LESSON PLAN

Social Media

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

Social Media

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students will take a brief survey concerning their use of social media. Class data will be collected and analyzed before students create quick graphs of the data. Class data will be compared to global data.

DURATION

Approximately 1 class period.

STANDARDS ADDRESSED

Common Core Standards in Mathematics

- **CCSS.MATH.CONTENT.6.SP.A.1** - Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
- **CCSS.MATH.CONTENT.6.SP.B.5** - Summarize numerical data sets in relation to their context.

OUTLINE OF LESSON

- Teacher activates prior knowledge of social media.
- View the Brainchild "Social Media" episode.
- Students complete the Social Media Survey.
- Teacher facilitates data collection/ analysis.
- Students summarize and graph based on social media data collected.

ACTIVITY PROCEDURE

- Teacher will present the warm up: ***List anything that comes to mind when you hear "social media".*** Have students share out and splash their ideas on the board. Teacher will introduce the "Social Media" episode and explain that they will be thinking about their own use of social media in the activity to follow.
- Whole class will watch the "Social Media" episode.
- Students will take 5 minutes maximum to complete the Social Media Survey.
- Teacher will facilitate the sharing of data and record on chart paper. The whole class will move through the questions to share information before going back to independently complete necessary calculations and graphs.
  - Teacher will record # of students in class on board.
  - Question 1, students will call out their average hours on social media, record on board. Students can find class average. Students will complete bar graph of data after whole class data collection is complete.

- Question 2, teacher will go through social media platforms to collect their amount of use. Students will raise hands if they use the given platform, results will be recorded on board. Students will convert data into percentages, then record in the given table, and create graphs comparing class and global data after whole class data collection is complete.
- Question 3, teacher will record on the board the number of students who chose "1" for each of the technology categories. Students will calculate and record percentages in the given table, and create a pie graph of data upon completion of whole class data collection.
- Question 4, students will share out, by a show of hands, if they, or someone they know has been a victim of cyberbullying. Class will record results for later completion of percentage and reflection.
- Students will go back and complete question 5, percentages, graphing, and reflections independently. *Note: Graphs should be completed with thin marker or colored pencil in order to fit in space provided.*

FOLLOW-UP

Students will complete the Social Media Data Sheet for homework. Percentages and results should be compared the following day for accuracy and reflection. Question 4, ***How does social media technology both connect and disconnect people?***, can be used as a springboard the next day after students have had time to digest the question more. This question can also be used as a larger writing assignment.

MATERIALS LIST

• Student Activity Resource

• Chart paper for whole class data

Name _____ **Date** _____

Social Media Survey

1. What is the average amount of time (in hours) you spend on social media each day?

_____hrs./day

2. Please check of all social media platforms below that you currently use:

_____Facebook

_____Instagram

_____ Twitter

_____ Youtube

_____ Snapchat

3. Rate the following technology categories that your smartphone has replaced based on how often you use them (1 = use the most, 5 = use the least).

_____ Internet Surfing/Research

_____ Games

_____ Taking videos / photos

_____ Listening to music

_____ Watching TV / movies

4. Have you or someone you know been a victim of cyberbullying?

_____

5. How many selfies do you take in a week?

_____ Selfies/week

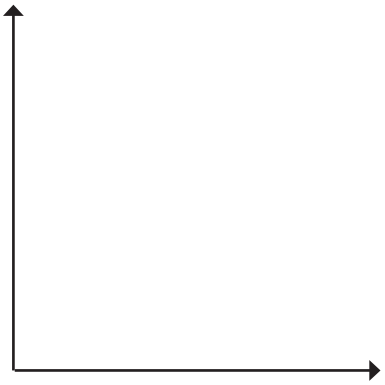
Name _____ Date _____

Social Media Data Sheet

1. Some surveys report an average of two hours per day that people spend using social media (depending on age group), and some report much more. Use your class data to create a simple bar graph comparing your usage, the class average, and the two-hour reported global average (Global WebIndex). Be sure to label your axis and create a logical scale for the y-axis.

Class Average _____

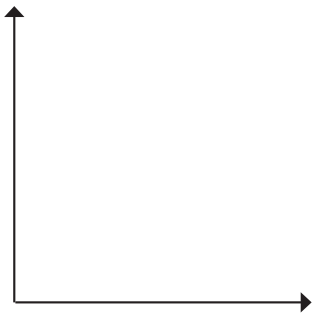
Your Average _____



2. In a 2018 study conducted by the Pew Research Center, the percentage of US teens using certain social media platforms are shown in the table below. Turn your class averages into percentages and write those averages into the table. Then, create a bar graph to compare your class to the national percentages.

Total Students in Class _____

Social Media Platform	National %	Total Class "yes" Responses	Class %
Facebook (FB)	51	2	
Instagram (IG)	72		
Twitter (TW)	32		
YouTube (YT)	85		
Snapchat (SC)	69		

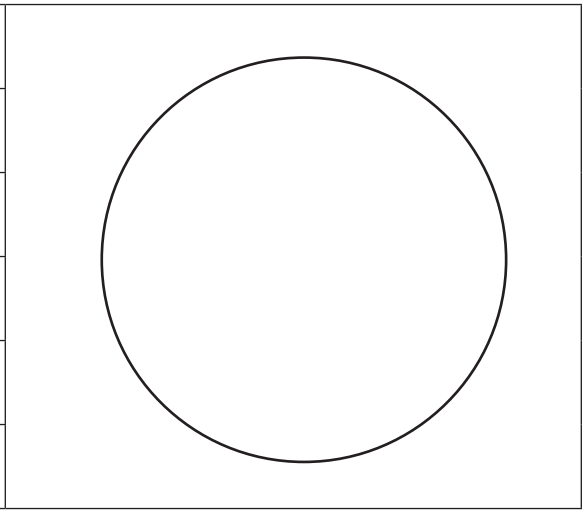


Name _____ Date _____

Social Media Data Sheet

3. Complete the table below to display the percentages of students who placed a "1" next to each of the categories in survey question #3. Create a pie graph to show the extent to which different technology categories have been replaced by our cell phones.

Total Students in Class _____

Technology category	# **students**	**Percentage**	
Internet Surfing / Research			
Games			
Taking videos / photos			
Listening to music			
Watching TV / movies			

4. What percentage of the class has or knows someone who has been a victim of cyberbullying? There are always two sides to technological advancement (think about nuclear technology and genetic technology). How does social media technology both connect and disconnect people?

Total Students in Class Responding "yes" _____

_____

_____

_____

5. In the episode, you learned that millennials take an average of about 25,000 selfies in their lifetime. An average lifetime for a human is 70 years (and increasing). Use the number of selfies/week you recorded in survey question #5 to determine the number you will take in a lifetime (assuming you keep taking them at the same rate and you live to 70!). Use the conversion factors shown below to help you.

12 months = 1 year *4 weeks = 1 month*

Show Work:

LESSON PLAN

Germs

GRADE LEVEL: MIDDLE SCHOOL

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Germs

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students will model the effects of the use of an antibiotic/antibacterial solution on a population of bacteria. A small number of bacteria in any population may be resistant to an antibiotic due to random genetic mutations. Students will graph and analyze their data and conclude in the context of Natural Selection.

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

Next Generation Science Standards

- **MS-LS4-4** - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1** - Write arguments focused on *discipline-specific content.*
- **CCSS.ELA-LITERACY.WHST.6-8.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

OUTLINE OF LESSON

- Class will be introduced to the content with a warm up prompt on hand sanitizers and potential risk.
- Class will view the Brainchild "Germs" episode.
- Class will complete the Antibacterial Products and Natural Selection Activity.
- Class will participate in graphing analysis and conclusion.

ACTIVITY PROCEDURE

- Teacher will present warm up prompt: Why do hand sanitizers state that they kill 99.9% of bacteria on your hands? What about the .1%? What happens to them?
- Whole group will discuss thoughts on the topic and teacher will guide towards understanding the overuse of antibiotics can encourage resistant strains.
- Teacher will explain that students will be learning about germs, also referred to as pathogens, which are types of microbes that can cause disease. To follow up the episode, class will be digging deeper into understanding the effects of antibacterials or antibiotics on bacterial resistance.

