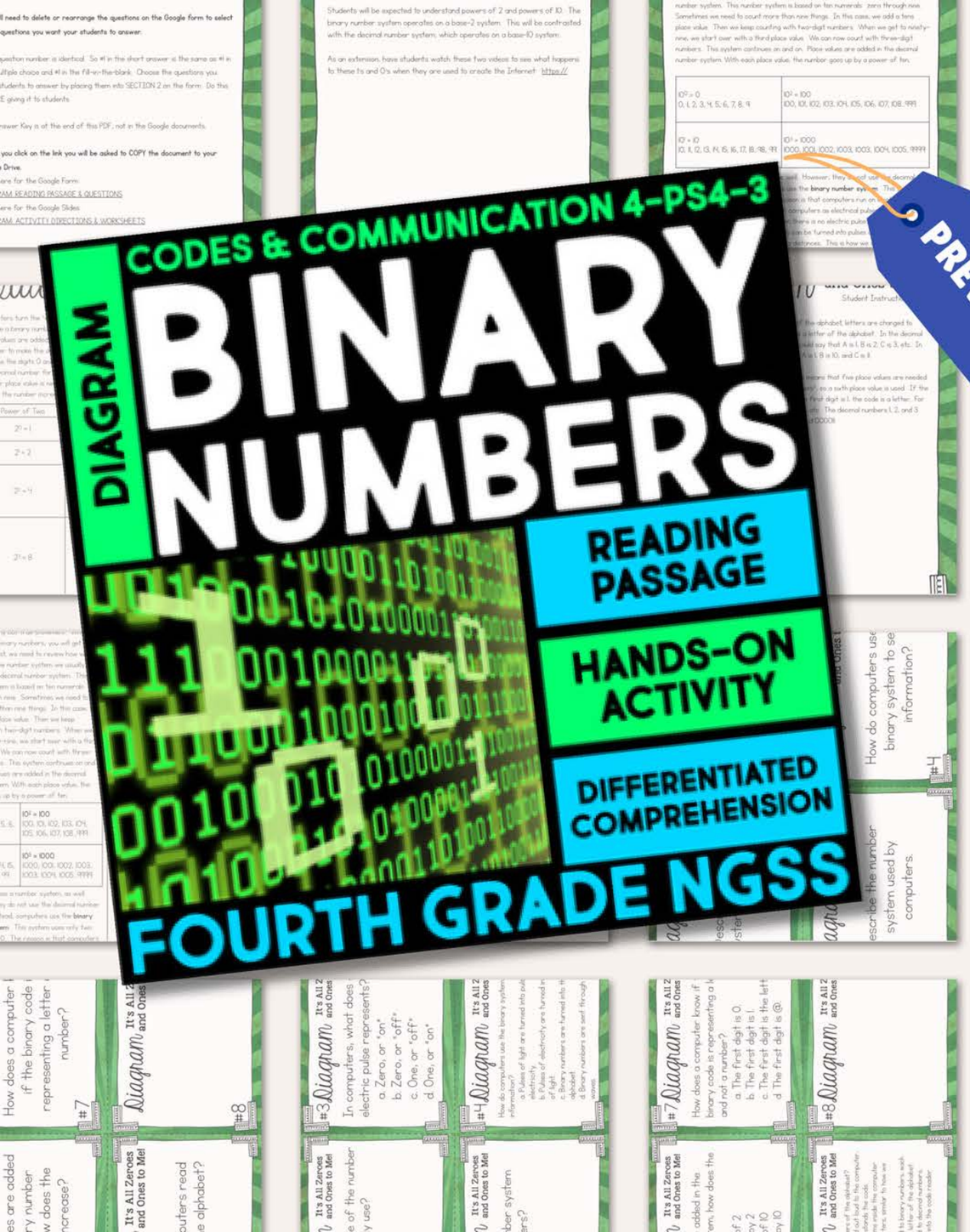


4TH GRADE

Can You Read Binary?

DIAGRAM

BINARY NUMBERS- COMMUNICATION THROUGH CODES & TECHNOLOGY

KEEP SCROLLING TO SEE WHAT'S INSIDE!

YOU WILL LOVE THIS BECAUSE



Hands-On Learning Through Diagrams

Students create a binary diagram that helps them understand digital communication more deeply.



