?	Explanation How do magnetism and gravity interact?
<p>Magnetic Disc Spring</p> 	<ul style="list-style-type: none"> • Discs bounce when you push them • Some discs attract • Discs can bounce off the pole 	<ul style="list-style-type: none"> • Magnetic force is strongest at the magnetic poles • Invisible lines of magnetic force create a magnetic field • Magnetic force is stronger than gravity -- it levitates!
<p>Levitating Pen/MagLev Spinner</p> 	<ul style="list-style-type: none"> • It floats and spins above the base • Pen does not spin 	<ul style="list-style-type: none"> • Gravity is a non-contact force that pulls the spinner down towards earth • Levitation occurs when magnetic force attracts and repels in very quick repeating cycles
<p>Magnetic Cars</p> 	<ul style="list-style-type: none"> • Cars can attract or repel each other • Magnets can push or pull other cars 	<ul style="list-style-type: none"> • Like (or the same) magnetic poles repel • Opposite magnetic poles attract • Magnetism can pull the cars up against the force of gravity
<p>Magnetic Twirler</p> 	<ul style="list-style-type: none"> • Disc is attracted to the track • Discs lights up when it moves • Disc moves up and down as you rotate the track 	<ul style="list-style-type: none"> • Magnetism attracts disc to the track • Completes electrical circuit • Gravity pulls the disc down • Magnetism is stronger than gravity when the disc moves up



Magnetic Toys and Magnetic Art



Earth's Magnetic Field



Aurora Borealis

Activity 4: Mighty Magnetic Substances

How can you turn a substance into a magnet?

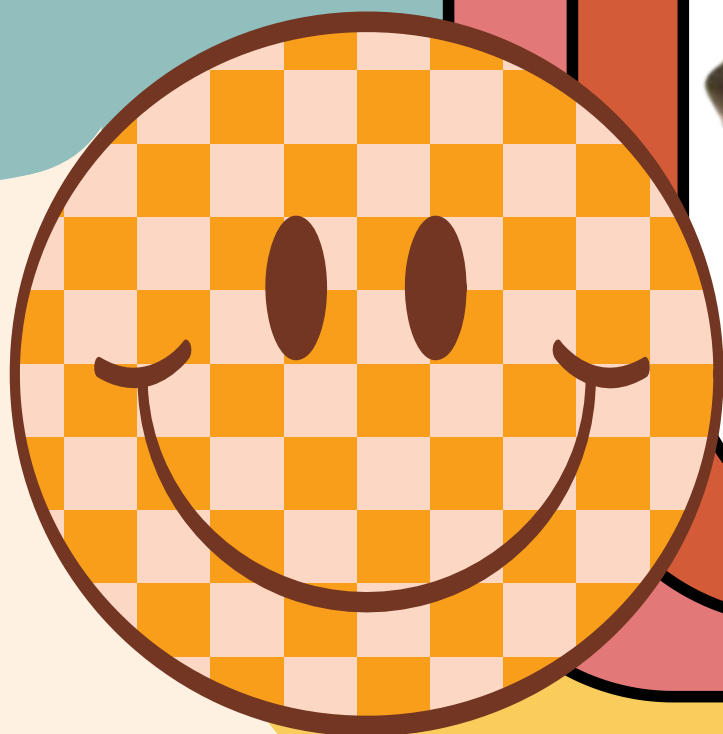


Table 4: Mighty Magnetic Substances

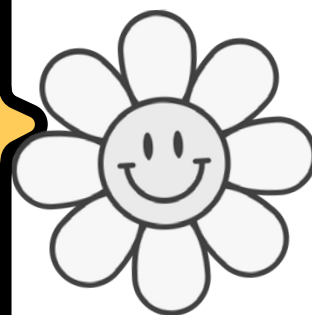
Magnetic Putty



**Table 4:
Mighty Magnetic
Substances -
Magnetic Putty**



**Magnetic
Chains**



	Observations What do you see and feel?	Explanation How do magnetism & gravity interact?
Putty Not Magnetic		
Putty Becomes Magnetic		

Table 4: Mighty Magnetic Substances

Magnetic Putty

**Table 4:
Mighty Magnetic
Substances -
Magnetic Putty**

	Observations What do you see and feel?	Explanation How do magnetism & gravity interact?
Putty Not Magnetic	<ul style="list-style-type: none"> • Stretchy, gooey and slimy 	<ul style="list-style-type: none"> • Iron particles scattered so NO magnetic force • Gravity pulls down on the putty to stretch it
Putty Becomes Magnetic	<ul style="list-style-type: none"> • Putty sits on a very powerful magnet • Thin fibers attract/repel a magnet 	<ul style="list-style-type: none"> • Strong magnet pulls iron particles into alignment • Putty may defy gravity when pulled by a magnet • Chains form when magnetic force passes through iron



Magnetic Chains

Conclusion: Forces From a Distance

How are Gravity and Magnetism the **SAME**?