- Class will view the "Germs" episode.
- Students will participate in the Antibacterial Products and Natural Selection Activity after teacher explains that the marshmallows represent normal bacteria, the hard candies represent bacteria with a genetic mutation, and the toothpick represents the antibacterial.
  - Students should be divided into groups of 3-4. Each group of students will receive a paper plate, toothpick, and a cup each of mini marshmallows and any small round hard candy (something difficult to pick up with toothpick).
  - Teacher will read through the procedure with students after distributing the activity resource.
  - Teacher will instruct each pair to place 2 hard candies and 8 marshmallows on the plate.
  - On teacher's cue, one group member will use the toothpick alone to pick up as many candies as possible, one at a time, and place it in the cup in 7 seconds. Students can use their hand to remove bacteria from toothpick.
  - Students will count marshmallows (normal bacteria) and hard candies (mutated bacteria) remaining on the plate, and double the amount of each to represent reproduction.
  - This will be repeated with each group member for 4 trials.
- Students will record and analyze data on activity sheet and respond to the questions:
  1. Using quantitative evidence from your graph, explain which bacteria (normal or mutated) were killed most easily with each use of antibacterial.
  2. If the trend in your data continues (if you continued with a 5th, 6th, 7th dose) what do you predict will be the outcome for both types of bacteria?
  3. In 5-7 sentences, explain which type of bacteria experienced a population growth and which experienced a decline. In your answer, use the words survive, natural selection, environment, adapt/ adaptation, and gene.

FOLLOW-UP *(optional homework or classwork)*

- Students can create a graph of their data.
- Mini research project: Antibiotics save lives. How can their misuse lead to the development of stronger, more resistant strains of bacteria? How can we use antibiotics safely?

MATERIALS LIST

- Student Activity Resource, 1 per student
- Toothpicks, at least 1 per student
- Mini marshmallows
- Small hard candy (Skittles)
- Cups, 1 per small group

Name _____ Date _____

Antibacterial Products and Natural Selection

PROCEDURE

1. Place 8 mini marshmallows and 2 small hard candies on the plate in the middle of your group. The marshmallows represent normal bacteria and the hard candies represent bacteria with a genetic mutation.
2. On the teacher's cue, one student from your group will use the toothpick, which represents the antibacterial, to pick up as many bacteria as possible and place in the empty cup in 7 seconds. Only one bacterium at a time may be picked up.
3. Count how many bacteria of each kind are left on the plate and record in your data table.
4. The bacteria left on the plate are now going to reproduce. Double the number of both types of bacteria left on the plate. Record this number in your data table.
5. A new student in your group will now repeat steps 2-4.
6. Repeat steps 2-4 until all members of your group have had a chance.

Time	# of Normal Bacteria	# of Mutated Bacteria
At the beginning	8	2
After 1st dose of sanitizer (D1)		
After 1st reproduction (R1)		
After 2nd dose of sanitizer (D2)		
After 2nd reproduction (R2)		
After 3rd dose of sanitizer (D3)		
After 3rd reproduction (R3)		
After 4th dose of sanitizer (D4)		
After 4th reproduction (R4)		

Name _____ Date _____

Antibacterial Products and Natural Selection

CONCLUSIONS AND ANALYSIS

1. Using quantitative evidence from your graph, explain which bacteria (normal or mutated) were killed most easily with each use of antibacterial.

2. If the trend in your data continues (if you continued with a 5th, 6th, 7th dose) what do you predict will be the outcome for both types of bacteria?

3. In 5-7 sentences, explain which type of bacteria experienced a population growth and which experienced a decline. In your answer, use the words survive, natural selection, environment, adapt/ adaptation, and gene.

Name _____ Date _____

Antibacterial Products and Natural Selection

MINI RESEARCH PROJECT HOMEWORK

Use reliable resources to research the following prompt:

Antibiotics save lives. How can their misuse lead to the development of stronger, more resistant strains of bacteria? How can we use antibiotics safely? Respond in essay form and record your resources. Continue on separate paper if necessary.

LESSON PLAN

Superheroes

GRADE LEVEL: MIDDLE SCHOOL

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Superheroes
Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students explore what can seem like super powers but are just the ability to understand and use the physical laws of nature. Students will learn about an object or person's center of gravity and then how to use it to seemingly immobilize people or make them lose their balance. Superpower: Mind Control!

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

Next Generation Science Standards

- **MS-PS2-4** - Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1** - Write arguments focused on *discipline-specific content*.

OUTLINE OF LESSON

- Introduction to the topic of the Brainchild "Superheroes" episode.
- View episode
- Students independently read background information on center of gravity.
- Students will work in pairs to carry out simple experiment using their body and a wall or door frame, make careful observations of center of gravity and develop physical explanations for their observations.

ACTIVITY PROCEDURE

- Class will participate in a warm up discussion. Teacher will present the following questions: What are superpowers? List them. Are there any true stories of humans who seem to have superpowers? Splash list of human superpowers on board, students will want to share out and explain the stories they have heard. Teacher will introduce the "Superheroes" episode.
- Whole class will view the "Superheroes" episode.

- Students will read background information regarding an object's center of gravity provided on activity resource as a whole group, small group, or independently.
- In pairs, students will follow the procedure given on the activity resource, taking turns standing with one foot and shoulder against the wall, trying to lift their other foot off the ground. It's impossible! Students will try to pick up an object that is just a foot away from him or her while his or her back is to the wall and heels are against the wall. Keep the area clear as you're sure to have tumbling students! Now students will repeat both tasks without standing near the wall. Make careful observations of center of gravity as you make the motions. All observations will be recorded on given chart. Students will begin to analyze their results in class and will complete that section for homework by responding to the following prompts: Explain why you were unable to lift your leg when one side of you was against the wall but you were able to without the wall. Be sure to include your center of gravity in your explanation. Explain why you were unable to pick up the object when your heels were against the wall but you were able to without the wall. Be sure to include your center of gravity in your explanation. What does wearing a heavy book bag do to your center of mass? How do we usually compensate for this change to maintain our balance?

FOLLOW-UP

Students will complete the analysis portion of their activity resource for homework. Whole group can discuss analysis the following day.

MATERIALS LIST

- Student Activity Resource, 1 per student

Name _____ Date _____

Superheroes: Center of Mass

BACKGROUND

Although invisible, gravity is a force that exists between any two objects, such as the Earth and yourself. When you move, gravity acts on you as if you are just one point of mass (not many points like arms and legs), almost like averaging all your different parts together. This point is called your **center of mass**. It is somewhere just below your belly button and will change as you grow, and your body changes shape. If you stand with your feet about shoulders width apart, your center of mass is directly above what is supporting you on Earth's surface (your legs), and you feel steady and balanced. When you lean forward or backwards, your center of balance is no longer right over your supports, and you feel unbalanced. You could even tip over!

PROCEDURE

1. Stand with one side of your body against a wall (shoulder and foot should touch the wall). Try with all your might to lift your other leg off the ground. It's as if your foot is glued to the ground!
2. Stand with your back to the wall (heels should be touching the wall) and try to pick up an object that is just a foot away from you without bending your knees.
3. Repeat steps 1 and 2 but this time away from the wall. Carefully observe your movements during these activities. Record your observations.

Position	**Observations** (note center of mass)
Side against wall, lift leg	
No wall, lift leg	
Back to wall, pick up object	
No wall, pick up object	

Name _____ **Date** _____

ANALYSIS

1. Explain why you were unable to lift your leg when one side of you was against the wall but you were able to without the wall. Be sure to include your center of gravity in your explanation.

2. Explain why you were unable to pick up the object when your heels were against the wall but you were able to without the wall. Be sure to include your center of gravity in your explanation.

