



# Gravity Assisted Launcher

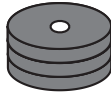


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## Your Gravity Assisted Launcher Kit Includes



1 Gravity Assisted Launcher



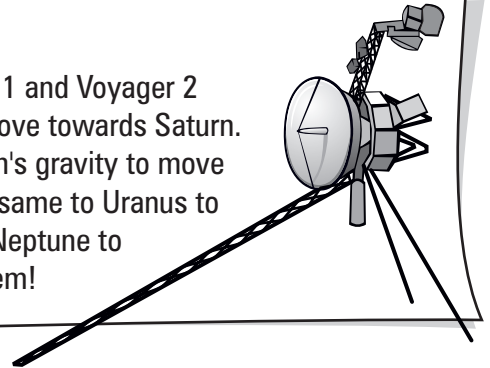
3 Magnets



1 Metal Ball

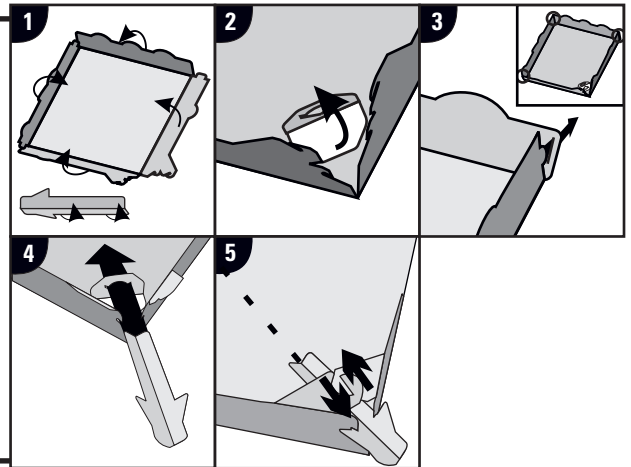
## Fun Fact

The space probes Voyager 1 and Voyager 2 used Jupiter's gravity to move towards Saturn. Voyager 2 then used Saturn's gravity to move towards Uranus. It did the same to Uranus to move to Neptune. It used Neptune to move out of the solar system!



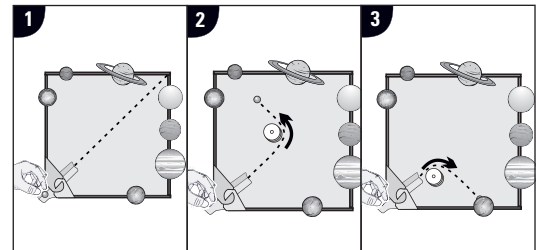
## How To Assemble Your Gravity Assisted Launcher

- Step 1:** Fold and unfold all the flaps and panels at their seams.
- Step 2:** Lift and fold the ramp support at its seam.
- Step 3:** There are three planet panels with tabs. Insert each panel's tab into the next panel's slot.
- Step 4:** The ramp has a narrow end and a wide end. Slide the narrow part of the ramp into the ramp support slot from the corner towards the centre.
- Step 5:** Adjust the ramp so you can stabilize it with the remaining corner tabs.



## Using Your Gravity Assisted Launcher

- Step 1:** Your metal ball is your space probe. Launch it by placing it at the top of the ramp and then letting go. Where does your space probe end up?
- Step 2:** Place the three magnets in the circle target in the center of the launcher. Launch your space probe again. Where does your space probe end up?
- Step 3:** Place the three magnets in the circle target near the base of the ramp. Launch your space probe again. Where does your space probe end up?
- Step 4:** Move the three magnets to other locations within the launcher to change where the space probe ends up. Can you send your space probe to all the planets shown in your launcher?

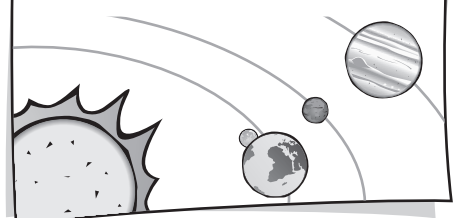


## The Science Behind Your Gravity Assisted Launcher

You made a space probe launch model! The magnets have a magnetic field that pulls metal towards it. Your metal ball was moving too fast to get pulled in all the way. The magnets' field made it curve instead. Gravity does this to real space probes. Any object with enough gravity can pull another object towards it. Even the Moon has enough gravity to pull on a space probe. The pull of gravity does two things to a space probe. It makes the space probe move in a new direction. It also makes the space probe move faster or slower. This is called a gravity assist. Scientists use gravity assist to launch probes at specific targets in space.

