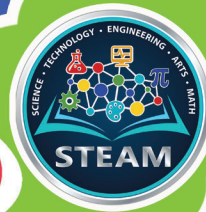


STEAM

KIDS



CIA
ACTIVITY
BOOK

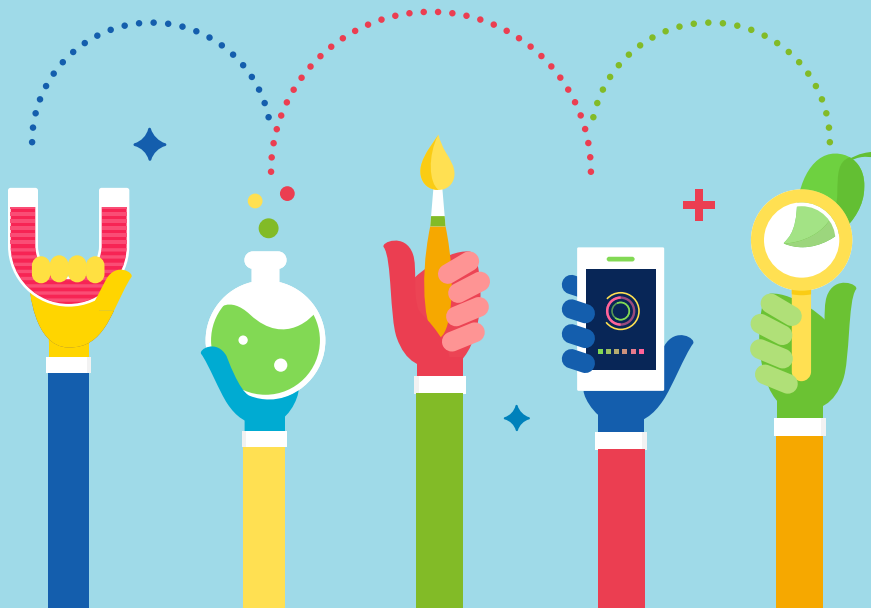


The **NEED** for **STEAM**

STEAM

S = SCIENCE **T = TECHNOLOGY**

E = ENGINEERING **A = ARTS** **M = MATHEMATICS**



Are you interested in Science, Technology, Engineering, Arts, or Math?

The Central Intelligence Agency, often referred to as the CIA, uses STEAM to enable our mission to keep our nation safe!

Do you like to travel? Our Scientists, Technologists, Engineers, Artists, and Mathematicians travel around the world, working with the Intelligence Community, Government, Academic, and Industry partners to solve the challenges we face every day.

Do you like to learn about different countries and cultures? Check out the CIA World Fact Book on CIA.gov

The CIA depends on scientific innovation and diversity of thought to come together to solve the challenging problems we face to keep our nation safe!

Here are some fun STEAM stories and activities to get you **STEAMING ALONG!**

STEAM STORIES

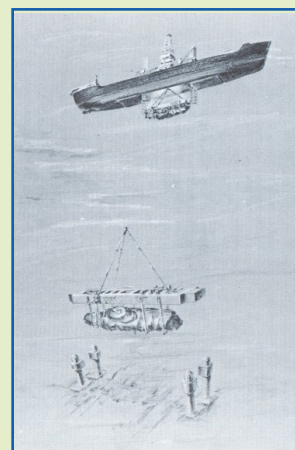
STEAM STORIES



Pigeon Ops

In the 1970s, we created a camera so tiny that a pigeon could carry it! The camera was strapped to the bird's chest with a little harness, and the bird would be released over a secret area in a foreign country that we wanted to know more about. The camera would snap pictures as the bird flew back home to us.

Pigeons were perfect because they are such common birds! Who would ever think a pigeon was actually a secret spy-bird taking photographs for the CIA?



Project AZORIAN

Imagine standing on top of the Empire State Building with an 8-foot-wide claw attached to a 1-inch-diameter steel rope. You must lower the claw to the street below, grab a tiny car full of gold, and lift the car back to the top of the building... without anyone noticing.

(Just like those arcade games with the big claw that you have to try and grab a toy with).

That describes what we did in Project Azorian, where we used a ship called the Glomar Explorer to secretly snatch a wrecked Soviet submarine from the bottom of the Pacific Ocean. It was one of the greatest intelligence successes of the Cold War.