3. What does wearing a heavy book bag do to your center of mass? How do we usually compensate for this change to maintain our balance?

LESSON PLAN

Dreams

GRADE LEVEL: MIDDLE SCHOOL

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Dreams

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

While the underlying purpose of dreaming is still heavily debated in the scientific community, there are undeniable physiological processes that are reset and rejuvenated when a person goes through the sleep and dreaming cycle. There is ample evidence for the physical conditions that result from a lack of sleep and dreaming such as increased risk of heart disease, diabetes and obesity. In this activity, students will explore reaction time and the effect that sleep and dreaming has on reaction time.

DURATION

Approximately 1 class period and follow-up discussion.

STANDARDS ADDRESSED

Next Generation Science Standards

• **MS-LS18 -** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

OUTLINE OF LESSON

- Warm Up: Why do we dream while we sleep? Can sleep and dreaming improve our performance on a task?
- View the Brainchild "Dreams" episode.
- Reaction time activity

ACTIVITY PROCEDURE

- Teacher will introduce the topic of the "Dreams" episode by posing the questions: Why do we dream while we sleep? Can sleep and dreaming improve our performance on a task? Whole class will generate ideas and discuss.
- Whole class will view the "Dreams" episode, while considering the class discussion topic.
- Students independently read the background information regarding memory, dreaming, and reaction time and follow procedure in pairs: catching a falling ruler as quickly as possible after it is dropped, determining reaction time. Data will be entered into provided data table in addition to class data collection chart (see sample). Final trials will be completed before bed and after waking up in the morning for homework. See activity resource pages for more details. **Note: half the class should act as a control group and do the second set of trials long before they go to bed. Entire class will complete trial upon waking in the morning.**

EXAMPLE CLASS CHART

	Round 1	**Round 2** Record in school data (Partner A)	**Round 2** Record at home data (Partner B)	**Round 3**
Student Name				
Class Average Reaction Times				

FOLLOW-UP

Teacher will facilitate a follow up discussion of results the next day. Students will complete the Dream Survey as a warm-up or as homework. Students will enter their reaction time averages data on a class chart in order to calculate whole class average reaction times for the three different collection times. Discussion questions: Does there seem to be a correlation between the performance on a task and how close to bedtime you practice it? Provide evidence in your answer. How could you improve this experiment? What variables did we fail to control? What makes sleep and dreaming experiments so difficult to conduct?

MATERIALS LIST

- Rulers
- Student Activity Resource: in-class activity, reaction time conversion chart, homework sheet
- Chart paper

Name _____ Date _____

Dreams: Sleep and Reaction Time

BACKGROUND

Your five senses receive information from the environment through specialized sensory neurons and are carried to the brain as electrical impulses. Your brain then processes this information and produces a physical response, but also a memory. While the world of dreaming is far from understood by science, it is commonly believed that our sleep and dreaming cycle has a great deal to do with our processing of information from the day.

In this activity, you will carry out a simple task to determine your reaction time, or how quickly you respond to a stimulus. You will then repeat the task at home just before bed and then again first thing in the morning. You will make careful note of how long you slept and any dreams you can recall. One question we are trying to answer is: Will reaction time on a task improve in the morning if you do it right before bed as opposed to earlier in the day?

PROCEDURE

1. Sit with your arm resting on a table but your hand off the table. Hold your thumb and forefinger about an inch apart.

2. Have your partner hold the ruler from the 30.5 cm end so the zero end is hanging at the top of your open thumb and forefinger.

3. Without warning your partner is to release the ruler and you are to catch it with your two fingers as soon as you can.

4. Measure the distance in cm the ruler fell before it was caught. Measure from the top of your thumb and forefinger. Record this data in your table.

5. Use the reaction time conversion chart to convert the distance in cm to time in milliseconds.

6. Repeat steps 1-5 four more times for a total of five trials, determine your average reaction time.

7. Switch roles with your partner and repeat steps 1-7.

Partner A only:

8. Repeat steps 1-7 before leaving school today, record all data.

Partner B only:

9. Repeat steps 1-7 just before going to bed tonight, record all data.

Both Partners:

10. Repeat steps 1-7 ten minutes after waking up the next morning. Record all data, respond to dream/sleep questionnaire.

Name _____ Date _____

Sleep and Reaction Time

DATA COLLECTION

Round 1 **Ruler Task**

Trial	Distance (cm)	Reaction Times
1		
2		
3		
4		
5		

Average Reaction Time: _____

Round 2 **Ruler Task** (circle A or B)
Partner A in school control group
Partner B before bed

Trial	Distance (cm)	Reaction Times
1		
2		
3		
4		
5		

Average Reaction Time: _____

Round 3 **Ruler Task**
After waking up in the morning

Trial	Distance (cm)	Reaction Times
1		
2		
3		
4		
5		

Average Reaction Time: _____

Class Data

Group	Average Reaction Time (s) **Round 1**	Average Reaction Time (s) **Round 2**	Average Reaction Time (s) **Round 3**
A			
B			

Name _____ Date _____

Dreams: Sleep and Reaction Time

WARM UP - DREAM SURVEY

"Sleep hacks", such as routine bedtimes, avoiding food consumption right before bed, and limiting screen time are highlighted in the "Dreams" episode of Brainchild.

Write your observations of the previous night and this morning in the table. Comment on whether or not this was a typical night/morning or not. (ex. "I went to bed at 11:00pm but I usually go to bed much later")

Sleep Hack	**Observations**
Routine (going to bed and waking up at same time)	
Avoiding Eating (when and what did you eat last?)	
Screen Time (what and for how long did you watch/ play?)	

Do you remember any of your dreams from last night? If so, record anything you can remember.

_____

_____

ANALYSIS AND DISCUSSION OF SLEEP AND REACTION TIME DATA

Both the A and B students did the task the same number of times. The variable we looked at was whether or not doing the task right before bed would increase performance due to the processing occurring in our sleep. Answer the following questions based on the shared class data.

DISCUSSION POINTS

- Does there seem to be a correlation between the performance on a task and how close to bedtime you practice it? Provide evidence in your answer.
- How could you improve this experiment? What variables did we fail to control? What makes sleep and dreaming experiments so difficult to conduct?

Name _____ Date _____

Reaction Time Conversion Chart

Distance (cm)	Time (s)	Distance (cm)	Time (s)
1	.045	16	.181
2	.064	17	.186
3	.078	18	.192
4	.090	19	.197
5	.101	20	.202
6	.111	21	.207
7	.120	22	.212
8	.128	23	.217
9	.136	24	.221
10	.143	25	.226
11	.150	26	.230
12	.156	27	.235
13	.163	28	.239
14	.169	29	.243
15	.175	30	.247

The above reaction times were found using the following equation where d=distance ruler fell, a=acceleration due to gravity (980 cm/s2), t=time:

$$t = \sqrt{2d/a}$$

brainchild

LESSON PLAN

Space

GRADE LEVEL: MIDDLE SCHOOL

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i am OTHER NETFLIX ATOMIC ENTERTAINMENT

Space
Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students focus on concepts of pressure through the guiding question explored in the Brainchild episode, "Space": What would happen to a body in space? Students will diagram and analyze a teacher demonstration of the force of atmospheric air pressure. Students will then explore atmospheric pressure in a hands on activity that demonstrates what 15 lbs/in^2 feels like.

DURATION

This collection of activities can be used as a 2 class period activity using all of the provided centers, or as a 1 class period activity if teacher chooses to isolate the forces.

STANDARDS ADDRESSED

Next Generation Science Standards

- **MS-PS1** - Develop models to describe the atomic composition of simple molecules and extended structures.
- **MS-PS1-4** - Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

OUTLINE OF LESSON

- Warm Up: "What do you think would happen to your body in space without a suit? Why?"
- View the Brainchild "Space" episode.
- Pressure demo and student activity.

ACTIVITY PROCEDURE

- Students will discuss as a whole group their responses to the warm up question, "What do you think would happen to your body in space without a suit? Why?"
- Class will view the "Space" episode with pressure in mind. *Note: scale of the universe and the goldilocks zone segments are especially useful in the discussion as well.

