What Is Quantum Computing?

Lesson Plan for Grades K-4

OVERVIEW & PURPOSE

This lesson introduces elementary students to quantum computing and its benefits to society.

EDUCATION STANDARDS

Tennessee K–8 Science Standards are built on six core principles:

Foundational Concepts	Algorithmic Thinking	Programming Concepts	Data and Analysis	Networking & the Internet	Impacts of Computing

This lesson includes introductory elements of Foundational Concepts, Algorithmic Thinking, Data Analysis, Programming Concepts, and Impacts of Computing.

OBJECTIVES

1. Define the term quantum and how it applies to computers.
2. Compare and contrast bits and qubits and how they relate to binary codes.
3. Demonstrate how superposition works.
4. Explain how quantum computing can improve our world.

MATERIALS NEEDED

1. Quantum Computing slideshow
2. Computer and projector screen (with speakers)
3. Optional: cardstock and string for the activities included.

VOCABULARY

1. **Quantum**- the study of things that are very small
2. **Qubit**- quantum bits; tiny pieces of information
3. **Binary Code**- a two-digit code made of 0's and 1's.
4. **Superposition**- placing one thing in front of or on top of another to present multiple forms at the same time

APPROXIMATE CLASS LENGTH: 1-1.5 HOURS

1. What is Quantum Computing? Use this Google Slides presentation to explain quantum computing.
2. Crack the code: Encourage your class to “crack” the binary code on the attached worksheet.
3. Choose one of the optional activities: Spinning quarter, Understanding Superposition, or Create-your-own Thaumatrope.
4. Class discussion: Would you want to work with quantum computers? Why or why not?

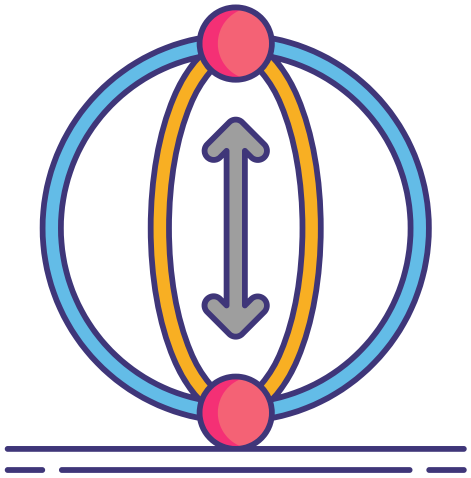
Activities adapted from Quantum Computing for Alland Dr. Dave’s Science in Teachers Pay Teachers.

Create-your-own thaumatrope

A thaumatrope is a toy that people used to play with. The thaumatrope has two sides, like a qubit has two values.

When the thaumatrope is spinning, it is like a qubit in superposition - it's both values at the same time.

This is a real-life example of superposition that you can make.

