CRYPTOGRAPHY

TEACHERS' NOTES

You don't always need specialist knowledge to break codes but you do need certain skills, many of which can be developed with practice and are also vitally important to navigating everyday life, learning and future employment.

These include problem solving, imagination, logic skills, critical thinking, perseverance, language skills, mathematical skills, resilience, patience and planning skills. These skills were also needed by the Bletchley Park codebreakers.

The activities in this pack are designed to enhance students' engagement with the subject of cryptography. Any or all of them can be used as preparation for a visit to Bletchley Park, as a post visit follow up or as standalone activities.

We hope you find them useful.

CAN YOU BREAK THE CODE?

About the activity:

This activity could be used as an introduction to the topic of Bletchley Park. It encourages students to think critically and logically, solve problems, persevere and develop resilience. These skills would have been very useful for a Bletchley Park employee, and this knowledge should help to engage students as they begin to understand what working at Bletchley Park might have involved.

The activity is designed to:

- Engage the students by encouraging them to become codebreakers themselves.
- Help the student understand the process of breaking a code.
- Help the students practise skills of resilience and deduction.
- Develop students' problem solving skills.

Required:

- Worksheets
- Stopwatches

Instructions:

1. Ask students to break the code in front of them. By enciphering information you can control who can understand it. Bletchley Park's job was to decipher information to understand messages they weren't meant to read. Morse code is an international code (not a secret code) whereas Enigma was a highly complex cipher.

2. Give students time to break the code. You could use stopwatches so the students could time themselves - how quickly can they break the code?

3. Ask the students to answer the questions at the bottom of the worksheet. These questions are designed to encourage the students to reflect on the process they have gone through. They begin to make links between their own work and what a Bletchley Park employee would do.

Note: Torches could also be used to deliver Morse code messages.
Answer: Well done for deciphering the message. You have made a good start.

You could also come up with your own message. There are numerous Morse code translators available online.

WRITE YOUR OWN MESSAGE

About the activity:

In this task students begin to apply what they have learnt from the previous activity. This is a collaborative exercise as students generate unique problems for each other to solve. It requires students to be creative and to employ critical thinking skills.

The activity is designed to:

- Engage the students by encouraging them to become codebreakers themselves.
- Help the students understand the process of making and breaking a code.
- Help the students be creative and use their imagination.
- Allow students to have the opportunity for some collaborative learning.

Required:

- Worksheets

Instructions:

1. Give students the worksheet. This would be a good activity to do in pairs. Give the students an allocated amount of time (whatever is most realistic for the group) and ask them to write their own message in Morse code.

2. Ask the students to swap and work out the other student's code.

3. You could ask them to evaluate their performance afterwards. Suggested questions: What was difficult? What steps did you take to break the code? Could you guess what the other person had written without working out every letter? How?

ALPHABET TALLY

About the activity:

This activity is designed to help students understand that some letters of the alphabet are much more common in English than others. They can then begin to consider how this affects the process of codemaking and codebreaking.

The activity is designed to:

•Allow students to explore their code breaking skills further.
•This activity has links to mathematics through the use of frequency tables. This is an avenue that could be explored. If a mathematics focus was required this sheet could lead into a study of graphs and ratio.
•Help the students make links across the curriculum.
•Understand how cryptography and language work together.

Required:

• Worksheets

Instructions:

1. You could use any piece of text you wanted. The students could read from the same one or pick different ones.

2. They need to tally how often letters appear in a paragraph and then analyse the data they collect.

Further information:

This is known as frequency analysis. The longer the text the more accurate the letter distribution. However, frequency analysis can be defeated. Consider the text below:

How quickly can you find out what is unusual about this paragraph? It looks so ordinary that you would think that nothing was wrong with it at all, and in fact, nothing is. But it is unusual. Why? If you study it and think about it you may find out, but I am not going to assist you in any way. You must do it without coaching. No doubt if you work at it for long, it will dawn on you. I don't know. Now, go to work and try your luck.

The letter E does not appear in this text!