And the claw... her name was Clementine.

STEAM STORIES



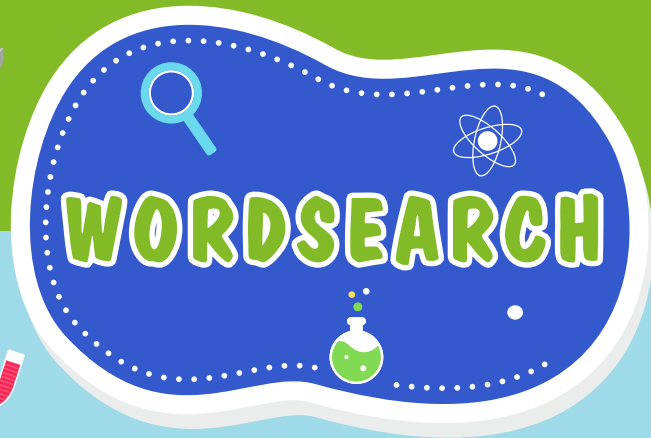
Be the Hero of Your Story

Virginia Hall's life reads like a spy movie. She worked for America's first spy agency, the Office of Strategic Services, during WWII.

Virginia organized spy networks, assisted escaped prisoners of war, and provided essential information to help us win the war. She had to stay one step ahead of the Nazis who desperately wanted to capture her.

For her cunning and courage, she was awarded the Distinguished Service Cross—the only civilian woman in America to be so honored.

After WWII, Virginia joined the CIA. She continued to work on secret operations, one of only a few women at the time to do so, until she retired in 1966. And she did it all despite having a prosthetic leg, which she named Cuthbert.



W	G	U	C	P	T	E	H	L	E	D	I	R	S
D	E	I	F	I	S	S	A	L	C	B	E	G	A
I	N	S	E	A	E	O	L	G	N	Y	J	F	C
R	O	R	D	H	N	T	F	L	E	L	D	E	O
E	I	C	O	M	S	D	I	R	G	S	T	S	M
C	T	S	A	C	O	L	L	M	I	A	E	I	P
T	C	M	T	O	R	A	G	E	L	N	O	S	U
O	E	Y	T	E	C	H	N	O	L	O	G	Y	T
R	L	O	C	Y	A	E	I	F	E	R	T	L	E
I	L	I	G	N	U	M	A	G	T	I	O	A	R
F	O	R	E	O	E	C	E	T	N	F	W	N	O
E	C	Y	T	L	I	G	Y	A	I	R	C	A	N
T	F	A	R	C	R	I	A	S	T	E	O	G	C

COMPUTER
TECHNOLOGY
AGENCY
INTELLIGENCE
CLASSIFIED
DIRECTOR

SENSOR
AIRCRAFT
COLLECTION
STEAM
ANALYSIS

I SPY. IMAGE ANALYSIS

Can you find the difference
between the pictures below?
How many differences can you find?



I SPY IMAGE ANALYSIS

Can you find the difference
between the pictures below?
How many differences can you find?





COMPUTER TALK



COMPUTER TALK

Talk like a computer – Computers talk with Zeros and Ones. They make messages by combining sequences of 0's and 1's that mean the letters of the alphabet.

The table below shows a very simple code used by computers to represent letters called ASCII code.

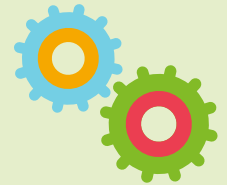
'CAT' = 01000011 01000001 01010100

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

Can you write your name in ASCII?

Can you write a message in ASCII so that a computer can understand it?

Can you decode this computer message?



