



## ***Sending Messages Using Morse Code***

**NATURE Sunday Academy 2012-2013**



### **Project Description:**

*In this lesson we will examine the background and history of Morse code. We will utilize internet websites and computer programs to interpret Morse code. Finally, we will build our own telegraph machines to send messages using Morse code.*

### **Project Objectives:**

- The students will learn the basics of Morse code and how it was sent.
- The students will build a machine that will transmit information to another machine.
- The students will interpret Morse code both through sound and sight.
- The students will learn how to encode and decode messages using Morse code.

### **State Standards:**

- 9-10.1.1 Explain how models can be used to illustrate scientific principles
- 9-10.2.2 Use appropriate safety equipment and precautions during investigations
- 9-10.6.1 Use appropriate technologies and techniques to solve a problem
- 9-10.8.3 Explain how individuals and groups, from different disciplines in and outside of science, contribute to science at different levels of complexity

### **Session Organization:**

|               |  |
|---------------|--|
| 11:00 – 11:30 | Cultural Connection/Brief Introduction                 |
| 11:30 – 12:00 | Background/PowerPoint                                  |
| 12:00 – 12:45 | Lunch  |
| 12:45 – 1:15  | Activity 1 – Code and Decode Messages Using Morse Code |
| 1:15 – 2:00   | Activity 2 – Computer Activity with Morse Code         |
| 2:00 – 2:30   | Activity 3 – Build a Telegraph Circuit                 |
| 2:30 – 3:00   | Activity 4 – Use Telegraph to Send Morse Code Message  |



## Applications and Career Paths:

An important application is signaling for help using SOS, ". . . — — — . . .". This can be sent many ways: keying a radio on and off, flashing a mirror, toggling a flashlight, and similar other methods. Morse code has been employed as an assistive technology, helping people with a variety of disabilities to communicate. Morse code can be sent by persons with severe motion disabilities, as long as they have some minimal motor control. An original solution to the problem that caretakers have to learn to decode has been an electronic typewriter with the codes written on the keys. Codes were sung by users; see the voice operated typewriter employing Morse code, or VOTEM, Newell and Nabarro, 1968. Morse code can also be translated by computer and used in a speaking communication aid.

In general Morse code is a form of encoding and decoding messages. This technique is called Cryptography. Cryptography is the practice and study of techniques for secure communication in the presence of third parties (called adversaries). More generally, it is about constructing and analyzing protocols that overcome the influence of adversaries and which are related to various aspects in information security such as data confidentiality, data integrity, and authentication.

**Modern cryptography intersects the disciplines of mathematics, computer science, and electrical engineering.**

**Applications of cryptography include ATM cards, computer passwords, and electronic commerce.**

## History of Morse Code:

Morse code is a method of transmitting text information as a series of on-off tones, lights, or clicks that can be directly understood by a skilled listener or observer without special equipment. Each character (letter or numeral) is represented by a unique sequence of dots and dashes. Using Morse code when writing or speaking may not be practical. Every letter and number has a unique code. Using the code below, please fill in the blanks that describe the history of Morse code. For emergency signals, Morse code can be sent by way of improvised sources that can be easily "keyed" on and off, making it one of the simplest and most versatile methods of telecommunication. The most common distress signal is SOS or three dots, three dashes and three dots, internationally recognized by treaty.



Example of Morse code: SOS- Morse code

|   |           |   |             |
|---|-----------|---|-------------|
| A | ● ■       | U | ● ● ■       |
| B | ■ ■ ● ● ● | V | ● ● ● ■     |
| C | ■ ■ ● ■ ● | W | ● ■ ■       |
| D | ■ ■ ● ●   | X | ■ ■ ● ● ■   |
| E | ●         | Y | ■ ■ ● ■ ■   |
| F | ● ● ■ ■ ● | Z | ■ ■ ■ ● ●   |
| G | ■ ■ ■ ●   |   |             |
| H | ● ● ● ●   |   |             |
| I | ● ●       |   |             |
| J | ● ■ ■ ■ ■ |   |             |
| K | ■ ■ ● ■   | 1 | ● ■ ■ ■ ■   |
| L | ● ■ ■ ● ● | 2 | ● ● ■ ■ ■ ■ |
| M | ■ ■ ■     | 3 | ● ● ● ■ ■   |
| N | ■ ■ ●     | 4 | ● ● ● ● ■   |
| O | ■ ■ ■ ■   | 5 | ● ● ● ● ●   |
| P | ● ■ ■ ■ ● | 6 | ■ ■ ● ● ●   |
| Q | ■ ■ ■ ● ■ | 7 | ■ ■ ■ ● ●   |
| R | ● ■ ■ ●   | 8 | ■ ■ ■ ■ ● ● |
| S | ● ● ●     | 9 | ■ ■ ■ ■ ■ ● |
| T | ■ ■       | 0 | ■ ■ ■ ■ ■   |