Aligned with NGSS

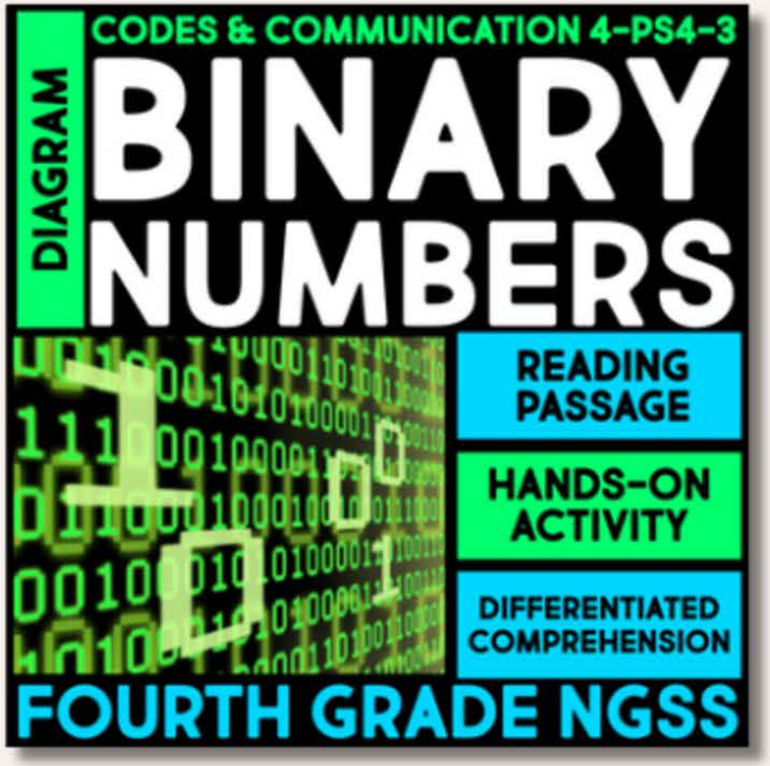
These lesson plans aren't just random; they're laser-focused on Next Generation Science Standards.



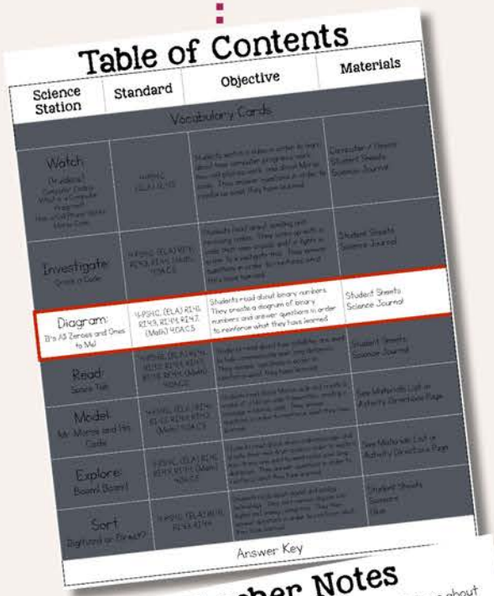
Encourages Science Journaling

Students analyze and record their findings, reinforcing observation and explanation skills.

ACTIVITY OVERVIEW



- **Students will read a short paragraph about binary numbers.**
- **Then your students will create a diagram of binary numbers.**
- **Then lastly they will answer questions about binary numbers.**


Table of Contents

Science Station	Standard	Objective	Materials
Vocabulary Cards			
Watch: (Or videos) Computer Coding What is a Computer Program? How do Computers Understand Code		Students watch a video in order to learn about basic computer programming concepts. They will also learn about Morse Code. They answer questions in order to assess what they have learned.	Computer of Doom Student Sheets Science Journal
Investigate: Create a Code		Students read about sending and receiving codes. They solve problems in order to help them learn important skills of flight in order to investigate what they have learned.	Student Sheets Science Journal
Diagram: It's All Zeroes and Ones to Me!	4-PS4-3, (ELA) RI.4.1, RI.4.3, RI.4.9, RI.4.7, (Math) 4.OA.C.5	Students read about binary numbers. They create a diagram of binary numbers and answer questions in order to reinforce what they have learned.	Student Sheets Science Journal
Read: Secret Text			
Model: Mr. Morris and His Code			
Explore: Board Board			
Sort: Right or Wrong?			

Answer Key


Science Stations Overview

Watch a Video
At this station, students will watch a video relevant to the topic and answer questions. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Play a Game
Students play an online video game and answer questions about the experience. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Investigate
Students use materials to investigate the science topic by following directions and recording results. Students answer questions about the investigation.