- Students will independently, in partnerships, or as a whole group read the background information regarding atmospheric pressure on the Student Activity Sheet.
- Teacher should have the air pressure can-crushing demonstration set up at the front of the class: a clean soda can with a small amount of water in it, heating to boil on a hotplate or burner with a small container of ice water next to the hotplate.
- Students diagram the current state of the demonstration in the Student Activity Resource.
- Once steam is visible coming from the opening of the can, teacher should invert the can into the small container of ice water. This will demonstrate how air pressure moves from high to low. The can crushes when the hot steam is rapidly cooled and condensed in the can in the ice bath, causing the pressure to drop, and crush the can. Because there is no longer air in the can, you've created a vacuum.
- After observing the collapse of the can, students will record high and low pressure areas inside and outside of the can using diagram format and respond to analysis question.
- Students will read an extension regarding pressure on airline flights and the effects on everyday objects.
- Teacher will facilitate a class discussion around student responses to the question: How will your plastic/foil sealed gum or sealed water bottle change from lift-off to flight?

FOLLOW-UP / HOMEWORK

In the Space: Pressure Drop Follow Up (see Student Activity Resource), students will work to explore air pressure on a single square inch and then over the many square inches that make up the surface of a newspaper. Students will calculate the air pressure exerted over the surface of the newspaper as they develop their understanding of how pressure affects the universe around us.

MATERIALS LIST

- Student Activity Resource
- Ice bath
- Empty soda can
- Rulers (1/group)
- Heat source (hot plate, burner)
- Newspaper (2 sheets/group and 1 inch square piece/group)

Name _____ Date _____

Space: Pressure Drop

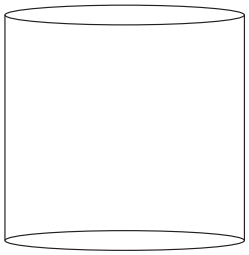
BACKGROUND

In this episode of Brainchild, you learned that **air pressure** is the weight of the atmosphere on a planet. Let's dig a little deeper into what this means before we experiment with the pressure on our planet. Remember that an atmosphere on any planet is made up of different gases held near the planet by gravity. Here on Earth, many gases make up our atmosphere, or air. However, most of the air (99%) is just nitrogen and oxygen. It's hard to imagine because we can't see it, but the molecules that make up air have mass. Even though the mass of an oxygen molecule might be very small, like the straw that broke the camel's back, if you put a whole bunch of them together the weight can be substantial! As we walk on the surface of the planet we have 62 miles worth of air molecules stacked on top of us, or about 15 pounds of pressure on every square inch of our bodies (14.7 to be exact). As you move up through the atmosphere towards space, there is less and less air stacked on you and therefore, less and less air pressure. When you get to space there are very few molecules at all and therefore very little pressure at all (so little we can consider it to be zero). So, the more molecules of gas in an area, the higher the **air pressure.**

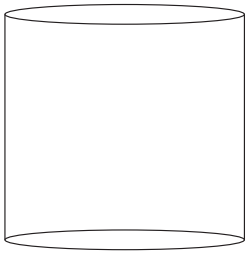
Task 1

INSTRUCTIONS

To show the force of 15 lbs/in^2, your teacher will set up a demonstration which you will diagram and base predictions on. Remember that air always moves from high pressure to low pressure. In the can below, sketch and label the initial set up and use circles/dots to represent molecules in the liquid and gas phases.



1. When the can is quickly cooled (and no more air can enter) the water vapor that now fills the can is condensed back into a liquid. Keeping in mind what air pressure is, label the inside and outside of the can below with an "L" or an "H" for "low pressure" or "high pressure".



2. If 15 lbs/in^2 are always pushing on all objects at the surface of Earth, then why doesn't an empty soda can crush on its own?

_____

_____

Name _____ **Date** _____

In this activity you explored one of the fundamental principles of our universe, pressure moves from high to low in fluids (liquids and gases). You also explored the effects of many invisible molecules in a gravitational field that changes with distance from Earth (or any other body in space). Packages of gum and water are manufactured at the Earth's surface with little pockets of air in them. On a typical flight, 40,000 feet above the surface of Earth where there are fewer gas molecules, the cabin of a plane is pressurized (adding air molecules) so we are comfortable and feel at home. The plane exterior or "skin" is engineered so it doesn't blow outward from higher to lower pressure (few molecules outside plane means low pressure). The cabin of a plane, however, is at a lower pressure than we are used to at Earth's surface.

3. How will your plastic/foil sealed gum or sealed water bottle change from lift-off to flight?

_____

_____

_____

Space: Pressure Drop Follow up
Task 2

INSTRUCTIONS

Place a ruler on the edge of the table so that about 5 inches hang off the table. Place a 1 inch square piece of paper on the end of a ruler that is on the table and not hanging. Use your hand to quickly karate chop the hanging edge of the ruler. Respond to the question below.

1. Approximately how many pounds were pushing down on the 1 inch square piece of paper on the end of a ruler?

_____ lbs/in^2

2. Record your observations below:

_____

PREDICT

How will placing two sheets of newspaper on the table end of the ruler affect the result?

INSTRUCTIONS

Set up the ruler as before, but this time place two sheets of newspaper over the ruler. Flatten the paper down to remove any air between the sheets. Proceed as before with a quick karate chop to the free end of the ruler.

Name _____ **Date** _____

1. Record your observations with the newspaper added to the table end of the ruler.

_____ lbs/in^2

2. Why do you think the results were different with two sheets of newspaper as opposed to just one square inch?

_____

3. Use the box below to calculate how many pounds of air pressure were pushing down on the newspaper. Show all work and give a final answer with units.

Newspaper page = 12" x 22" air pressure (sea level) = 14.7 lbs/in^2

Equation: (# sq. in of newspaper) X (air pressure (lbs/in^2)) = weight (lbs) on ruler

LESSON PLAN

Emotions

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

Emotions

Middle School lesson plan

OVERVIEW OF ACTIVITY

Students will explore the body's response to a stressor by collecting heart rate data after viewing the Brainchild "Emotions" episode.

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

Next Generation Science Standard

- **MS-LS1-8** -Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1** - Write arguments focused on *discipline-specific content*.
- **CCSS.ELA-LITERACY.WHST.6-8.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

OUTLINE OF LESSON

- Class will learn to take pulse rate.
- Class will view the "Emotions" episode, with data collection.
- Whole class will analyze data collected during viewing and discuss.
- Students will continue to explore how stressors or non-stressors affect pulse rate.

ACTIVITY PROCEDURE

- Teacher will go over the procedure for checking **pulse rate**. [To check your pulse at your wrist, place two fingers between the bone and the tendon over your radial artery — which is located on the thumb side of your wrist. When you feel your pulse, count the number of beats in 15 seconds. Multiply this number by 4 to calculate your beats a minute. (mayoclinic.org)]
- In partnerships or small groups, students will take turns taking their pulse to determine their resting pulse rate and record data on their student resource page.
- Teacher will introduce the content of the episode, explaining that they will be watching a Brainchild episode on emotions. They will be focusing in on how certain emotions illicit a particular physical response.

When someone feels stressed, the **amygdala** sends distress signals to the body, resulting in the **"fight or flight"** response. When feeling calm and peaceful, your body feels completely different.

- Class will view episode with the understanding that they will be asked to stop and take their pulse a few times during the viewing. Teacher will pause episode right after love story clip and again right after the horror story clip for students to check pulse and record.
- Students will view the entire "Emotions" episode.
- Students will reflect on the mind-body connection between the body's heart rate response to viewing the love and horror video clips by answering the concluding questions. Teacher will be sure to discuss why there were differences, if any, in pulse rate. There most likely will be discrepancies. Teacher should use these as teachable moments. Why were some of the heart rates more elevated during the horror clip and others more elevated during the love story? Teacher will explain that students will continue exploring this topic with real world data to add to their understanding for homework.

