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| **Lesson Title : What is Cryptography?** | **Unit #:**  **1** | **Lesson #:**  **1** | **Activity #:**  **1** |
| **Activity Title: Sharing Messages** |

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| **Estimated Lesson Duration:** | **7 days** |
| **Estimated Activity Duration:** | **3 days** |

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| **Setting:** | **Classroom** |

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| **Activity Objectives:** |

Students will

1. compare and contrast the pros and limitations of sharing messages privately vs. publicly.
2. explain the historical relevance of cryptography and identify common errors in coding.
3. explain present day security concerns and identify specific flaws in cryptographic systems.
4. describe the big idea of the unit and essential questions.

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| **Activity Guiding Questions:** |

* How can I share a private message publicly?
* How can I use patterns to write function rule to describe keys to various ciphers?

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☐ Cause and effect |
| ☐ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☒ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

| **Ohio’s New Learning Standards for Science (ONLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☒ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Common Core State Standards -- Mathematics (CCSS)** | |
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| **Standards for Mathematical Practice (Check all that apply)** | |
| ☐ Make sense of problems and persevere in solving them | ☒ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☒ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☒ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, ONLS and/or CCSS):** |

[CCSS.MATH.CONTENT.7.EE.B.4](http://www.corestandards.org/Math/Content/7/EE/B/4/)

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

Computers or Phones for students

Poster Boards (1 per pair)

Markers

Introduction to Cryptography PPT

Caesar Cipher Practice

Cryptography [WebQuest](http://questgarden.com/author/create/preview.php?u=182279&l=182279-150702115934&a=&p=introduction&pt=student)

[Class Cryptography Blog](http://ihms6cryptography.blogspot.com/)

[4-2-1 Summarizer](https://docs.google.com/document/d/1-yyexvylauX4-h5p0WnWxsWe-mN4kX_EhaCD3zgxzNM/edit?usp=sharing)

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| **Teacher Advance Preparation:** |

1. Ask students to bring their devices to class or arrange for the students to have school devices.
2. Hang posters around the room and place markers next to the posters.
3. Print Caesar Cipher Worksheet
4. Place link to Survey, [WebQuest](http://questgarden.com/author/create/preview.php?u=182279&l=182279-150702115934&a=&p=introduction&pt=student), and [Blog](http://ihms6cryptography.blogspot.com/) in a commonly shared location, such as Blackboard, for students to easily access.

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| **Activity Procedures:** |

1. Have students take the pre-unit survey/pre-test.
2. Hook: Share a message privately vs. publicly
   1. Break the class into partners and have one them sit across the room from each other.
   2. Give one partner a message (famous quote) to secretly pass along to their partners without moving from their seat or speaking to their partner.
   3. Take away all electronic devices and tell the students the second partner will now pass a message. However, this time, they have an added constraint, they can ONLY share the message using the markers and poster boards on the wall. The posters must remain on the wall.
3. Conduct a group discussion over the challenges of sharing a private message over a public forum.
4. Develop the Big Idea and Essential Questions for the Unit.
   1. Conduct a [4-2-1 activity](https://docs.google.com/document/d/1-yyexvylauX4-h5p0WnWxsWe-mN4kX_EhaCD3zgxzNM/edit?usp=sharing). On their own, have students generate a list of the 4 most important things we need to learn based on the hook.
   2. Once all student have 4 items on their chart, have them work with a partner to share and narrow down their list to find the 2 most important things we need to learn.
   3. Finally, have the students work with their teams (groups of 4) to decide on the 1 most important idea from our hook.
   4. Conduct a full class discussion on their final choice and choose a big idea as a class.
   5. Have the students summarize the big idea on their sheets and with a partner write 3-4 essential questions (EQs) they will need to answer in order to understand the big idea.
   6. Share EQs on the board and select 3-4 as a class to guide our unit.
5. Introduce Cryptography and Ciphers (Caesar and Substitution) (Use PPT to assist presentation)
   1. Give students a Scytale to decrypt a message.
   2. Give students time to play on the sites and applets on the sample Blog post. Share observations as a class.
   3. Allow students to create an encrypted message to send to a partner (teams will come up with the cypher before creating and passing messages).
6. Have students read through the sample blog post with a partner and list important features to include in their team posts.
7. Break students into 6 groups and allow them to complete the [WebQuest](http://questgarden.com/author/create/preview.php?u=182279&l=182279-150702115934&a=&p=introduction&pt=student) in order to learn about and create a [Blog](http://ihms6cryptography.blogspot.com/) Post on their assigned topic (Historical - Zimmerman Telegram – WWI, Enigma – WWII; JN-25b - Midway – WWII; Present Day Considerations – Passwords and Cell Phones; Credit Cards and Bank Information; Target/Samsung/Anthem)
8. Allow groups to share their [Blog](http://ihms6cryptography.blogspot.com/) Post while members of the class comment on their work and ask questions.
9. Explain that in our next lesson, we will begin learning about Public Key Cryptosystems.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Class discussion over the Hook.

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

Students will be assessed according to the [blog](http://ihms6cryptography.blogspot.com/) presentation rubric on the [WebQuest](http://questgarden.com/author/create/preview.php?u=182279&l=182279-150702115934&a=&p=introduction&pt=student).

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.  Refer to Activity Template for details. |

After this lesson, the students took a field trip to hear from a member of the NSA and observe a real Enigma machine. This solidified the content they researched and wrote about in groups. Students were given a variety of materials to choose from to conduct research (in the Webquest). They were also able to devise their own methods for sharing information. Post discussion also exposed students to new information sharing ideas.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

This lesson was highly engaging and the students were all able to arrive at the big idea using the 4-2-1 organizer. This organizer helped guide discussion. However, in the future, it is important to clarify what the students are to address in the organizer. Many were confused and needed additional guidance to understand what they were expected to do. I would also include tasks to allow the students a hands on task to allow the students to examine and experience sending messages via secret key systems.