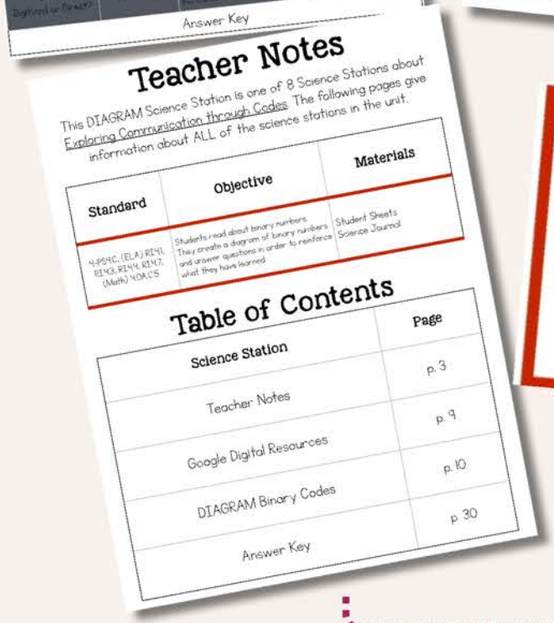
Draw a Diagram
Students draw and label a diagram specific to certain requirements. Students then explain how their diagram meets the requirements.

Read a Passage
Students read a short passage about the topic and answer questions about the information in the passage. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Create a Model
Students use materials to illustrate the science concept and answer questions. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Explore
Students create a sample and manipulate it using the new science concepts they have learned. Students answer question based on the effects.

Sort
Students sort cards into groups or put them in a specific order. Students record the sort and then describe their reasoning.


Teacher Notes

This DIAGRAM Science Station is one of 8 Science Stations about Exploring Communication through Codes. The following pages give information about ALL of the science stations in the unit.

Standard	Objective	Materials
4-PS4-3, (ELA) RI.4.1, RI.4.3, RI.4.9, RI.4.7, (Math) 4.OA.C.5	Students read about binary numbers. They create a diagram of binary numbers and answer questions in order to reinforce what they have learned.	Student Sheets Science Journal

Table of Contents

Science Station	Page
Teacher Notes	p. 3
Google Digital Resources	p. 9
DIAGRAM Binary Codes	p. 10
Answer Key	p. 30

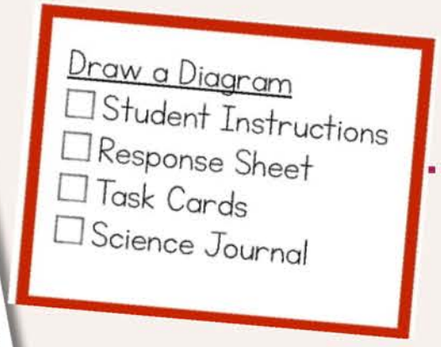

Draw a Diagram
- ☐ Student Instructions
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal