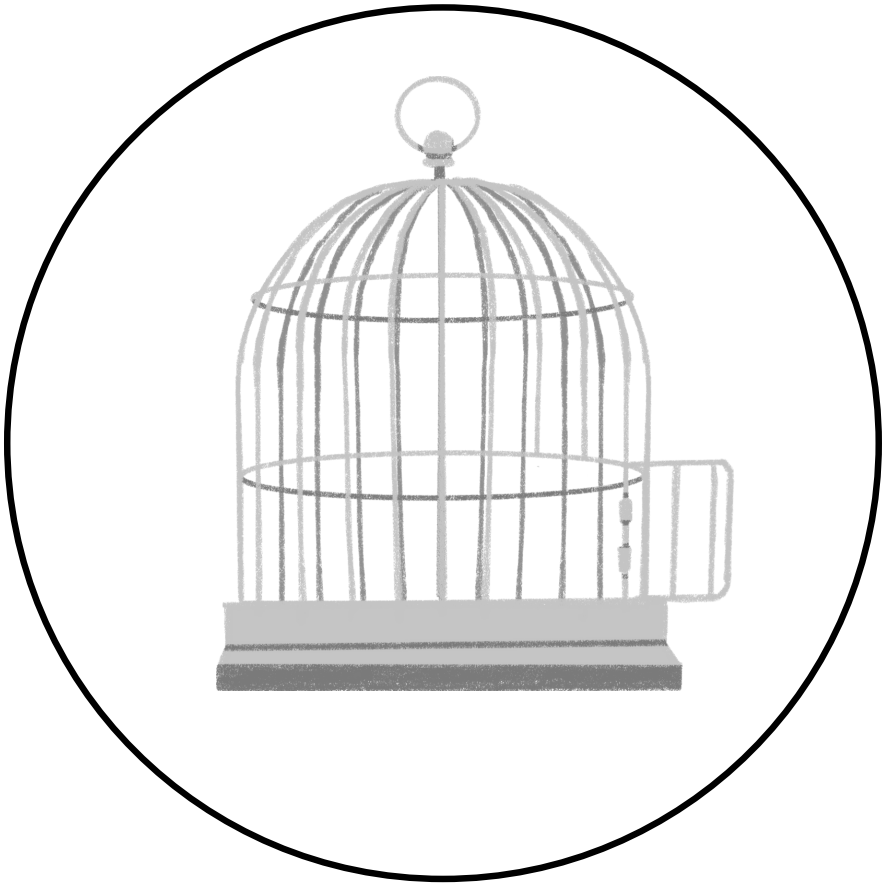


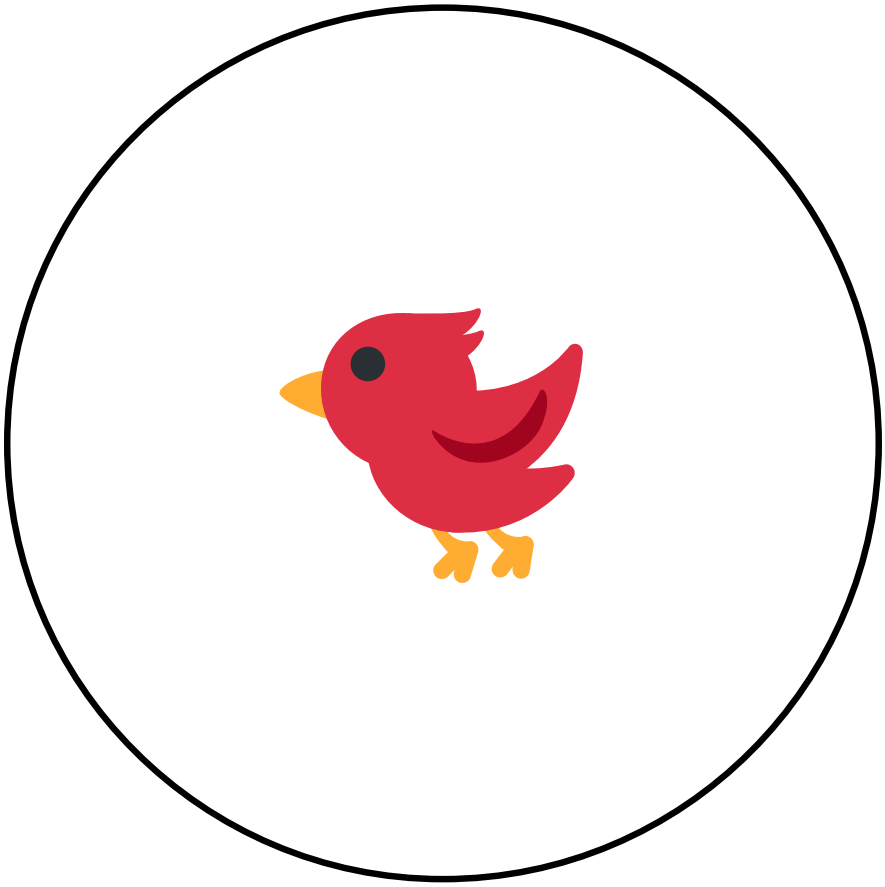
Materials

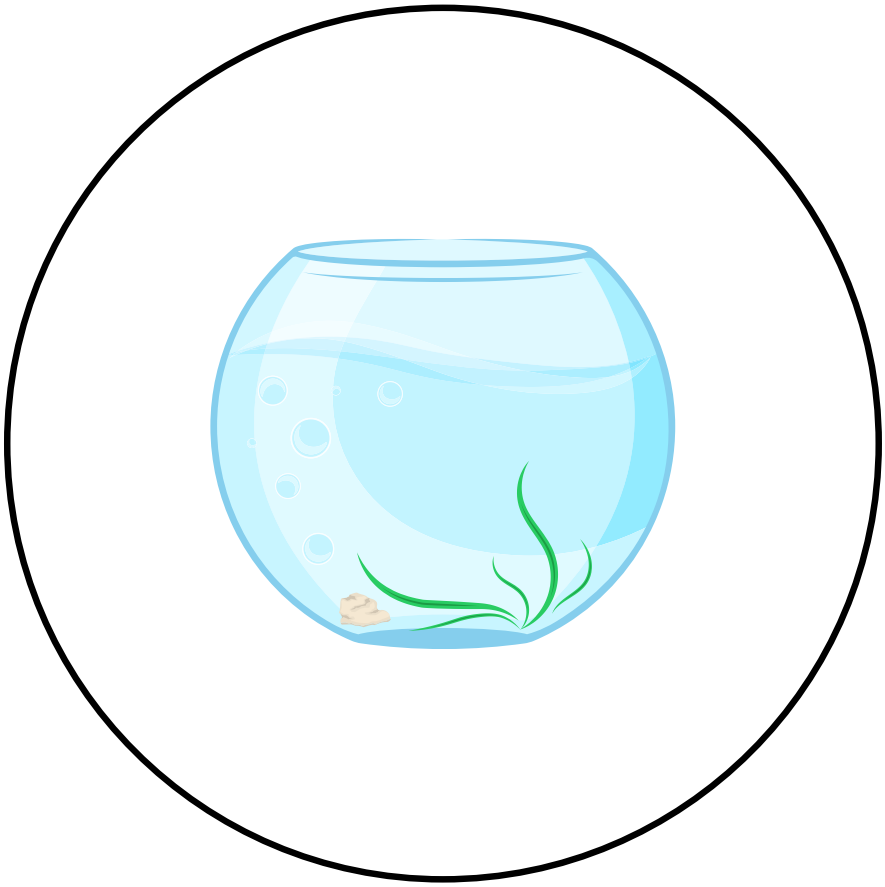
- Thaumatropes (attached)
- Glue
- Hole punch
- Rubber bands