FOLLOW-UP

Students can take what they have learned about the effect of emotions on heart rate and test out their hypothesis at home. Students will record their resting pulse rate, then compare it to their pulse rate after experiencing a stressful or peaceful situation at home. Students will reflect on their findings and share with their class the following day. Teacher will continue discussion on why their pulse rates were affected, connecting back to Brainchild content of hormonal influence in response to a stimulus.

MATERIALS LIST

- Activity Resource
- Stopwatches

Name _____ Date _____

Emotions and Heart Rate

PURPOSE

To explore the mind-body connection and measure the body's heart rate response to viewing the love and horror video clips.

HYPOTHESIS

How does viewing video stimuli designed around different emotions affect heart rate?

_____

_____

_____

PROCEDURE

1. Take resting pulse rate, record in table

2. View love clip

3. Take pulse, record in table

4. View horror clip

5. Take pulse, record in table

Student Name	Resting Pulse Rate	Love Clip Pulse Rate	Horror Clip Pulse Rate

Name _____ Date _____

Emotions and Heart Rate

CONCLUSIONS

How did the different clips affect heart rate for the individuals in your group overall? Did any of the data stand out to you? Explain.

_____

_____

_____

Using a bodily response from the video, explain why heart rates are usually higher after viewing the horror clip.

_____

_____

_____

Name _____ Date _____

Emotions and Heart Rate *Follow-Up Activity*

Test out your findings during the pulse rate Brainchild activities at home!

PROCEDURE

1. Take resting pulse rate, record.
2. Have your stopwatch ready for action. When you experience something stressful or something peaceful at home, take your pulse immediately and record it in the table. Try this out a few times.
3. Record the experience that inspired you to take your pulse.
4. Analyze your findings.

Resting Pulse Rate: _____

Description of events immediately before taking pulse rate	Pulse Rate

Name _____ Date _____

Emotions and Heart Rate *Follow-Up Activity*

CONCLUSIONS

What are you noticing about the data you collected? How might this information on pulse rate affect your learning at school?

OPTIONAL PULSE RATE PROCEDURE

To check your pulse on your wrist, place two fingers between the bone and the tendon over your radial artery, located on the thumb side of your wrist. When you feel your pulse, count the number of beats in 15 seconds. Multiply this number by 4 to calculate your beats a minute.

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LESSON PLAN

Motivation

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

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Motivation

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

In the opening game of the "Motivation" episode, students are introduced to the idea of incentives as motivators. Through this follow up activity, students will explore incentives as well as deeper, more personal motivators in their discovery of extrinsic and intrinsic motivation.

DURATION

Approximately 1 class period.

STANDARDS ADDRESSED

Common Core Learning Standards

- **CCSS.ELA-LITERACY.SL.7.1.A** - Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

OUTLINE OF LESSON

- Introduction of the topic, motivation, through a warm up discussion question.
- View the Brainchild "Motivation" episode.
- Students will read background information about intrinsic and extrinsic motivation before moving on to two tasks that require differentiating between the two types of motivation.

ACTIVITY PROCEDURE

- Teacher will introduce the topic of the "Motivation" episode by posing the question: ***Why are some students motivated to get good grades and others are not?*** (answers range from intrinsic to extrinsic, no need to introduce the terms yet) Class will discuss their responses.
- Whole class will view the "Motivation" episode while considering the class discussion topic.
- Teacher will distribute the Student Activity Resource. Students will independently, in partnerships, or as a whole group read the background on intrinsic and extrinsic motivation.
- After students work independently on task 1, teacher will facilitate a share out of students' ideas for transforming an intrinsic motivation into an extrinsic one.
- Students will complete task 2 independently and share their ideas with a partner or group.

- Teacher can close out by facilitating a group share of student written intrinsic motivations and discuss how this information can help students grow and learn.

FOLLOW-UP

Teacher can have students reflect on self worth, the idea of Ego, and ultimately comparing and measuring up to others. Then, they can look at the intrinsic examples above to see if one's own Ego could make a seemingly intrinsic statement actually extrinsic in reality. Teacher can assign this reflection as a discussion piece or a written component.

MATERIALS LIST

- Student Activity Resource

Name _____ Date _____

Motivation: From Outside or From Within

BACKGROUND

The prefix "ex" is found in words like extract, exhale, exoskeleton, exoplanet, exothermic, and in the case of motivation, **extrinsic**, and implies the meaning "from outside" or "of the outside". The opposite prefix, "in" can be used to give us **intrinsic,** and has the exact opposite meaning. Latin might be the most logical language there ever was! Simply put, **extrinsic motivation** means you engage in a behavior for something outside of you such as money, a deadline, a trophy or a bet. **Intrinsic motivation** means you do something for your own personal enjoyment or sense of personal accomplishment. Like most things in the world, motivation is not always a black and white issue, often times we find ourselves using a mix of motivation types to go through various situations in life.

Task 1

Read the following story and use a pencil to underline statements or portions of the text that exemplify **intrinsic motivation**. Use a pen or a different color to underline statements that exemplify **extrinsic motivation.** Use any other annotation devices you have learned to identify anything that seems unclear or important in the story.

On their path home, students from the nearby school would pass an old man on a stoop every day who had put up with years of adolescent insult throwing. After picking up a piece of schoolwork on the ground and reading it, the old man stumbled on a psychology paper about motivation. He got an idea! The next day, he approached a group of students who regularly visit him for insults and made an offer: "I will pay you each $5 for coming by to insult me tomorrow". Blown away by this surprising offer, the students happily came back the next day to get paid for what they were enjoying doing anyway. After paying out each kid as promised, the old man said, "come and insult me again tomorrow and I'll pay you each a dollar". Thinking it was still better than nothing, the kids showed up again to tease the old man. They were again paid as promised, but this time the man said "I can only afford to pay you a penny for your insults tomorrow". To this the kids said "forget it, it's not worth it"!

DISCUSS

Based on the Background reading and the above story, use one sentence to explain how to turn an intrinsic motivation into an extrinsic motivation. (share with classmates)

_____

_____

Name _____ **Date** _____

Task 2

Read each statement below and classify as either an intrinsic or extrinsic motivation. In the space next to your classification, try to turn the statement into the opposite motivation (the first row is filled in as an example).

Motivation statement	Motivation type (intrinsic/extrinsic)	Motivation change
"I love chess so much, I can't wait to get my next trophy"	extrinsic	"I love chess so much, even if I don't win I get better and learn another pitfall of mine every time" (intrinsic)
"Everyday I try to do one more pullup than I did the day before"		
"I'm doing this home-work because it's what my teacher wants me		
"We have to win!"		
"I finally figured out how to whistle"		
"I got it done by the due date"		

Your Turn: See if you can write your own intrinsic and extrinsic motivation statement below.

Instrinsic: _____

Extrinsic: _____

FOLLOW UP

Sometimes it is not so clear if a person's motivation is intrinsic or extrinsic. Further explorations into psychology will certainly discuss the Ego, or sense of self worth (in comparison to others). For example, if a person says "I'm so happy I can finally whistle", but the reality is you never were interested in whistling until someone recently said "I'll bet you will never be able to whistle", then the motivation to whistle seems to be more extrinsic than intrinsic. Look at the intrinsic examples above to see if one's own Ego could make a seemingly intrinsic statement actually extrinsic in reality. Can you come up with any other examples?

brainchild

LESSON PLAN

Oceans

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

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Oceans

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students explore the effects of salinity and temperature on density through a hands on activity and a teacher demonstration.

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

Next Generation Science Standard

- **MS-ESS2-6 Earth's Systems -** The Roles of Water in Earth's Surface Processes. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1** - Write arguments focused on *discipline-specific content.*
- **CCSS.ELA-LITERACY.WHST.6-8.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

OUTLINE OF LESSON

- Warm Up: Students will respond to the question: "Which weighs more, a pound of feathers or a pound of bricks?"
- View the Brainchild "Oceans" episode.
- Students will read background information about salinity and ocean currents. They will explore the effect of increasing salt concentration on the ability for an object to float.