Fig.1. Morse code

## Activity 1:

The first telegraphy system was invented by Samuel Morse who was a

• — • — • • — • — • — • \_\_\_\_\_ by trade. He liked to work with  
electromagnets and worked with Leonard Gail and Alfred Vail to invent this system. The first  
telegraph message was sent in • — — — — — — — • • • • • — • • • • — \_\_\_\_\_. It was  
sent from the Supreme Court chamber to a railway depot in Baltimore. The message was:

● — —   ● ● ● ●   ● —   —   ● ● ● ●   ● —   —   ● ● ● ●   — — ●   — — —   — ● ●

● — —   ● — ●   — — —   ● ● —   — — ●   ● ● ● ●   —

\_\_\_\_\_

Morse code became popular in United States and European countries because it was easy to use and it worked even when the wire quality was low. The biggest problem with Morse code was the use of spaced dots.

The Morse code was used for • - - - - - - • • • • - - - - - - \_\_\_\_\_ years.

Morse proved that signals could be transmitted by wire. He used pulses of

- • - • • • - • - • • - • - • - \_\_\_\_\_ to deflect an electromagnet.

In 1954, Morse received a • - - • • - - • - • - \_\_\_\_\_ for the Morse code from the Supreme Court.

### Some More Practice:

• • • - • - • • • • - • - • - • • • • - • - • - - - - - - - - • - • •

\_\_\_\_\_

- - • - - - - - - • • - • • • - •

\_\_\_\_\_

- - • - - • • • • • • • • • • - • - • • - • - • • - • - • - • • •

\_\_\_\_\_

### Write the Following in Morse Code:

1. Reduce, reuse and recycle
2. Write your name (include your middle name)
3. The quick brown fox jumps over the lazy dog
4. Write your phone number (include your area code)

## Activity 2:

### *Part 1: Practice with this Morse code translator*

In this activity, students will test and type Morse code messages to observe their equivalent English form. This exercise will help illustrate how to translate Morse code into English.

Students: Please type the following web address in your internet browser.

<http://www.omnicron.com/~ford/java/NMorse.html>

You should see the following screen. Follow the instructions of your instructor.

## Morse Code Translation and Copy Practice

The screenshot shows a web application titled "Morse Code Translator". It features a large text input area labeled "Input" with the placeholder text "Type your text or dots and dashes here.". Below the input area is a "Translation" section containing a dropdown menu set to "Typed Input" and a text box labeled "using these letters:" containing the string "etianmos". At the bottom of the interface are four buttons: "Translate", "Save...", "Play at 10 WPM", and "Stop".

### *Part 2: Play the Morse Code Game*

In this activity, students will compete to determine who can accurately send a message in Morse code the quickest.

Students: Please type the following web address in your internet browser.


<http://www.plenilune.pwp.blueyonder.co.uk/morse-code.htm>

You should see the following screen. Follow the instructions of your instructor.

Speed of transmission:

.....

faster ... .. slower



Do you want to hear the beeps?

Yes ☒

No ☐

Try to detect new words?

Yes ☐

No ☒

How do you want to 'transmit' code?

Mouse ☐

Keyboard ☒

clear message

hide key for Morse code

|   |      |   |      |     |         |      |         |        |     |
|---|------|---|------|-----|---------|------|---------|--------|-----|
|   |      |   |      | how | quickly | daft | jumping | zebras | vex |
| A | ••   | J | •••• | S   | •••     | 2    | ••••    |        |     |
| B | •••• | K | •••• | T   | •••     | 3    | ••••    |        |     |
| C | •••• | L | •••• | U   | •••     | 4    | ••••    |        |     |
| D | •••• | M | •••• | V   | •••     | 5    | ••••    |        |     |
| E | •    | N | •••  | W   | •••     | 6    | ••••    |        |     |
| F | •••• | O | •••• | X   | ••••    | 7    | ••••    |        |     |
| G | •••• | P | •••• | Y   | ••••    | 8    | ••••    |        |     |
| H | •••• | Q | •••• | Z   | ••••    | 9    | ••••    |        |     |
| I | ••   | R | •••• | 1   | ••••    | 0    | ••••    |        |     |