Table of Contents

Science Station Overview

Materials Checklist

Table of Contents / Teacher's Notes

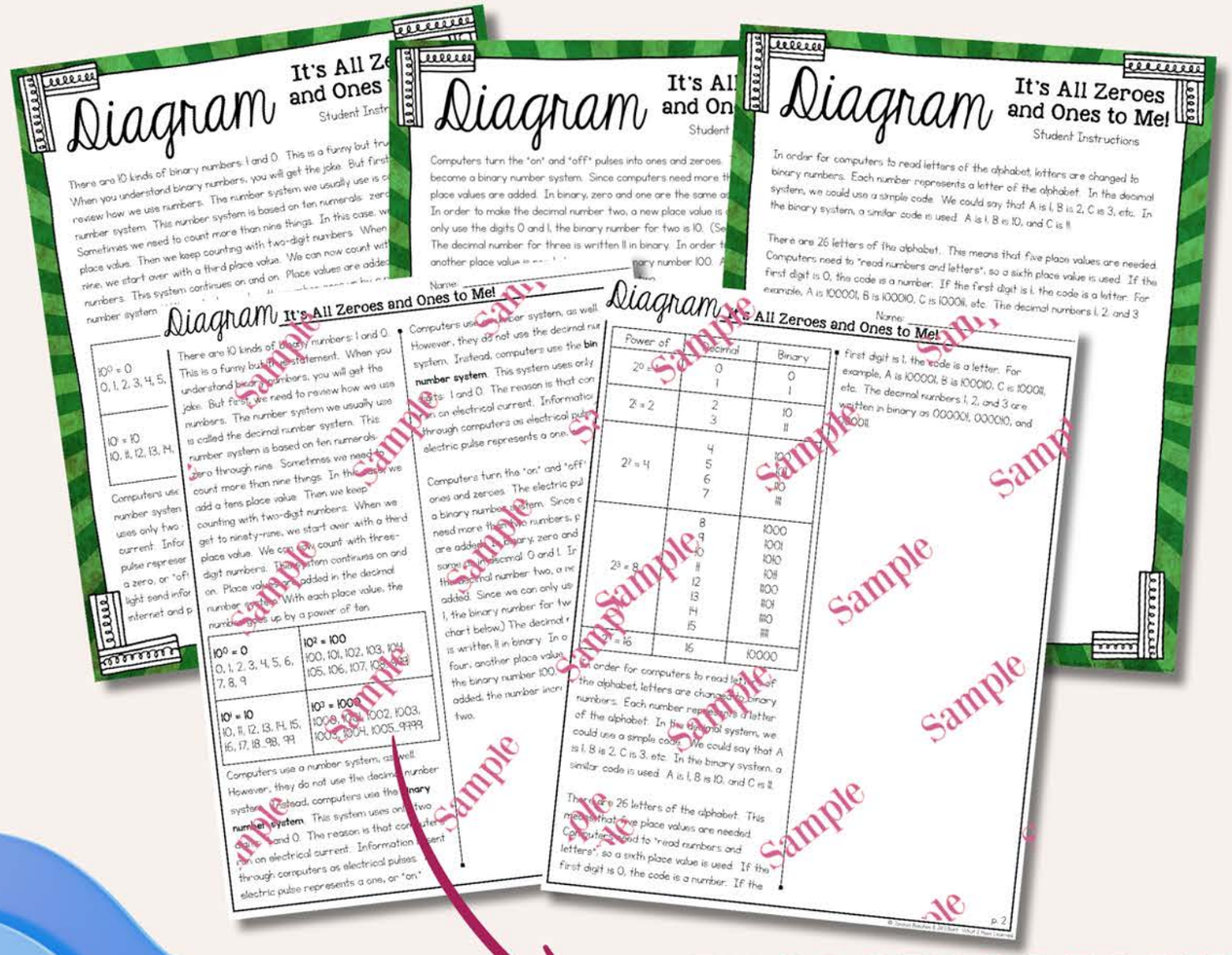
WHAT'S INCLUDED

DIAGRAM SCIENCE STATION

- Teacher Notes
- Student Text in two formats
- Student Instructions
- Activity Sheets for the diagram
- Differentiated Questions
- Answer Key
- Google Form™
- Google Slides™