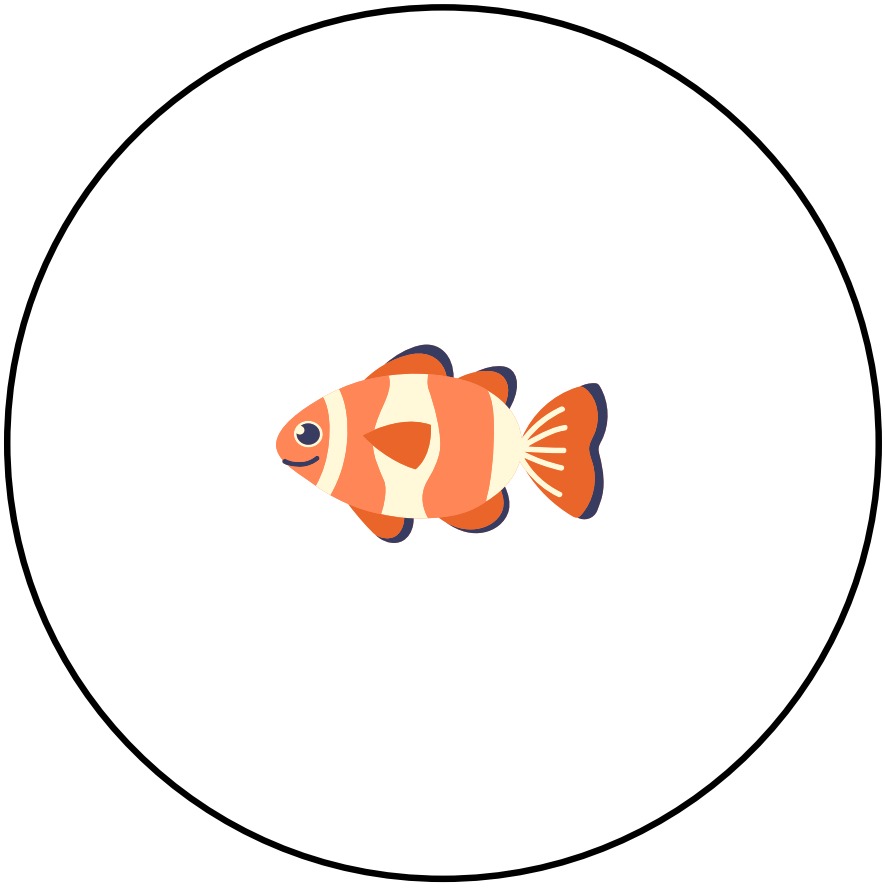
Directions

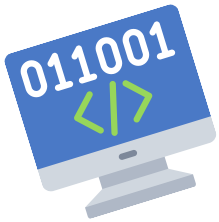
1. Print and cut both sides of the template.
2. Cut out both circles and place them on the table in the correct orientation.
3. Take one circle and flip the top towards you. Put glue on the back. Glue the other circle to the back straight on (do not flip).
4. Use a hole punch to punch a hole on each side.
5. Loop a rubber band through each hole.
6. Spin the thaumatrope!











Crack the code

Look at the alphabet in binary code. Can you figure out the secret word?

A: 01000001	**G:** 01000111	**N:** 01001110	**U:** 01010101
B: 01000010	**H:** 01001000	**O:** 01001111	**V:** 01010110
C: 01000011	**I:** 01001001	**P:** 01010000	**W:** 01010111
D: 01000100	**J:** 01001010	**Q:** 01010001	**X:** 01011000
E: 01000101	**K:** 01001011	**R:** 01010010	**Y:** 01011001
F: 01000110	**L:** 01001100	**S:** 01010011	**Z:** 01011010
	M: 01001101	**T:** 01010100	

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