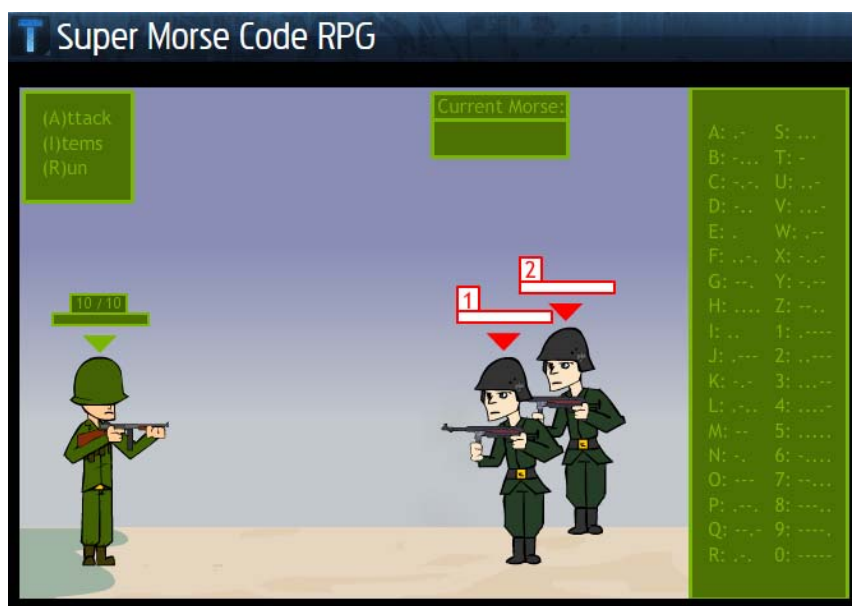
### Part 3: Play Super Morse Code RPG

In this activity, students will play a WWII-themed game where you try to defeat Germany. Students must use Morse code to communicate with the game.

Students: Please type the following web address in your internet browser.

<http://www.newgrounds.com/portal/view/567733>

You should see the following screen. Follow the instructions of your instructor.

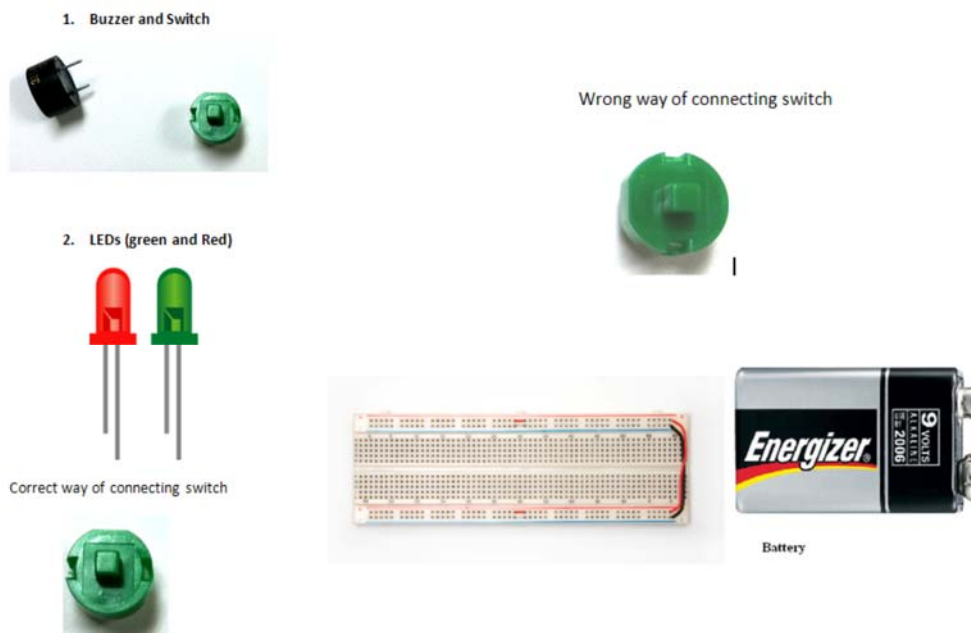


## Activity 3:

### Building a Telegraph System

Objective: Students will build a portable telegraph circuit using switches and buzzers.