READING PASSAGE & ACTIVITIES

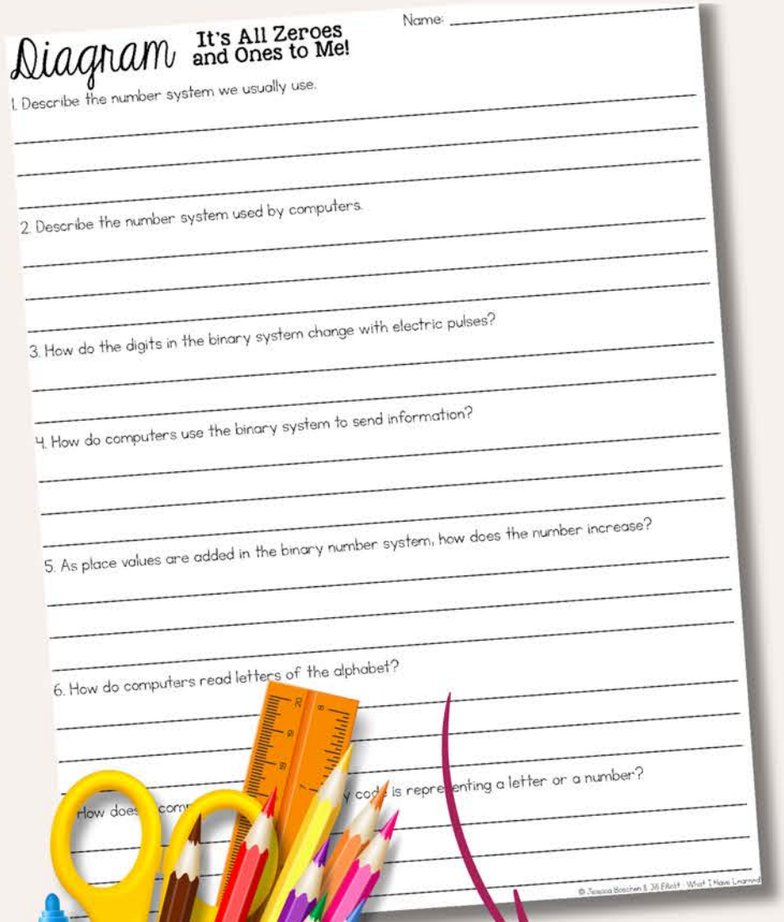


ENGAGING READING: 2 TYPES OF READING PASSAGES



HANDS-ON ACTIVITIES

Differentiated Questions


Diagram It's All Zeroes and Ones to Me! Name: _____

1. Describe the number system we usually use.

2. Describe the number system used by computers.

3. How do the digits in the binary system change with electric pulses?

4. How do computers use the binary system to send information?

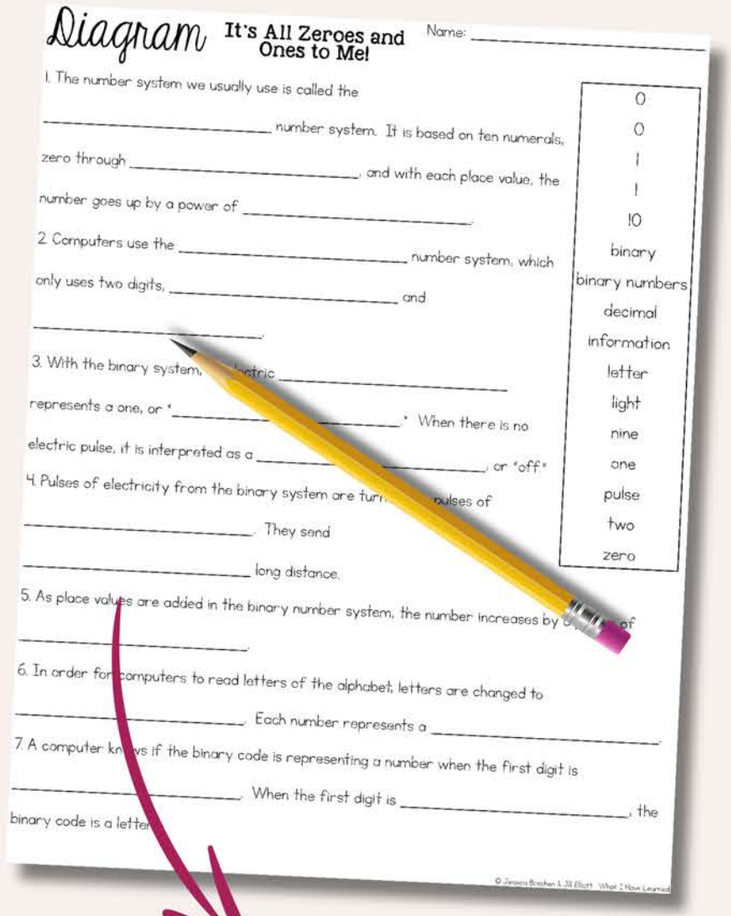
5. As place values are added in the binary number system, how does the number increase?

6. How do computers read letters of the alphabet?

How does ... code is representing a letter or a number?

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SHORT ANSWER


Diagram It's All Zeroes and Ones to Me! Name: _____

1. The number system we usually use is called the _____ number system. It is based on ten numerals, zero through _____, and with each place value, the number goes up by a power of _____.

2. Computers use the _____ number system, which only uses two digits, _____ and _____.

3. With the binary system, electric _____ represents a one, or "_____." When there is no electric pulse, it is interpreted as a _____, or "off."

4. Pulses of electricity from the binary system are turned into pulses of _____. They send _____ long distance.

5. As place values are added in the binary number system, the number increases by a power of _____.

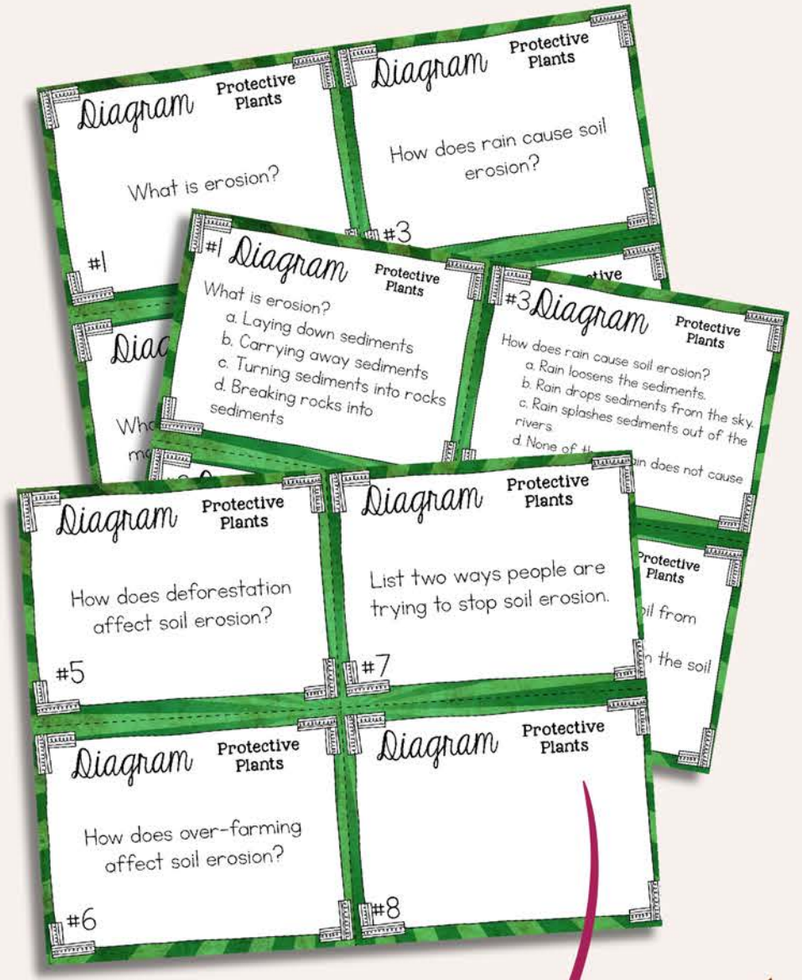
6. In order for computers to read letters of the alphabet, letters are changed to _____. Each number represents a _____.

