Wonder Women: Smart Stuff!

Not all superheroes use their physical strength to fight evil! Oracle fights with her hacking skills and She-Hulk uses powers of persuasion as a lawyer...Just like many of our real-life wonder women who use their smarts to make a difference!

Supplies:

- Pencil & Paper
- Scissors
- Brass brad
- Printed Cipher Wheels (file included below!)
- All your spy skills!

Instructions:

1. Put your smarts to the test! Like some real life wonder women—spies like Virginia Hall & codebreakers like Elizebeth Friedman—see if you can crack our codes! Learn about different types of **cryptology** below and take a stab at becoming a codebreaker.
2. Using what you learn about codes, write your own and see if a friend or family member can crack it! You can even send them the codes via text to connect across the city or country! How did they do?
3. Go learn about some real-life superheroes that used their smarts to make this world better and safer! Check out our Wonder Women guide or look online or at your library for stories about inventors, spies, mathematicians, doctors, and scientists.
4. Think: What do you know a lot about? What are you an expert at? What "smarts" do you have? How can you use your knowledge to help other people and make this world a better place?

What's Cryptology?

Good question! **Cryptology** is the study of codes and the art of writing and solving them! It's been used for thousands of years to keep messages safe and into the right hands. Messages are **encrypted** (putting **plaintext** messages into code) and **decrypted** (pulling those plaintext messages out of code) using a **cipher**. A cipher determines how the message will be encrypted and decrypted!

How Do We Use Cryptology Today?

We use cryptology just like people have for thousands of years—to keep **classified information safe!** Sometimes this means actual top-secret spy stuff, but more often that means protecting our messages and data being transmitted via the internet and technology! It protects our credit cards when we shop online, it protects our data, and keeps government and intelligence safe! Modern encryption sometimes requires complex mathematical formulas that require machines to encrypt and decrypt!

Can I Give It A Try?

Absolutely! Take a look at the different ciphers on the following pages and see how you do!

The Caesar Cipher & Cipher Disks:

What is it?

The Caesar cipher is one of the earliest and simplest **substitution ciphers** which was used by the Romans. In this cipher you replace each letter of the alphabet with another letter by shifting the whole alphabet a certain number of letters (wrapping around to the beginning once you reach the end!)

Instructions:

1. Print out and cut out both cipher wheels (file at end). Stack the small wheel on top of the small wheel and attach them in the middle with a brass brad.
   Remember: The outside wheel will always be the real, plaintext, letter and the inside wheel will always be the coded letter!
2. You will rotate the disk a certain number of letters between 1-25 to line up your real letter with its code letter (this number is the **key**). (26 is just the regular alphabet!)
3. Try decoding our messages using the given keys! Then write an encoded message using your key and the shifted alphabet. If it helps, write down your plaintext first and then encode one letter at a time! Give a friend the encoded message and the key!
4. Most Caesar ciphers use a simple key of 3 or 5, but harder codes us a pattern! For example, the first letter is a shift of 3, but then you rematch the letters and the second letter is a shift of -1. So you decode with the pattern 3, -1, 3, -1...

1. **CZJLA**

Key: 3

2. **QLM PBZOBQ**

Key: 3

3. **RCVO FDIY JK NCJZN YJ NKDZN RZVM? NIZVPZMN!**

Key: 5

Answers: 1. FCMOD, 2. Top Secret, 3. What kind of shoes do spies wear? Sneakers!

Transposition Cipher:

What is it?

This cipher is based off a Spartan code tool called a Scytale—the earliest known "machine" used for cryptography. Both the sender and receiver needed identical rods (the same length and diameter). The sender would wrap a long thin piece of leather around his Scytale and write a message in rows. When the leather was removed it had a long list of letters in no order. When it was delivered the receiver would wrap the leather around their Scytale revealing the original message! Today we use a grid system!

Instructions:

1. Write out your message in plaintext. ("Meet me at the fountain at nine.")
2. Identify your key. . .this is how many columns your grid will have! (Our key is 5)
3. Write your message into five columns wrapping to the next row when you reach five. If you have blank spaces at the end fill them with extra consonants.
4. Write your code by breaking each column into a section. This is what you would send!
   (MEETM EATTH EFOUN TAINA TNINE)
5. To decipher you need to know the key (remember this is the number of columns!) and rewrite your message text into those columns (top to bottom, right to left). Then, reading rows right to left, top to bottom, puzzle out where the word breaks are!

M	E	E	T	M
E	A	T	T	H
E	F	O	U	N
T	A	I	N	A
T	N	I	N	E

Crack our Transposition Ciphertext!

LAIR ECNE AKOE VAAY EGKZ PETX

Key: 6

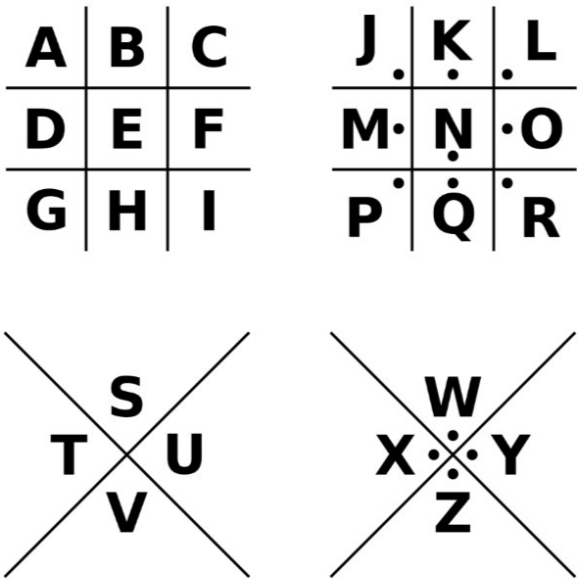
Answer: Leave package in oak tree yzx

Pigpen Cipher:

What is it?

The Pigpen Cipher is a substitution cipher that was used by the Freemasons in the 18th century! They substituted each letter of the alphabet with a picture based off of set diagrams.

Instructions:



So A is. . . .

And N is . . .

Today this wouldn't be a great cipher since everyone knows the diagrams. . . but can you make up diagrams or symbols for your own pigpen cipher?

Crack our Pigpen Ciphertext!

Answer: I have found the missing clue.