SCIENCE MUSEUM GROUP

CIPHER WHEEL

MAKING	Age 7–11	Topic MATHS, NUMBERS	30 MIN
	Skills used MAKING OBSERVATIONS • PROBLEM SOLVING • CURIOSITY		

Overview for adults

A cipher is a code used to protect information that is being stored or communicated, so that only people who are allowed can access it. This activity involves making a cipher wheel and using it to encrypt and decrypt messages, with a simple cipher.

What's the maths?

Using the cipher wheel to encrypt a message (make it secret) involves transforming each letter of the message into another letter or a number by following a series of steps: an algorithm. In this case, the algorithm involves simply shifting each letter of the message by a certain number of places through the alphabet. Algorithms are commonplace in mathematics. The message's receiver is aware of the algorithm – which, in the case of cryptography, is called a cipher – and can decrypt the messages by applying the algorithm in reverse. To anyone else, the message looks nonsensical.

Explore more

During (and before) the Second World War, German military forces used sophisticated devices called Enigma cipher machines to encrypt messages.

Maths in your world

Sophisticated encryption is used to send information across the internet, ensuring that credit card details, emails and other messages cannot be read by anyone who intercepts the data. Many websites are also secured using cryptography, so that hackers cannot gain access to the computer files that make up the website or personal data stored in them. The addresses of secure websites begin with 'https' rather than 'http'.

Did you know...?

The word 'cryptography' comes from the Greek words kryptos (meaning 'hidden') and graphia (meaning 'writing').

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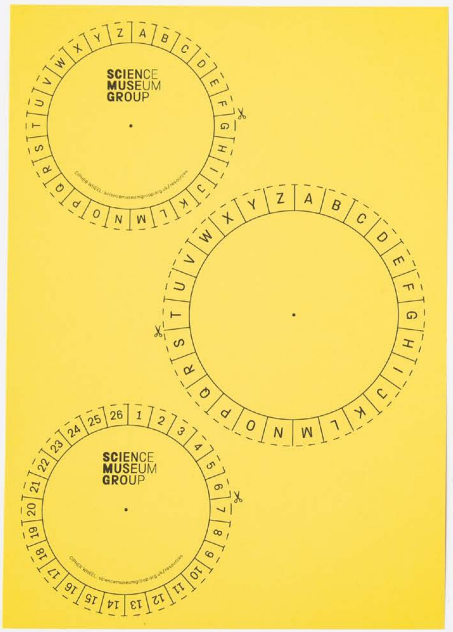
Make a cipher wheel, and use it to send secret messages to your friends and family.

You will need...



Cipher Wheel templates

Pencil for making notes and writing messages

Split pin

Scissors

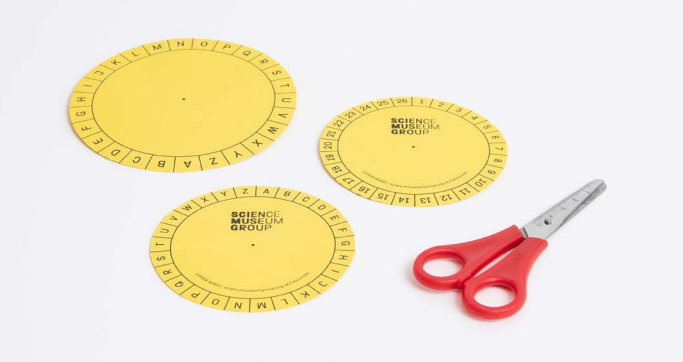
Think and talk about...

- Could you work out the encrypted message without the cipher wheel?
- What kinds of things might people want to keep secret?

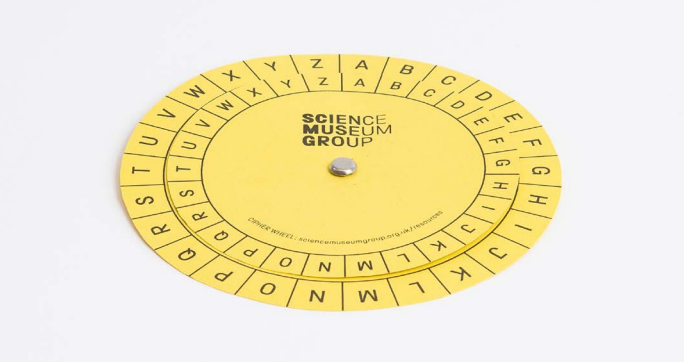
Investigate...