7. A computer knows if the binary code is representing a number when the first digit is _____. When the first digit is _____, the binary code is a letter.

0
0
1
1
10
binary
binary numbers
decimal
information
letter
light
nine
one
pulse
two
zero

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FILL-IN-THE BLANK



TASK CARDS:
SHORT ANSWER & MULTIPLE CHOICE


Diagram Protective Plants
Student Instructions
In July 2016, there was a terrible wildfire. It happened in Southern California, in a place called Sand Canyon. Sand Canyon is in the mountains. It is home to some of the Angeles National Forest. It took firefighters 3½ months to put out the fire. The area was destroyed. 18 homes were lost. 41,000 acres of land were burned.
Sand Canyon has mostly steep mountains and canyons. There are many bushes and trees. Tall grasses grow in the spring and become food for the deer that live there. When the fire came through, it burned hot and fast. It burned every tree, bush, and grass for miles around. The mountains and canyons were bare of any type of plant.
Most of Southern California's rain
the winter. In December 2016, Sand
Canyon's rainy season began. The
mountains and canyons. The
plants had not grown back since t
her moved into the
area. Homes and streets were
of 2017
brought even more rain. Sand
the worst in its history. Was
something to do with the mu
months, it caused bad mud
erosion.
Erosion is when rocks a
cause erosion. On Earth
energy. When water
when there is more
streams. Small cre
energy, it is able t
carried off in er
and sides of th
Diagram Protective Plants
Student Instructions
Rain causes erosion in the same way streams and rivers do. Rain is moving water that falls from the sky. As it hits the ground, it loosens the sediments. Raindrops falling on mountains come together into streams. These raindrops carry sediments with them into streams. More raindrops make bigger streams. This causes more sediments to be carried down the mountain. If slopes are steep, streams move faster. They have more energy and can carry more sediments.
Too much erosion in mountains can cause problems. Plants protect an area from erosion in a few ways. Plants protect the soil. Trees, shrubs, and grasses cover the ground. This keeps the raindrops away from soil. Falling rain hits the plants and not the soil. Rain then falls off the plants. It rolls downhill from there. These raindrops join together into streams. They take less sediment because the plants are covering and protecting the sediments.
Another way plants prevent erosion is with their roots. Plant roots grow into the ground. Some roots grow straight down and deep. Other roots grow outward. They are just below the surface of the soil. They grow as great mats of roots. This tangled web of roots weaves through the soil. When raindrops hit the soil, the roots hold onto the soil. This keeps the soil from becoming sediments. Less sediment is carried away in streams of rain.
Soil erosion is a big problem around the world. One main cause of soil erosion is deforestation. Deforestation is the clearing of all the trees in a forest. Every hour, more than 200 acres of trees in the Amazon Rainforest in Brazil are cut down. This happens for many reasons. Trees are cut down for lumber for homes and furniture. Trees are used for burning in fires. After the trees are cut down, there are no roots to hold the soil in place. The wind blows away the soil. Rain washes away the soil. If there is too much soil erosion, new plants cannot grow. The area will never be able to become a forest again.
p. 2
Diagram It's All Zeroes and Ones to Me!
Name: _____
The number system we usually use is called the decimal number system.
It is based on ten numerals, zero through nine, and with each place
value, the number goes up by a power of 10.
2. Computers use the binary number system, which only uses two digits,
1 and 0.
3. With the binary system, an electric pulse represents a one, or
one." When there is no electric pulse, it is interpreted as a
zero, or "off."
4. Pulses of electricity from the binary system are turned into pulses of
light. They send inform
long distance.
5. As place values are added in the binary number system, the n
two.
6. In order for
ers to read letters of the alphabet, let
binary numb
. Each number represen
A computer knows if the bi
de is representing a
the first digit
0
binary code is a letter.
SafeShare.tv
Pricing FAQ Sign In
WHAT IS THE INTERNET?
0:05 / 3:44
Diagram It's All Zeroes and Ones to Me!
Describe the number system we usually use.
#1
Diagram It's All Zeroes and Ones to Me!
What is the name of the number system we usually use?
a. Decimal
b. Power
c. Binary
d. Alphabet
Diagram Where Did the Light Go?
Extension
Materials:
Computer
As an extension, watch a these two videos to see what happens to these 1's and 0's when they are used to create the Internet.