Components needed: buzzers, switches, breadboards, 9V battery, wires, LEDs



#### Procedure for Connecting to the Breadboard:

Step 1: Connect the 9V battery Red wire to + line (top side) of Breadboard 1 and the black wire to minus(-) line on bottom side of Breadboard 1.

Step 2: Take a small red wire and place one end of the wire in + line (top side) and the other end of the wire to (jth row, hole 10) of Breadboard 1.

Step 3: Place one end of the green switch to (h,10), (f,10) of Breadboard 1 and the other end in (h,12) (f,12). Notice that this switch has two leads on each end in order to sit on the breadboard properly. (Referring to Breadboard 1 now).

Step 4: Take a red wire and place one end of the wire in (j,12) of Breadboard 1.

Step 5: The other end of the wire from Breadboard 1 should go to (j,5) in Breadboard 2.

Step 6: Take the RED LED (light bulb) and place the longer (positive side) lead in (h,5) in Breadboard 2. The shorter side of the LED should be connected to (h,8).

Step 7: Now take the Buzzer and use breadboard 2. The longer side of the Buzzer pin should be connected to (f,8) and the shorter side to (f,11) in Breadboard 2.

Step 8: Take a red wire and connect one end of the wire to (j,11) in Breadboard 2 and the other end to the minus line (bottom side) in Breadboard 1.

Step 9: Now press the green switch and see if your RED light works! If so, you have completed one side. If it does not turn ON, then you should double check your connections. Call Prakash for help!

Step 10: Take a Blue wire now. Connect one end of the blue wire to + line (top side) of Breadboard 1. The other end of the wire should go to (f,50) in breadboard 2.

Step 11: Place the switch between (j,50)(h,50) and (j,52)(h,52) in Breadboard 2.

Step 12: Take a Blue wire. Now place the one end of the wire in (f,52) in breadboard 2 and the other end of the wire in (h,50) in breadboard 1.

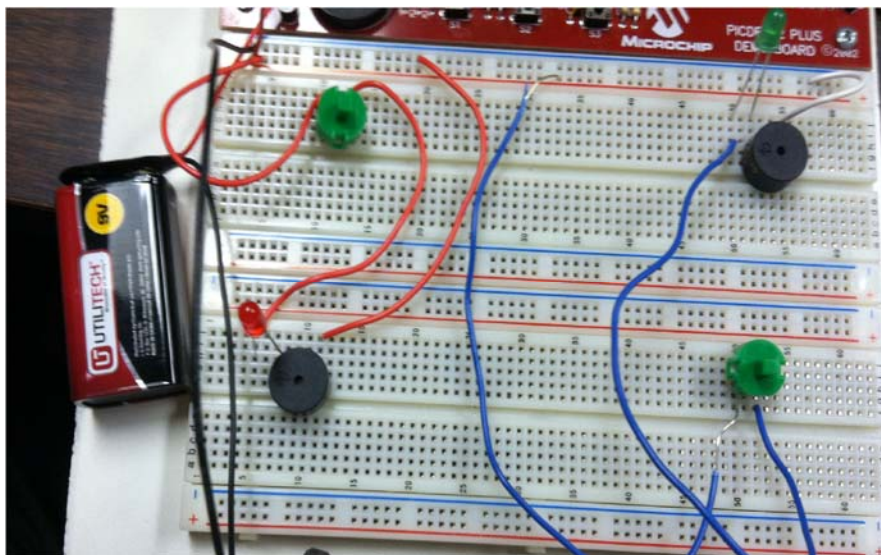
Step 13: Take a Green LED. Place the longer side of Green LED to (j,50) in Breadboard 1 and the shorter side to (j,52) in Breadboard 1.

Step 14: Place the longer side of the second buzzer to (f,52) in Bread board 1 and the shorter side in (f,55) in Breadboard 1.

Step 15: Take a wire of any color. Place one end of the wire to (j,55) in Breadboard 1 and the other end to minus line (bottom side) of breadboard 1.

Step 16: Now press the second switch in Breadboard 2 and the Green LED should turn ON. If not, check your connections or call Prakash for help!

Step 17: Now you have built the Morse code circuit! Try sending Morse code signals to your partner at the other end.



Morse code circuit

YouTube Video link: <http://www.youtube.com/watch?v=t3G01qEa8kw>

#### Summary Questions:

1. Morse code for SOS is \_\_\_\_\_
2. Morse code was invented in \_\_\_\_\_
3. You would need to major in \_\_\_\_\_ disciplines (art or engineering ...?) in order to understand various encryption and decryption techniques like the Morse code lesson you learned about today.