01001000 01000101 01001100 01001100 01001111
01010111 01001111 01010010 01001100 01000100

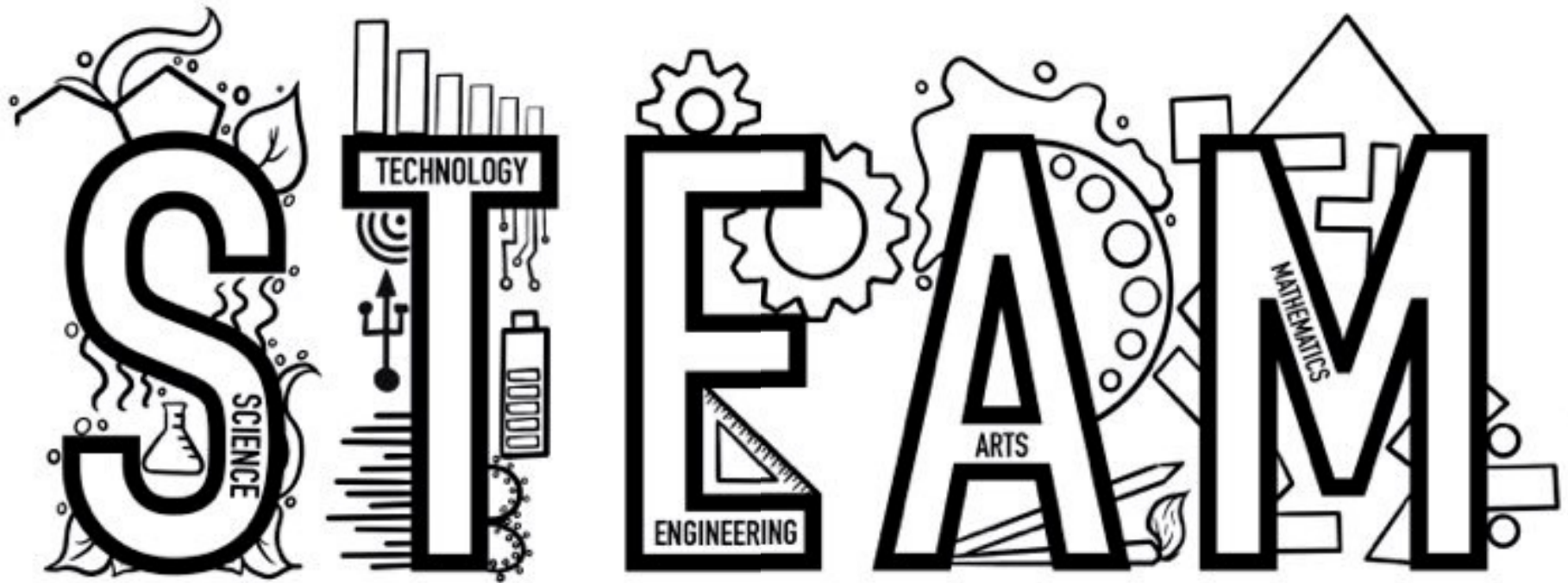
Trade messages with a friend and see if you can read the message like a computer.

01000001	A
01000010	B
01000011	C
01000100	D
01000101	E
01000110	F
01000111	G
01001000	H
01001001	I
01001010	J
01001011	K
01001100	L
01001101	M

01001110	N
01001111	O
01010000	P
01010001	Q
01010010	R
01010011	S
01010100	T
01010101	U
01010110	V
01010111	W
01011000	X
01011001	Y
01011010	Z

COLOR ME

COLOR ME





STEAM RECIPES

Ice Cream in a Baggie

Have you ever made ice cream? It can be a lot of fun, and you end up with a tasty frozen treat! There is actually a lot of interesting chemistry that goes on behind making ice cream.

What you will need:

- ½ cup whole milk or light cream
- 3 teaspoons of sugar
- ¼ teaspoon vanilla extract
- 6 tablespoon of rock salt
- 2 cups of ice
- Zip closure baggies (1 pint sized & 1 gallon sized for each serving)
- Strainer
- Paper towels

1. Inside the pint sized ziploc baggie, mix milk or cream, sugar, and vanilla.
2. Seal bags shut. *(You might reinforce the zip closure with masking tape).*
3. In the gallon-size baggie, put the ice cubes *(bag should be about ½ full with ice)* and add the rock salt.
4. Place the sealed, pint-size baggy into the gallon-size baggie and shake for 5-10 minutes or longer, until the ice cream forms. *(For young children, you might provide gloves to insulate their hands from the cold.)*
5. To serve, clean the salt off the small baggie, then either scoop the ice cream out or cut off one corner of the pint-sized baggie so the kids can squeeze the ice cream out, right into their mouths!