How are they **DIFFERENT**?

Gravity

Pulls
objects
down to
Earth

Constant
on Earth

Magnetism

North and
South poles

Attracts or
repels magnetic
objects

Opposites attract

Stronger
levitation

Invisible

Act without
touching



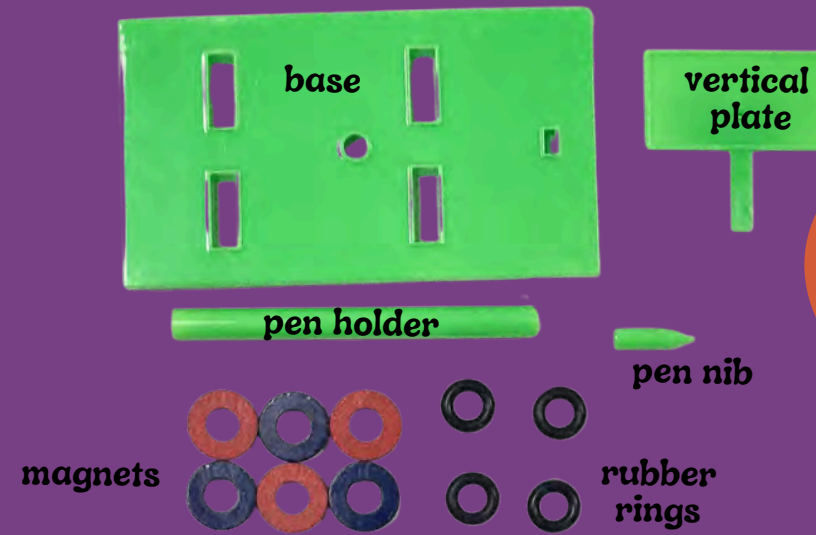
**Take Home
Activity:**

**Levitating
Pen!**



Step-by-Step Instructions: Levitating Pen

Materials



Step 1

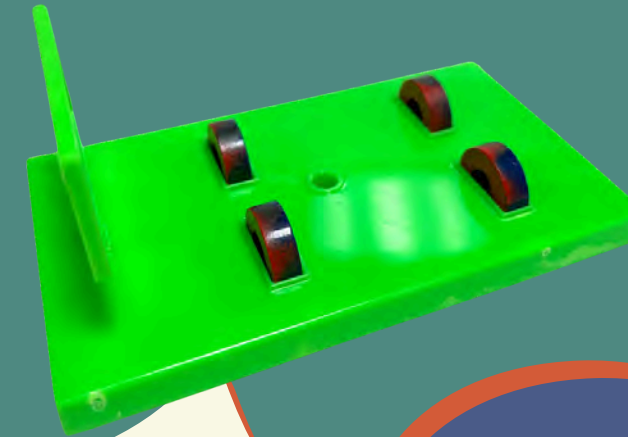
Insert vertical plate in base.

Bigger hole faces in



Step 2

Place 4 magnets in the base. North poles (red) faces the vertical plate.



Step 3

Install nib on the pen holder.



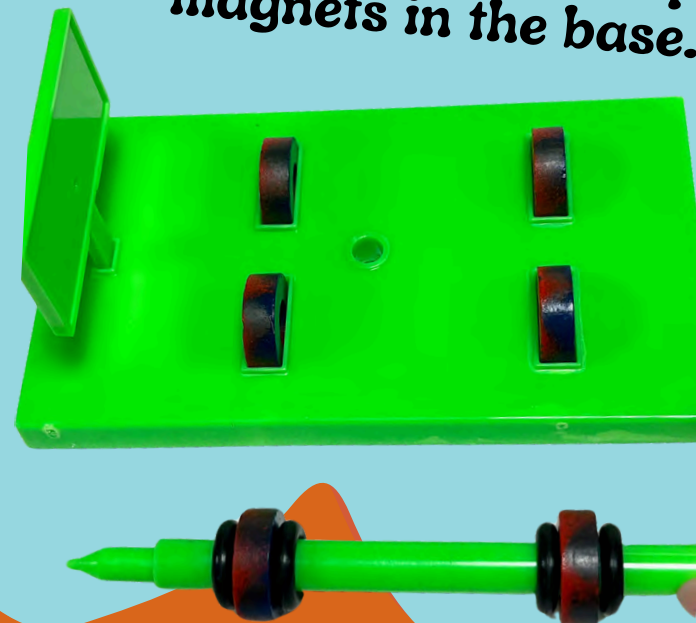
Step 4

Slide the black rubber rings and magnets through pen holder in an alternating pattern. North poles should face tip of pen (same direction as magnets in the base).



Step 5

Slide to align magnets on the pen with the magnets in the base.



Step 6

Place the pen nib in the opening of the vertical plate and gently release to make the pen levitate!