CREATE YOUR OWN CIPHER

About the activity:

This activity is designed to accompany the 'Break the Code' and/or 'Write your own Message' activities. Here students have the opportunity to explore the topic in a structured way that allows for creativity and critical thought.

The activity is designed to:

- Engage the students by encouraging them to become codebreakers themselves.
- Allow students to create a cipher, enhancing their understanding of encryption.
- Help the students practise skills of resilience and deduction.
- Develop students' problem solving skills.

Required:

- Worksheets
- Scrap paper for students to write their ciphers on

Instructions:

Instructions are provided on the worksheet. Some examples of codes or ciphers could be provided as inspiration for students.

MATCHSTICK CHALLENGE

About the activity:

This activity attempts to help students to think in a similar way to an employee of Bletchley Park. Engaging the group through an active and collaborative task should enable students to understand the problems and frustrations that can come with codebreaking. Students are also encouraged to look at a problem in different ways, think logically and have the resilience required when presented with a challenge.

The activity is designed to:

• Introduce the students to what being a codebreaker at Bletchley Park might have felt like.

• Make students aware that a problem never stayed solved for very long as the rules kept changing and the problem kept evolving.

• Introduce students to the 'trial and error' method and apply their knowledge of this method to their understanding of Bletchley Park.

• Develop students' critical thinking, problem solving, perseverance, resilience and logic skills. They can begin to make links between problem solving and Bletchley Park whilst developing as learners themselves.

Required:

• Worksheets
• Matchsticks or equivalent. The physical objects are essential for part 2.
• Timer

Instructions:

1. Give each student/group/pair of students 6 matchsticks and display the problem either on the whiteboard or on a sheet in front of them. Give them an allocated amount of time to solve the puzzle (5 minutes is a guideline).

2. Stop the group and explain that the time has run out and the task has now changed slightly. Set them on the problem again but with new rules. Again give them an allocated amount of time to solve the puzzle (5 minutes is a guideline).

3. Once the time is up, give them the 'Matchsticks Challenge Review' sheet.

MATCHSTICK CHALLENGE - CONTINUED

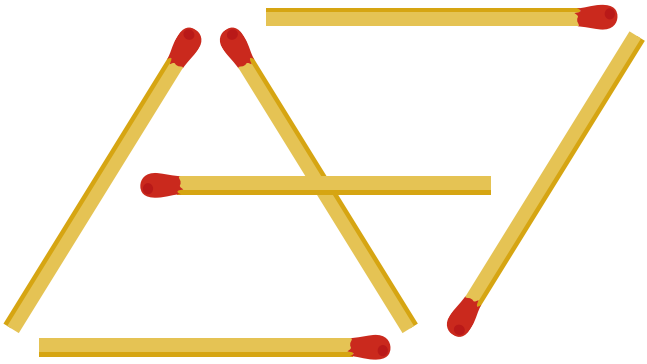
4. Once those are completed explain that:

The workers at Bletchley Park would have felt exactly as they did! They had to solve difficult problems under lots of pressure without a lot of time. They often had to use trial and error, meaning they had to test lots of different methods and different possibilities until they found the ones that worked.

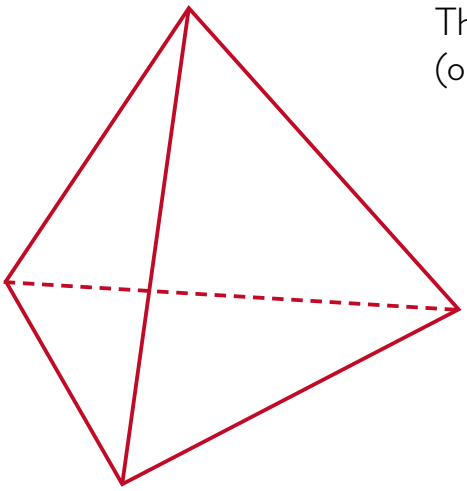
For example, the settings on the Enigma machine were changed every day, meaning that the codebreakers had to start again with different rules.

Answers:

1.



2.



The trick is to think in 3D. This is why physical matchsticks (or equivalent) are essential for part 2.