



SUPER POWER: Codes and Ciphers!

CIPHER WHEEL

LAB NOTES...

TO MAKE YOUR CIPHER WHEEL...

BUILD TIME
15
MINS

1. Watch Nanogirl making her cipher wheel!
2. Take two pencils and lie them side-by-side so that the points line up. It helps if your pencils are about the same length.
3. Tie together near the top with an elastic band.
4. Place a skewer piece horizontally across the middle of the two pencils and secure pencil to opposite ends with the two elastic bands.
5. Push the two pencil nibs 6cm apart and secure with blu-tack on the skewer.
6. Use the pencil compass to draw a circle on your card/paper. It might be easier to place some blu-tack under the paper and piercing a hole through the sheet and into the blu-tack with the centre pencil.
7. We need to divide up the circle into equal parts.
8. Make a mark anywhere on the circumference of the circle then place the centre pencil nib on the mark and draw a mark with the outer pencil at the two points either side where it crosses the circle circumference.
9. Use your ruler to draw straight lines from each of these three marks through the centre of the circle to the opposite edge. You should now have a circle with six equal sections.
10. We need to divide each of those sections in half to make twelve sections.
11. Place your centre nib on one of the marks you made at the circumference and draw an arc outside of the circle. Move your nib to along to the mark on your circumference and draw another arc above the circle. You should see a point where your last arc and this arc cross. Mark this point. Repeat until you have six marks from crossed arcs.
12. Draw lines from each of these marks through the centre of the circle to the opposite side.
13. We need to divide each of those sections in half to make twenty four sections.
14. Place your centre nib on one of the marks on your circumference and the other nib on the adjacent section mark on the circumference.
15. Keep your centre nib on the circumference mark and draw another arc above the circle. Mark where this arc crosses with the previous arc.
16. Move the centre nib across to the next segment line and repeat. Do this until you have twelve crossed arcs.
17. Draw lines from each of these marks through the centre of the circle to the opposite side.
18. You should now have 24 equal sections in your circle.
19. Cut out your circle.
20. Move your two pencils 3.5 cm apart, draw another circle and cut it out.
21. Lay the smaller circle on top of the larger circle, and use the point of a skewer to push through the centre of both circles securing with blu-tack.
22. Using a pen, lengthen the section lines on the centre circle so they show on the outer circle.
23. Write one letter of the alphabet per section on both the inner and outer circle. You don't need to include X or Z.
24. Determine the key to your cipher by turning the outer circle so the letters aren't aligned with the inner circle. Write this code down, i.e. Small circle A = Outer circle U.
25. Write a message that you want to be coded.
26. Look up every letter in your message on the inner circle then write down the letter it is aligned to on the outer circle. With the key A=U then the letter B would be V.
27. Send your coded message to your friend with the key and the cipher wheel and see if they can solve it!

YOU WILL NEED

- A4 paper or thin card.....○
- Scissors○
- 2 x Pencils.....○
- Wooden Skewer (cut in half)○
- Ruler.....○
- Blue tack○
- 3 x Elastic bands○
- Pen○

CODES AND CIPHERS have been used to send secret messages for thousands of years. The type of cipher wheel you have created is called a "Caesar Cipher" because it was used by Julius Caesar in ancient Rome to safely send messages to his generals in battle. Only the generals who knew the key would be able to use the cipher to unscramble the message.

Today, you made an awesome superhero cipher wheel and a pencil compass to help you draw different sized circles. When you use a compass the distance from the middle to the edge (which is also the distance between your two pencils) is called the 'radius.' The distance from one edge of the circle through the centre to the opposite edge is called the 'diameter' and it is always twice as long as the radius. The edge of the circle is called its 'circumference.' Today you also used geometry to divide the circle up into equal segments.

If you lost your cipher wheel or forgot the key, how could you decode the message? For example, which letters and words do you think you would see most often?

How could you disguise or hide your secret message so that no-one else can find it?

Write out a coded message then give your cipher wheel to someone else. How fast can they decode your message once you give them the key?