

Magnetic Rainbow

Grade: 3-4

Time: 1 hour

Activity Overview :

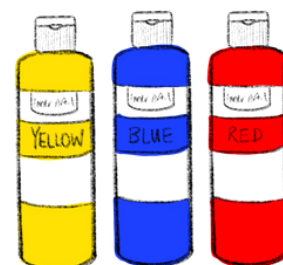
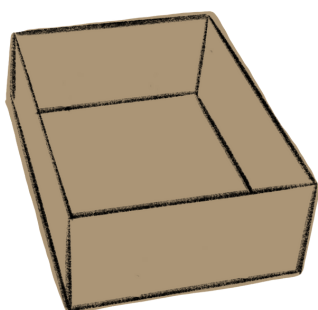
Today we are going to be learning all about physics in the best way possible; using rainbows! One thing that physicists study is optics, which is studying how light works, and how it is used to create colours. Light is a very important part of science and everyday life because it is used for lasers, electronics, and so you can see! Your project today is to create a full rainbow by mixing together red, blue and yellow paint. But there is a twist! You will not be using your hands and a paintbrush to mix the paint, instead you will be using the power of magnets! People use magnets everyday to create electricity, make our computers work, and stick pictures to the fridge. You will get the chance to explore what makes a material magnetic, find materials that are magnetic and see how they can help us paint.

Before we begin think about the following questions:

- What are primary colours? What about secondary colours?
- What types of materials are most attracted to magnets? What similarities do these materials have?

Materials:

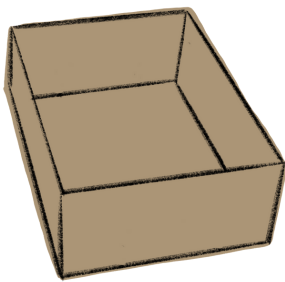
- Shoebox (or other box that can fit a piece of paper)
- White paper
- Red, blue, and yellow paint
- Strong magnet
- Variety of small objects
- Scissors



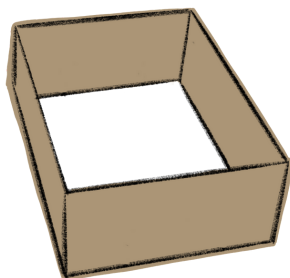
Activity:

- 1 We will start off by making the box that will hold the paper while we paint.
- 2 First, remove or cut off the lid of the shoebox so that you are left with a box with no lid and four tall walls.
- 3 Now place a piece of paper inside of the box so you have a smooth area to paint on, with the sides of the box stopping any paint from spilling out.
- 4 Next you need to find something to paint with! Grab your magnet and try sticking a variety of small objects to it. You can also glue your magnet to a popsicle stick to make it easier to hold and move around. Which objects stick to the magnet really well? Which ones don't stick at all? What do all of the objects that stick to the magnet have in common?
- 5 Now we are ready to paint! Place a small sample of paint (about the size of a loonie) on the page. Do this with three colours of your choice. Make sure there is enough space in between the paint to have room to mix colors together.
- 6 Next, place the magnetic object that you found on top of the paper that is inside of the box.
- 7 Lift up the box and without flipping it upside down, put the magnet on the underside of the box so that the paper and bottom of the cardboard box are sandwiched between the magnet and the magnetic object.
- 8 Now try sliding around the magnet that is underneath the box and watch as the magnetic object inside of the box moves along with it.

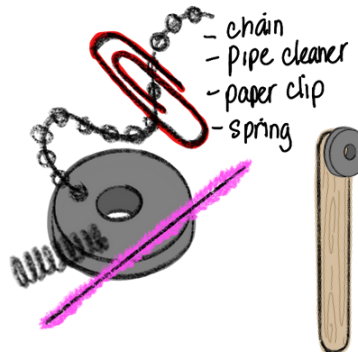
Step 2



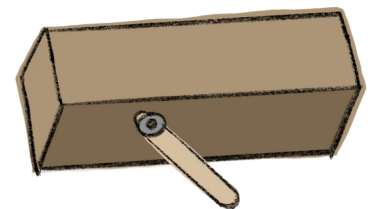
Step 3



Step 4



Step 5



- 9 Use your new magnetic paintbrush to try mixing the different colors of paint together to make new colors. What color does mixing blue and red make? What about red and yellow? Blue and yellow?
- 10 Using the colours you have, try making a painting of a rainbow using your magnets. Focus on what happens when you add a dark and a light colour together, which one stands out more? What colours combine into completely different ones than you started with? Test out a bunch of different combinations until you think you can make all the colours of the rainbow! Notice how using the magnet through a box to paint keeps your work space much cleaner than just a paintbrush would! How else could using magnets help keep your house clean?



Engineering and Science Connections

Today you learned about two different parts of physics: magnets and light. The reason that your magnets were able to stick together, even through a piece of cardboard, is because there is an invisible force holding them together. Each magnet has a north pole and a south pole. If you put the same pole together on two magnets (south pole to south pole or north pole to north pole) they will repel each other and move apart. If you put together the opposite poles of two magnets (north pole and south pole) they will do the opposite and attract each other!

When we built our magnetic paint brush, we only used one magnet, along with another object that was just able to stick to the magnet. Objects are magnetic because they are made of a metal that is considered ferromagnetic, which is a fancy word for a metal that can stick to magnets. This is why objects made of plastic, paper, wood or most other things didn't stick to your fridge magnet... because they don't contain any ferromagnetic metal. The object you ended up using was probably made of iron or steel, both of which are ferromagnetic metals!

You may be wondering how we can start off with just 3 colours of paint, and end up with making hundreds of new colours! In order to understand this, we need to know a little bit about how light works. Light moves around the world in tiny waves, and there are many different sizes of these waves. Each colour that you can see has a different size of wave; red has a big wave and purple has a smaller wave. When we see a certain colour, for example your blob of blue paint, that blue paint is actually reflecting only the one size of wave that blue light has, and is absorbing all of the other sizes of waves so that we cannot see those colours. Once the light that reflects off the paint reaches our eye, we see it as blue!

When we mix two or more different colours of paint together, the wavelengths from each paint colour get reflected back to your eye, and you see a mixture of both colours, which makes a new colour!

Extensions

For an extension, you can try using a different size of magnetic object or a different type of magnet (try a fridge magnet) to see what works the best!

What happens if you use a weak vs. strong magnet? Does it make mixing paint easier or more difficult?

If you use a big magnetic object to mix your colours, does mixing go faster or slower? Does that big magnetic object make painting a picture easier or more difficult?

Share your creations!



Don't forget to share your experiments and creations with us! We would love to see what you've made. You can Email us at: esqinfo@uwaterloo.ca or send us a message/tag us on our social media!

Facebook: @uwengoutreach

Twitter: @UWEngOutreach

Instagram: @uwengoutreach

Thanks for exploring, discovering, and learning with us!

3, 2, 1 Done!

3 - Write or draw 3 things you learned from this activity

2 - Write or draw 2 things you found super interesting or cool and want to learn more about

1 - Do you have any questions about the activity? Did something make you wonder...what if? how? or why?