SCIENTIFIC OBSERVATION

Which ingredients changed forms?
What did the salt do to the ice?

Additional Experiment:

Try putting ice in gallon bag without salt.
What did you observe that was different?

States of Matter:

There are three states of matter, Solid, Liquid, and Gas.
In this experiment did you observe Solids? Liquids? Gas?
Did you see things change states between Solid/Liquid/Gas?

THINK LIKE A SCIENTIST

Make an Observation:

Observe the world around you every day!
What is unique and interesting?

Conduct the Experiment:

Now you get to test your hypothesis!

Ask a Question:

Question 'How things work?' or 'how can you make something change?'

Analyze Your Data:

Draw pictures of changes in your system.
Did your data match your hypothesis?

Make a Hypothesis:

What do you think is the answer to your question? Can you test it?

Draw Conclusions:

What did you learn? Was your hypothesis correct? What questions do you have now?

STEAM RECIPES

Make Plastic from Milk!

Did you know you can also turn milk and vinegar (liquids) into plastic? This technique was used from the early 1900s until 1945. It was even used to make jewelry for Queen Mary of England. When some liquids are mixed together, a chemical reaction can occur that causes a solid to form out of that solution.

Casein Plastic Recipe

What you will need:

- 1 cup of milk
- 4 teaspoons of vinegar
- Strainer
- Paper towels

1. Heat milk over stove until it is steaming hot.
(Be sure to have parents help you or you can heat in the microwave!)
2. Mix in Vinegar and stir for 60 seconds.
3. Pour into a strainer to remove the excess liquid.
4. Press on a paper towel to further remove the liquid.
5. Layout and press into a cookie mold set on a paper towel.
6. Dry for 48 hours.
7. Color with paint or permanent markers.

SCIENTIFIC OBSERVATION

Which ingredients changed forms?

What did the vinegar do to the milk?

What did you observe?

States of Matter:

There are three states of matter, Solid, Liquid, and Gas.
In this experiment did you observe Solids? Liquids? Gas?
Did you see things change states between Solid/Liquid/Gas?

THINK LIKE A SCIENTIST

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ACID OR BASE?

ACID OR BASE?

Try This at Home!

A liquid is characterized as being an acid or a base depending on where it lands on the pH scale. In general, a liquid that is acidic is typically sour and a liquid that is a base is typically bitter. In science, pH indicators are used for chemical reactions and understanding the outcome of chemical experiments.

Item								
Color	Red	Pink	Purple	Blue	Light Blue	Green	Yellow	
pH	0	2	4	6	8	10	12	14



At home, how can you determine if a liquid is an acid or base? Purple Cabbage/Red Cabbage is a natural pH indicator and can answer that question for you. The scale above and the colors will help you know what the pH is of a liquid.

What you will need:

- 4 large purple cabbage leaves
- 2 lemons or lemon juice (2-3 oz)
- Baking Soda
- Sugar to taste
- Blender
- 5 clear plastic cups
- Straw

1. Preparation of pH Indicator: In a blender put in 4 large cabbage leaves and fill half way with water. Blend together and strain out the pulp. Pour the liquid into 3 clear plastic cups filling about $\frac{1}{2}$ way.
2. Juice the lemons or place lemon juice in one of the remaining empty cups. Taste the lemon. What does it taste like? Do you think the juice from the lemon is an acid or a base?

3. Put a teaspoon of lemon juice in one of the purple cabbage juice cups.
 - What color did it turn?
(Check out the pH indicator color strip on the previous page!)
 - Is it an Acid or Base?
4. Place a teaspoon of baking soda in one of the purple cabbage juice cups.
 - What color did it turn?
(Check out the pH indicator color strip on the previous page!)
 - Is it an Acid or Base?
5. In your last empty cup, mix a tablespoon of lemon juice with a teaspoon of baking soda. What happens?
FIZZY LEMONADE!!
NOTE: This is a chemical reaction that causes carbon dioxide to form. When we breathe out we also create carbon dioxide.
6. Take a straw and blow into the last cup of the purple cabbage juice – what happens?
7. Lastly, mix your fizzy lemonade mixture into the last purple cabbage juice cup. What happens?

Add sugar to your fizzy lemonade mixture and enjoy!