## Fun Fact

The Sun's gravity keeps our solar system's planets in orbit.





# Gravity Assisted Launcher



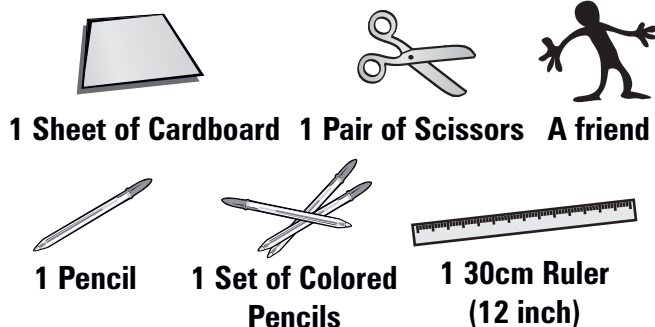
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## You Will Need

### Gravity Grab

## You Will Need



## Directions

- Step 1:** Draw an outline of the ruler on the cardboard. Cut it out.
- Step 2:** Draw sections on one side of the cardboard ruler at intervals of 1.5 cm (or 1/2") along its length. You should have twenty sections marked off if you made markings in centimeters. You will have 24 sections if you made markings in inches. Fill in each section with a different color to make it easier to read. Label this side of the ruler "Earth gravity".
- Step 3:** Draw sections in the opposite side of the cardboard at intervals of 9 cm (or 3") along its length. You should have three sections marked off if you made markings in centimeters. You will have four sections if you made markings in inches. Fill each section with a different color. Label this side of the ruler "Moon gravity".
- Step 4:** Stand up. Ask your friend to hold the cardboard ruler just above your outstretched hand.
- Step 5:** Try to catch the cardboard ruler when your friend releases it. Which section of the ruler could you catch? How is it different on the Earth and the Moon sides?

## What's Going On?

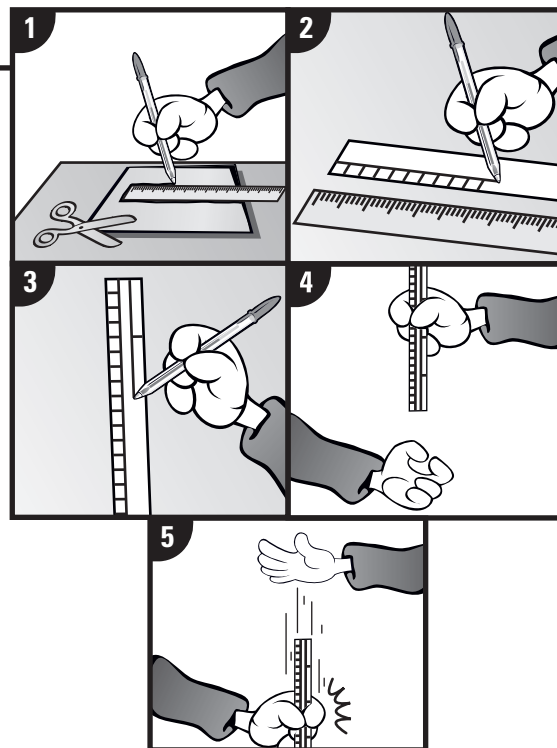
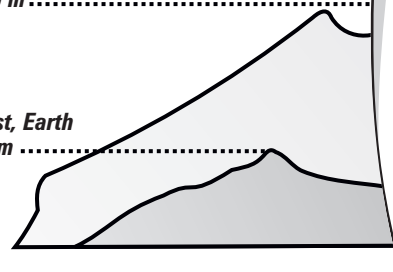
This experiment is a race between gravity and you (your hand and your brain). By the time the message from your brain (that the cardboard has been released and you need to catch it) reaches your hand, gravity has pulled the cardboard down. The Moon is smaller than the Earth. It pulls on objects with only 1/6 the strength as on Earth. If each section on your ruler was equal to a second, you would catch it faster on the Moon than on Earth.

## Fun Fact

More gravity makes the planet's surface flatter. Mars has higher mountains than the Earth because it has less gravity pulling on them!

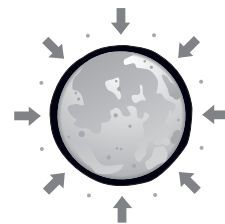
*Olympus Mons, Mars*  
22 500 m

*Everest, Earth*  
8 844 m



## Fun Fact

The Moon does not have an atmosphere because its gravity is too weak to hold on to any gas.



**WARNING:**  
CHOKING HAZARD - Small parts  
Not for children under 3 years.