ACTIVITY PROCEDURE

- Warm Up: Students will respond to the question: "Which weighs more, a pound of feathers or a pound of bricks?" After sharing some answers out, come to the agreement that they both weigh the same. Draw a brick on the board and a large bag or box labeled 1 lb, label the brick and the bag of feathers. Bring the discussion to the physical property that is different given that they weigh the same. Students should notice that the pound of feathers takes up much more space and we can define this as volume. Introduce the ratio

of mass and volume as the physical property density. Introduce episode. **Note: You may choose to make the distinction between weight and mass at this point or wait until an Astronomy unit.

- Whole class will view the "Oceans" episode, with special attention to density.
- Students will independently, in partnerships, or as a whole class read background information regarding salinity and density of water and its effect on deep sea currents and layering of the ocean. Then they will carry out the procedure in partnerships: *Fill the plastic cup about halfway with water. Drop a grape in the water and record your observations in the table. Comment on the relative densities of the water and the grape. Stir in salt to dissolve until you notice a change in the grape, record your observations and comment on the relative densities of the water and grape.*
- Students will observe a teacher demonstration of temperature and density:
  1. Fill a jar to the brim with cold water tinted with blue coloring.
  2. Fill a second jar to the brim with hot water tinted with red coloring, cover with an index card (or piece of plastic overhead transparency), invert and place on the blue jar.
  3. Make another identical setup but have the red on the bottom and blue on the top.
- Students will make predictions of what will happen when the index card is removed from between the jars.

FOLLOW-UP

Either for homework or during a following class period, students will respond to the following prompt and discuss responses in class: *What trend in temperature and salinity would you expect to find as we go deeper down through the seven layers of the ocean based on your experience? Explain.*

MATERIALS LIST

- Grapes, 1 per partnership
- Clear plastic cups, 1 per partnership
- 2 index cards per partnership
- Water
- Blue and red food coloring
- Salt
- 4 glass jars
- Student Activity Resource, 1 per student

Name _____ Date _____

Oceans: Exploring Density

BACKGROUND

As you learned in the "Oceans" episode of Brainchild, the seven layers of the ocean form due to differences in density. **Density** is a physical property of matter. It is found by measuring the mass and the volume of a substance and finding the ratio of the two (dividing mass by volume). The density of a substance does not change depending on how much of the substance you have. In other words, the density of a drop of water and the density of an entire swimming pool of that water is the same! It is important to know that density is constant for a substance, no matter how much of that substance you have, AS LONG AS TEMPERATURE DOESN'T CHANGE.

To understand this, we have to zoom in and look at what substances are made of, atoms and molecules. With few exceptions, when atoms or molecules in a substance are colder, they come close together. The opposite happens when they are warmer. When a group of molecules are close together, they take up less space, or have less volume, than if you warm them up. So if we take a substance and heat it up, (we have not added or taken substance away so the mass hasn't changed) its volume will increase due to the molecules spreading apart, and its density will decrease. Different temperatures of water in the ocean will have different densities and will form different layers. Remember, substances that are more dense will sink below substances that are less dense.

Salinity, or the amount of salt dissolved in water, plays just as important a role as temperature in helping form our ocean layers as well as deep ocean currents. Not just temperature but the amount of salt dissolved in water also will affect the density of the water. While dissolving salt in water doesn't seem to change the volume much, it certainly changes the mass. Because you are adding salt to water, you will end up with a larger mass but no noticeable change in volume, what do you think this will do to density? Let's find out!

PREDICT

Is salt water or plain water more dense? Why do you think that?

_____

_____

_____

_____

PROCEDURE

1. Fill the plastic cup about halfway with water. Drop a grape in the water and record your observations in the table. Comment on the relative densities of the water and the grape.
2. Stir in salt to dissolve until you notice a change in the grape, record your observations and comment on the relative densities of the water and grape.

Name _____ Date _____

Oceans: Exploring Density

Substance	Observations	Which is more dense?
Water		Water Grape
Salt water		Salt water Grape

DEMO ANALYSIS

Based on the reading above and your teacher's description of the setup in front of you, predict what will happen when the barrier between cups is removed.

ANALYSIS

What trend in temperature and salinity would you expect to find as we go deeper down through the 7 layers of the ocean based on your experience? Explain.

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LESSON PLAN

Thinking

GRADE LEVEL: MIDDLE SCHOOL

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Thinking
Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Spidey's Illusion, "The Game with the Red Cards," was designed to work by taking advantage of our thinking System 1, the more impulsive system that makes quick connections to information stored recently or long in the past. Students will explore several riddles designed to also take advantage of this system of thinking, and examine what happens when we use our thinking System 2 in these same types of tasks.

DURATION

Approximately 1 class period.

STANDARDS ADDRESSED

Next Generation Science Standards

- **MS-LS1-8 -** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1 -** Write arguments focused on discipline-specific content.
- **CCSS.ELA-LITERACY.WHST.6-8.4 -** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

OUTLINE OF LESSON

- Teacher will pose warm up questions, activating prior knowledge on thinking.
- View the Brainchild "Thinking" episode.
- Students will play ***Quick, Think!***, a riddle game designed to explore System 1 and System 2 thinking.
- Class will reflect on process and concepts.

ACTIVITY PROCEDURE

- Warm Up: Students will discuss the questions, "In what body system does thinking occur? In a 24 hour period, when are you *not* thinking?" as an introduction to the episode.
- Whole class will the "Thinking" episode.
- Teacher will review that **System 1** is fast, impulsive, and automatic, while **System 2** is calm, calculated, and takes more effort.

- Teacher will facilitate a reflection on Spidey's illusion, "The Game with the Red Cards." Students will then read an introduction, further reviewing Spidey's Illusion from the episode, and introducing the activity which will use a similar technique of implanting an idea and taking advantage of System 1 thinking.
- Students work in pairs playing ***Quick, Think!***, to test out riddles that implant an idea then require a quick response so System 2, more calculated responses, doesn't have time to kick in. Students will record responses. Then, students will be instructed to try one more similar riddle, but this time taking time before answering, then record responses. *Note: there is a form A and a form B, partners should have different forms.*
- Class will discuss results. Teacher will informally ask the number of students who fell for the riddle before and after taking the breath by a show of hands. Students find percentage correct before and after taking the time break. Students will verbally reflect on why they found certain results. Students can share out any bonus misdirection riddles written.

FOLLOW-UP

Students will reflect upon the nature of bias and its connection to System 1 thinking by responding to the following prompt: ***Bias is a tendency in favor of or against someone or something. Which system of thinking is more susceptible to bias? Why? Many biases negatively impact our lives and the lives of others. What system of thinking can we use to combat negative effects of bias? How? Use examples from your own life.***

MATERIALS LIST

- Student Activity Resource

Name _____ **Date** _____

Thinking: Quick, Think! (A)

Riddles are often called brain teasers for a reason. They take advantage of our more reactive, System 1 type thinking and reasoning. In this activity, you and a partner will take turns reading each other misdirection riddles that use a similar technique to Spidey's "The Game with the Red Cards" in Brainchild, by implanting an idea and then taking advantage of System 1 thinking. Then you will try a similar type of riddle, but give yourself time to slow down a bit by taking a few seconds before you answer. This should allow System 2 to think less reactively and in a more collected and calculated manner. Let's find out!

INSTRUCTIONS

Choose who will read first. The reader will read the word to their partner and the partner will say the word and then spell the word three times in a row. The reader will then ask a question, which their partner is to answer immediately. The reader will then record their partner's response. Switch roles so that you have each read a riddle, then repeat the process so you have each read two riddles total. For the second round, take turns reading the second riddle, but this time give your partner a few seconds (no more than 5) before they answer the question.