Diagram

It's All Zeroes and Ones to Me!

Student Instructions

There are 10 kinds of binary numbers: 1 and 0. This is a funny but true statement. When you understand binary numbers, you will get the joke. But first, we need to review how we use numbers. The number system we usually use is called the decimal number system. This number system is based on ten numerals: zero through nine. Sometimes we need to count more than nine things. In this case, we add a tens place value. Then we keep counting with two-digit numbers. When we get to ninety-nine, we start over with a third place value. We can now count with three-digit numbers. This system continues on and on. Place values are added in the decimal number system. With each place value, the number goes up by a power of ten.

$10^0 = 0$ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$10^2 = 100$ 100, 101, 102, 103, 104, 105, 106, 107, 108...999
$10^1 = 10$ 10, 11, 12, 13, 14, 15, 16, 17, 18...98, 99	$10^3 = 1000$ 1000, 1001, 1002, 1003, 1003, 1004, 1005...9999

Computers use a number system, as well. However, they do not use the decimal number system. Instead, computers use the binary number system. This system uses only two digits: 1 and 0. The reason is that computers run on electrical current. Information is sent through computers as electrical pulses. An electric pulse represents a one, or "on." When there is no electric pulse, it is interpreted as a zero, or "off." These electric pulses can be turned into pulses of light. Pulses of light send information quickly over long distances. This is how we are able to use the internet and phones to communicate with people around the world.

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Diagram

It's All Zeroes and Ones to Me!

Student Instructions

Computers turn the "on" and "off" pulses into ones and zeroes. The electric pulses become a binary number system. Since computers need more than two numbers, place values are added. In binary, zero and one are the same as in decimal. 0 or 1. In order to make the decimal number two, a new place value is added. Since we only use the digits 0 and 1, the binary number for two is 10. (See the chart b... The decimal number for three is written 11 in binary. In order to count to f... another place value is needed, making the binary number 100. As place va... added, the number increases by a power of two.

Power of Two	Decimal Number	Binar...
$2^0 = 0$	0 1	
$2^1 = 1$	2 3	
$2^2 = 4$	4 5 6 7	
$2^3 = 8$	8 9 10 11 1...	
$2^4 = 16$		

Diagram

Activity Sheet

Name: _____

It's All Zeroes and Ones to Me!

Continue filling in the diagram with the binary code for all the letters of the alphabet.

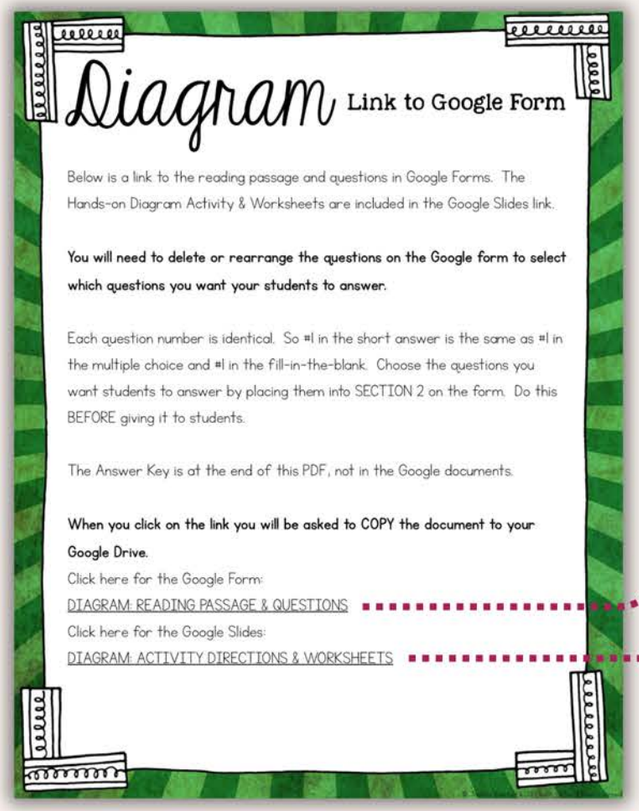
A = 100001	F = 100100	K =	P =	U =
B = 100010	G =	L = 101100	Q =	V =
C = 100011	H=	M =	R = 110010	W =
D=100100	I =	N = 101110	S =	X =
E =	J =	O =	T =	Y =
				Z =