Find other things in your house to test with your purple cabbage juice. (Suggestions: vinegar, soap, bleach. Make sure you ask your parents before testing)

SCIENTIFIC OBSERVATION

THINK LIKE A SCIENTIST

Make an Observation:

Observe the world around you every day!
What is unique and interesting?

Conduct the Experiment:

Now you get to test your hypothesis!

Ask a Question:

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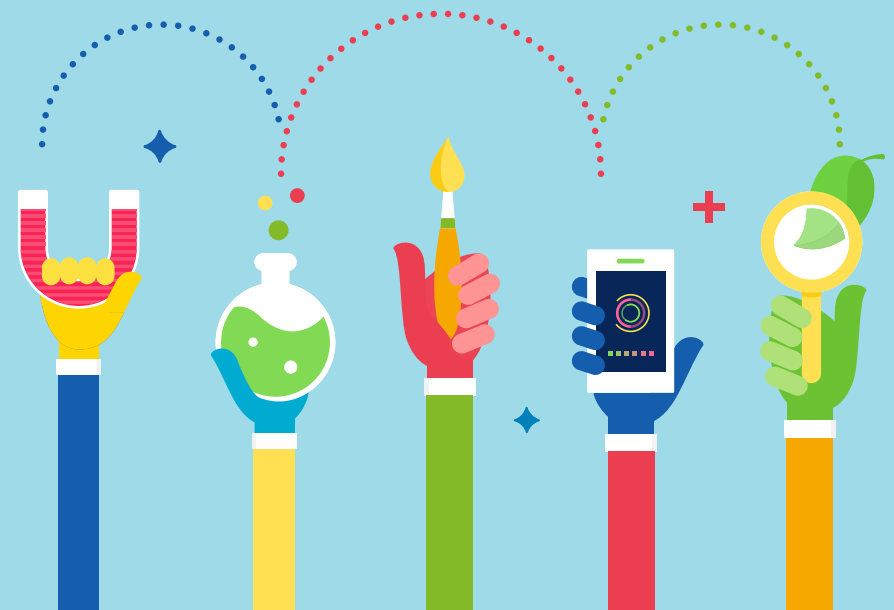
What do you think is the answer to your question? Can you test it?

Draw Conclusions:

What did you learn? Was your hypothesis correct? What questions do you have now?

INNOVATE & CREATE

What ideas do you have that can keep the nation safe by using science and technology?



CHEMISTRY EXPLANATION

What is a pH scale? The pH scale tells us if a substance is an acid or a base. The numbers 0-7 represent acids, 7-14 represent bases with 14 as the strongest base. Substances that are right at 7 are neutral.

What is a pH indicator? A pH indicator can show us if a substance is an acid or base.

What is an Acid? The word Acid comes from the Latin word 'acere' which means sour. Acids donate hydrogen ions.

What is a Base? A Base usually has a bitter taste and a soap-like texture. Bases accept hydrogen ions and most contain hydroxide ions. What happens when you mix an acid and a base? They create a chemical reaction. The closer an acid is to 0 and the closer a base is to 14, the stronger the reaction.

What is the science behind purple cabbage as an Acid or Base? Purple cabbage contains a water-soluble pigment called anthocyanin that changes color when mixed with an acid or base.

How did ice cream form in a bag? Pure water freezes at 0° Celsius. Salt lowers the melting temperature of ice so it starts to melt. Melting needs energy which comes from the milk mixture in the bag. Heat energy is absorbed from the milk making ice crystals form between the tiny fat molecules. The more salt the lower the freezing point.

Why did the milk and vinegar form a solid? All plastics are composed of molecules that repeat themselves in a chain called polymers. Milk contains many molecules of protein called casein. Individual casein molecules form chains which creates a polymer and causes milk to form into plastic.

RESEARCH

- More information can be found online.
- Review your experiments and results.
- What types of chemical reactions were you able to create?
- What was the strongest Acid you found?
- What was the strongest Base that you found?
- Think about other things that may have impacted your experiments. (Air Temperature, type of salt used for ice cream, how much fat was in the milk for ice cream and casein plastic. What other factors can you think of that may have made your experiment more/less successful?)
- What other experiments can you find that can help you learn more about acids, bases and chemical reactions?

Find more information
and ideas
at [CIA.GOV](https://www.cia.gov)