- How quickly can you encrypt and decrypt a message?
- Can you use a different cipher (for example A = 1 X 2 +1, B = 2 x 2 + 1 and C = 3 x 2 + 1) which is more difficult to solve? Try encrypting your message and see if someone else can decrypt it with your equation.
- Try encrypting a new message where you rotate the number wheel after each letter you use. How would you write this cipher so that someone can decrypt your message?

Follow these steps...



1 Cut out the templates.



2 Take the small circle with the letters on it and put it on the large circle. Secure with a split pin in the centre.

3 Turn the smaller wheel so that each letter on it lines up with a different letter on the larger wheel.

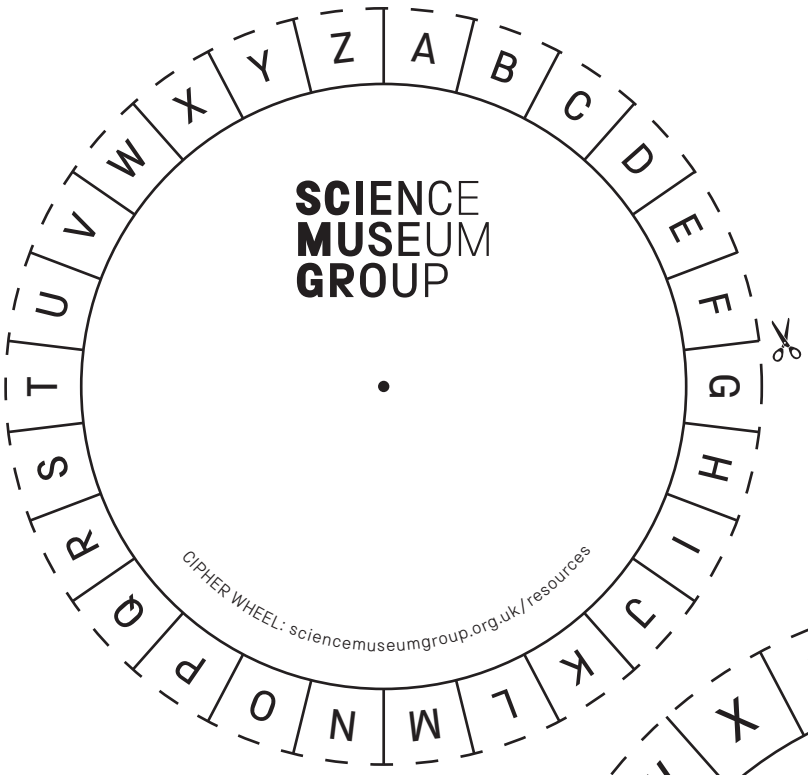
4 Now encrypt your message (make it secret). For each letter, write down the letter on the smaller wheel that appears directly beneath it.

5 Replace the smaller letter circle with the number circle. Now you can encrypt messages with numbers instead of letters.