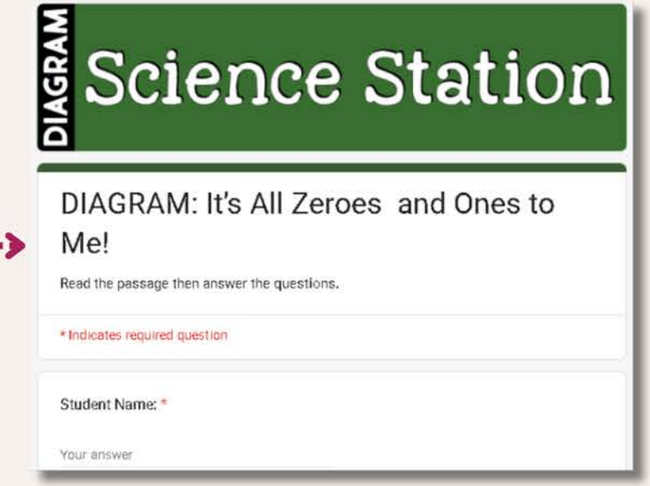
Fill in this diagram with the binary code for numbers.

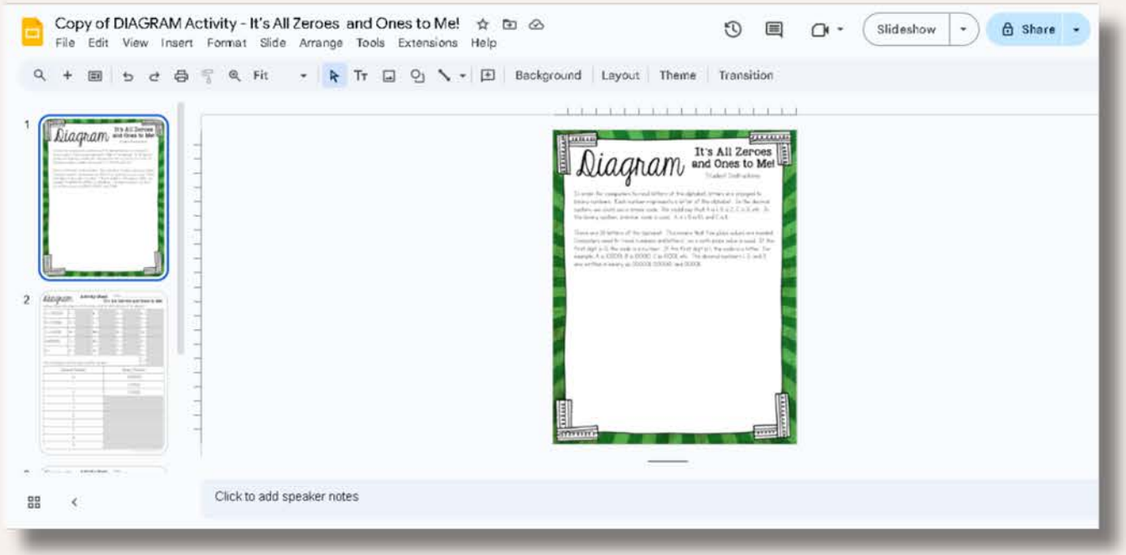
Decimal Number	Binary Number
0	000000
1	000001
2	000010
3	000011
4	
5	
6	
7	
8	
9	

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DIGITAL VERSIONS







DIGITAL VERSIONS

- ✔ Google Sheet with Activity & Directions
- ✔ Google Form with Reading & Questions

Answer keys provided

TEACHERS LOVE IT!

Helped with providing notes.

Sandra O.

This has been amazingly easy to use!!

Sharon P.





My passion is making learning accessible to all students. I love scaffolding learning, breaking down the concepts and building them up so that students can see the connections. I love figuring out the small components that build up to the big ideas and helping students see it all.



teach MATH

teach SCIENCE

teach READING

teach WRITING

What I have LEARNED