1. Word: **POTS** (say then spell three times in a row) Question: What do you do at a green light? (partner answers immediately) Answer:_____	2. Word: **ROAST** (say then spell three times in a row) Question: What do you put in a toaster? (give partner 5 seconds to answer) Answer:_____
Class Results: Total number of students in class _____ Total number answered question 1 correctly _____ = _____% Total number answered question 2 correctly _____ = _____%	

Bonus: Now that you have some practice, try to write your own misdirection riddles for your partner.

Name _____ **Date** _____

Thinking: Quick, Think! (B)

Riddles are often called brain teasers for a reason. They take advantage of our more reactive, System 1 type thinking and reasoning. In this activity, you and a partner will take turns reading each other misdirection riddles that use a similar technique to Spidey's "The Game with the Red Cards" in Brainchild, by implanting an idea and then taking advantage of System 1 thinking. Then you will try a similar type of riddle, but give yourself time to slow down a bit by taking a few seconds before you answer. This should allow System 2 to think less reactively and more collected and calculated. Let's find out!

INSTRUCTIONS

Choose who will read first. The reader will read the word to their partner and the partner will say the word and then spell the word three times in a row. The reader will then ask a question, which their partner is to answer immediately. The reader will then record their partner's response. Switch roles so that you have each read a riddle, then repeat the process so you have each read two riddles total. For the second round, take turns reading the second riddle but this time give your partner a few seconds (no more than 5) before they answer the question.

1. Word: **Ten** (say then spell three times in a row) Question: What are aluminum cans made of? (answer immediately) Answer:_____	2. Word: **Silk** (say then spell three times in a row) Question: What do cows drink? (give partner 5 seconds to answer) Answer:_____

Class Results:

Total number of students in class _____

Total number answered question 1 correctly _____ = _____%

Total number answered question 2 correctly _____ = _____%

Bonus: Now that you have some practice, try to write your own misdirection riddles for your partner.

Name _____ Date _____

Thinking: Quick, Think! Homework

Today you explored the different systems of thinking on Brainchild. **System 1** is fast, impulsive, and automatic, while **System 2** is calm, calculated, and takes more effort. Using what you have learned from Brainchild and the class activities, thoughtfully respond to the following prompt.

Bias *is a tendency in favor of or against someone or something. Which system of thinking is more susceptible to bias? Why? Many biases negatively impact our lives and the lives of others. What system of thinking can we use to combat negative effects of bias? How? Use examples from your own life.*

LESSON PLAN

Hidden Forces

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

Hidden Forces

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

These centers are designed as a hands-on extension to the concepts of electricity, by making a battery; gravity, by examining if gravity affects objects equally; and magnetism, by building an electromagnet; introduced in the "Hidden Forces" episode to begin a forces unit. Students should have a basic understanding of these concepts from elementary science. These activities are designed to be completed within two class periods or in one class period if isolating one center.

DURATION

This collection of activities can be used as a two class period activity using all of the provided centers or as a one class period activity if teacher chooses to isolate the forces.

STANDARDS ADDRESSED

Next Generation Science Standard

- **MS-PS2-5 -** Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, a magnet, or a ball, respectively).

Common Core Learning Standards in Writing

- **CCSS.ELA-LITERACY.WHST.6-8.1** - Write arguments focused on *discipline-specific content.*
- **CCSS.ELA-LITERACY.WHST.6-8.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

OUTLINE OF LESSON

- Whole class will participate in a prior knowledge activity.
- Whole class will watch the Brainchild "Hidden Forces" episode.
- Whole class will participate in one OR rotate through three exploratory stations. If teacher chooses to use all three centers, they will run most smoothly if they are introduced after the "Hidden Forces" episode on day 1 and carried out on day 2.

ACTIVITY PROCEDURE

• **Introduction to concepts:** Teacher will access student prior knowledge by discussing/ charting what they know about forces. Teacher will highlight vocabulary: **gravity, electricity, magnetism**.

• Class will view the "Hidden Forces" episode.

• Students will be broken up into groups of two or three then engage in one **or** three different centers to explore the forces of **gravity, magnetism, and electricity.**

• **Center Descriptions** *(see student resources for more details)*

- **Center 1: Gravity** - Drop It. Does gravity affect objects equally? Write a hypothesis. Pt.1 Students will receive multiple objects (4 objects with very low air resistance) to record their mass and the time it takes to drop from a given distance to the floor. Each object will be released separately and a stopwatch will be used to record the time taken to reach the floor. Pt. 2 Follow the same procedure with two identical papers, one balled up, one flat. Record observations and refer back to research questions from this exploration: Does gravity affect all objects equally?
  Materials list: Student Activity Resource, two pieces of identical paper, low resistance objects (binder clip, pen, golf ball etc.), balance, timer.

- **Center 2: Magnetism** - Make an Electromagnet - wire, nail, battery, paperclips, data table. Look at strength based on number of coils. Students will collect data to determine the effect of the number of turns of wire on a nail on the number of paperclips that can be picked up by the nail. What is the relationship between electricity and magnetism?
  Materials list: Student Activity Resource, wire (30 gauge magnet wire), nail, battery, paperclips, battery holder or electrical tape.

- **Center 3: Electricity** - Make Your Own Battery. Students will create a battery in order to make a light bulb light. In an aluminum air battery, students will create enough current and charge to power a small electronic device using the common materials of activated charcoal/ activated carbon, aluminum foil, salt, water, paper towels, and wire.
  Materials list: Student Activity Resource, activated charcoal/ activated carbon, aluminum foil, salt, water, paper towels, wire, bulb (1V), 2 alligator clip wires.

FOLLOW-UP

Students will complete the student resource page, revisiting each "conclusion" section to reflect on the centers. These centers are intended to lead into the forces school curriculum.

Name _____ Date _____

Forces: Gravity

HYPOTHESIS

Does gravity on Earth affect objects equally? Write a hypothesis.

PART 1

Work with a partner. Using the objects provided, complete the following table by measuring and recording mass. Then drop each object from one meter above the floor. Using a stopwatch, record the time it takes to drop from the one meter mark to touch the floor.

Object	Mass (g)	Time (s)

OBSERVATIONS

Name _____ Date _____

Forces: Gravity

PART 2

Now, with two identical papers, leave one flat and ball the other up. Complete the previous procedure.

Object	Mass (g)	Time (s)
Flat paper		
Balled paper		

OBSERVATIONS

CONCLUSION

Based on your data collection, does gravity affect objects equally? Explain your thinking.

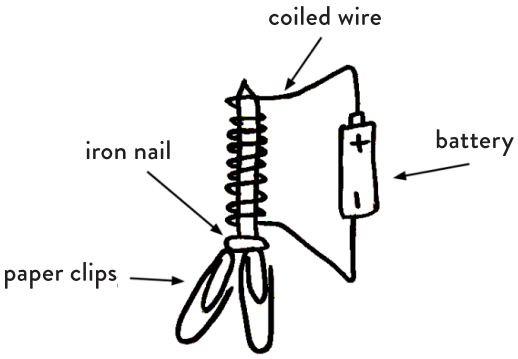
Name _____ Date _____

Forces: Magnetism

PURPOSE

Students will create an electromagnet and explore the relationship between the amount of wire coiled and the strength of the magnet.

PROCEDURE



1. Touch an iron nail to a metal paper clip, observe.
2. Create an electromagnet using an iron nail, battery and insulated wire. Count the number of times you wrap the wire around the nail. Connect to battery and determine the number of small paper clips your electromagnet can pick up.
3. Repeat step 1 but change how many times you wrap the wire around the nail. Do this two more times and complete your data table.

Number of turns	Number of paperclips lifted

CONCLUSION

What is the relationship between electricity and magnetism based on your observations?

Name _____ Date _____

Forces: Electricity

PURPOSE

Students will explore electrical energy from chemical sources through the creation of an aluminum air battery.