6 Encrypt messages to a friend in letters or numbers, and ask them to send you encrypted messages too.

Maths in your world

Encryption is used to send emails and information across the internet. Instead of a cipher wheel, a computer uses really complicated mathematics to encrypt the information.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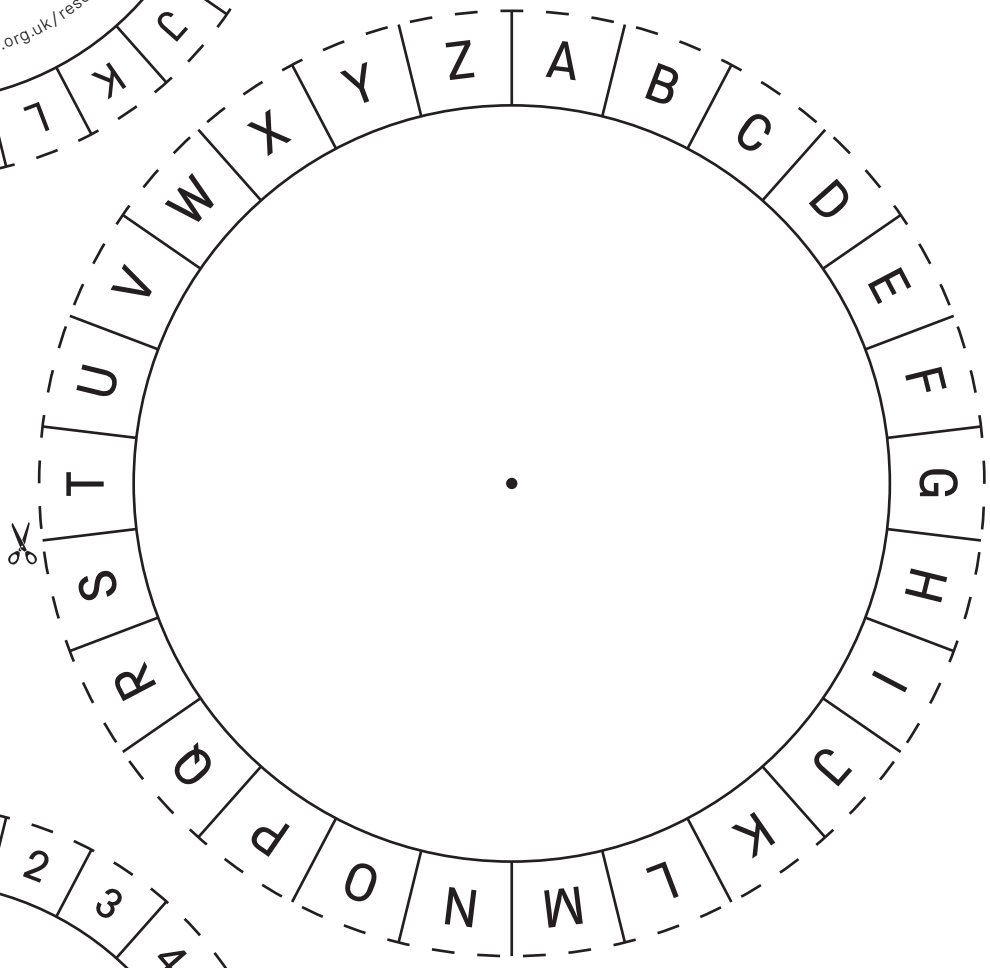
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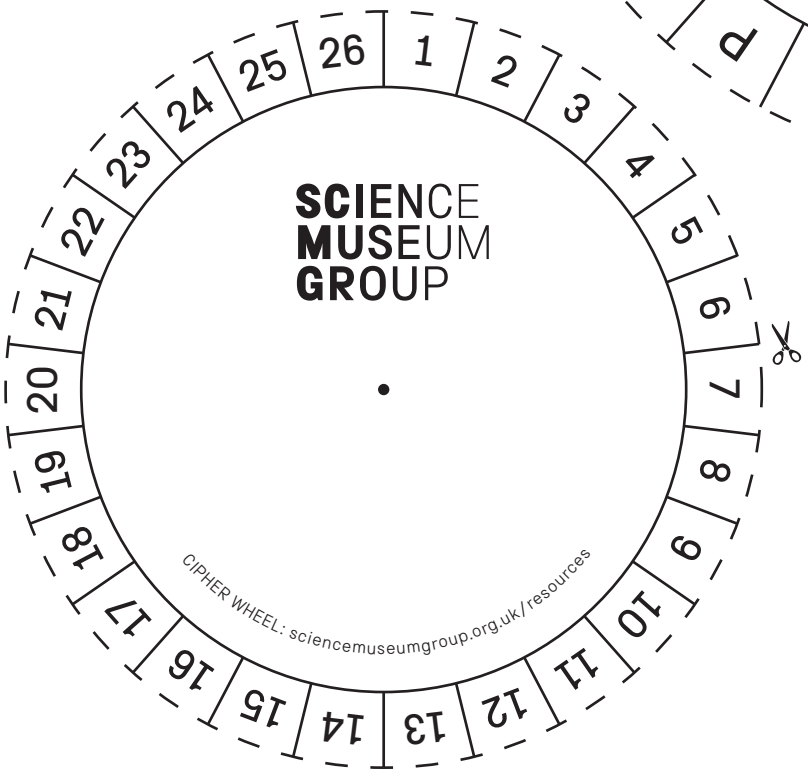
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