PROCEDURE

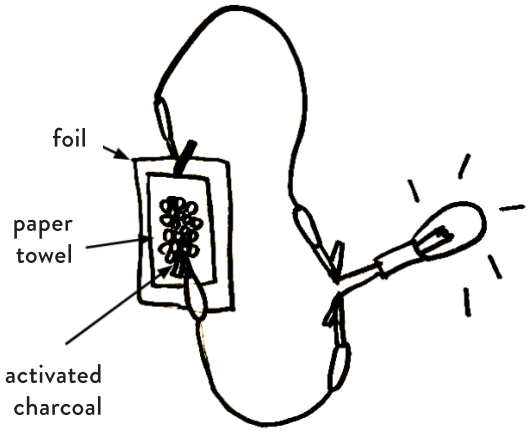
1. Place a 12 inch square piece of aluminum foil on the table.

2. Place a folded piece of paper towel (approx. 5 inch square) in the center of the foil.

3. Place a heaping spoonful of activated carbon on the paper towel (be sure that none touches the foil).

4. Place about ten drops of salt water on the activated carbon.

5. Connect a wire clip to the foil and place another clip in the pile of carbon. Both wires should be connected to a 1V bulb, or voltmeter.



6. Fold your foil and paper towel over so the carbon makes full contact with the clip and observe.

CONCLUSION

In this experiment, electricity was not made by burning fossil fuels or from collecting the sun's energy. Where do you think the electricity came from in this activity?

LESSON PLAN

Creativity

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

Creativity
Middle School Lesson Plan

OVERVIEW OF ACTIVITY

After experiencing how a seemingly simple question can take on different meanings depending on how you look at it, students will discuss how creative thinking is different than logical thinking. Students will have a chance to test out their own creativity through a series of exercises.

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

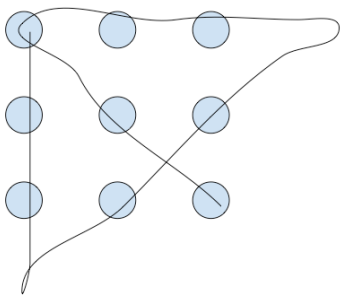
Common Core Learning Standards in Literacy

- **CCSS.ELA-LITERACY.RST.6-8.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases.

OUTLINE OF LESSON

- Introduce topic of creativity by discussing a warm up that is in the form of a riddle.
- Class will view the Bainchild "Creativity" Episode
- Students will read background information and begin a series of creativity tests.

ACTIVITY PROCEDURE



- Teacher will introduce the topic of the "Creativity" episode by posing the question: *How many months have 28 days? (All of them have at least 28 days.)* Class will discuss their responses. Use creativity in riddle solving to introduce the episode. Discuss difference between creative and logical thinking in context of the warm up.
- Whole class will view the "Creatvity" episode, while considering the class discussion topic.
- Teacher will distribute the Student Activity Resources. Students will independently, in partnerships, or as a whole group read the background on creativity and science. Students will begin the first test on the Activity Resource. After two minutes teacher gives the hint "think outside of the box." Allow two more minutes to complete (show answer on board at the end).
- Teacher will keep time for each test as students work through them.

- Students will exchange their paper with a classmate or two after time is called for question #3 on the Student Activity Resource in order to share and discuss creative thinking.
- As a closing, students share thoughts on the experience, reveal solutions to Students Activity Resource questions on the board. Teacher can facilitate a discussion on question 3, how many different ways the same line can be used.

FOLLOW-UP

Teacher can have students complete the following anagrams in class or for homework.
Anagrams, or rearranging the letters of a word or phrase to form new ones, requires creative thought. See what anagrams you can come up with for the words: listen, the eyes, eleven plus two. There are many possible answers. Here are some that relate to the original word/phrase directly: listen-silent, the eyes-they see, eleven plus two-twelve plus one.

MATERIALS LIST

- Student Activity Resource

Name _____ Date _____

Creativity: Using Your Whole Brain

BACKGROUND

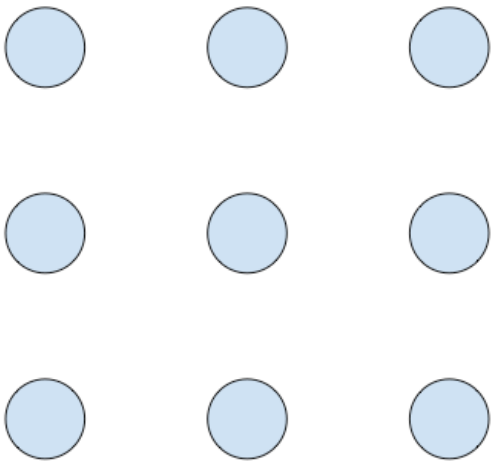
As pointed out in this episode, creativity is a matter involving the whole brain, not only the creative right side but also the more logical left side. Creative thinking is not only useful in the arts, but in any aspect of one's life. Creativity allows us to solve problems that don't seem to have solutions. Very few of the seemingly logical scientific concepts we have knowledge of would ever have come to be if discoverers were only using their left brains. Sometimes a simple walk in nature is enough to spark creativity, as was the case for engineer George de Mestral, the inventor of Velcro. The prickly little burs that got stuck to his clothing and dog gave him an idea that is in use everywhere today. While the engineer used his left brain for many aspects of developing his invention, there is no doubt it took a creative mind to look at a common nuisance as potentially useful.

TASK

The following activities are used by psychologists to test creativity. Read the brief introduction and then give each test a try. Treat these as a game and not a test. This will reduce anxiety (good advice for any test!). Then, read the explanation of the test

1.

Your job is to connect all 9 dots below using just 4 straight lines and without picking your pencil up from the paper. See what you can do in 2 minutes.



EXPLANATION

When your teacher gave you the hint, it was meant literally. However, "thinking outside of the box" is a common phrase used to illicit creativity from people in all lines of work. The phrase implies that you think outside of the normal rules or look at things from a new and different perspective.

Name _____ **Date** _____

2.

You will be given three seemingly unrelated words. Your job is to come up with a fourth word that is related to the three given words. Do as many as you can in 4 minutes.

Ex. teeth - arrest - start answer: false

- **cracker - fly - fighter** *answer:*_____
- **fish - mine - rush** *answer:*_____
- **opera - hand - dish** *answer:*_____
- **illness - bus - computer** *answer:*_____
- **spoon - cloth - card** *answer:*_____
- **baby - spring - cap** *answer:*_____

EXPLANATION

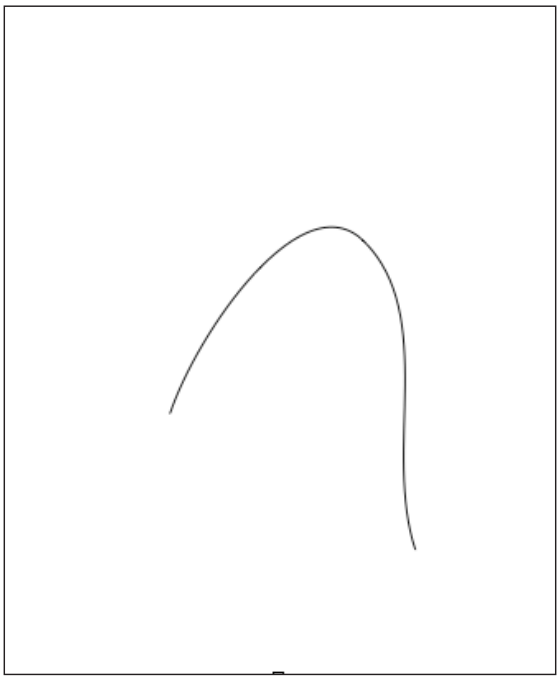
This is called a Remote Association test and is used to test creativity. The more seemingly unrelated the three words are, the more creative you have to be to make the association with a fourth word. This is an example of a convergent test because the questions have only one answer. The answers to the above in order are: fire, gold, soap, terminal, table, and shower. How did you do?

Name _____ **Date** _____

3.

There is a figure drawn below. Take 4 minutes to complete the figure and give your final drawing a title.

*Title:*_____



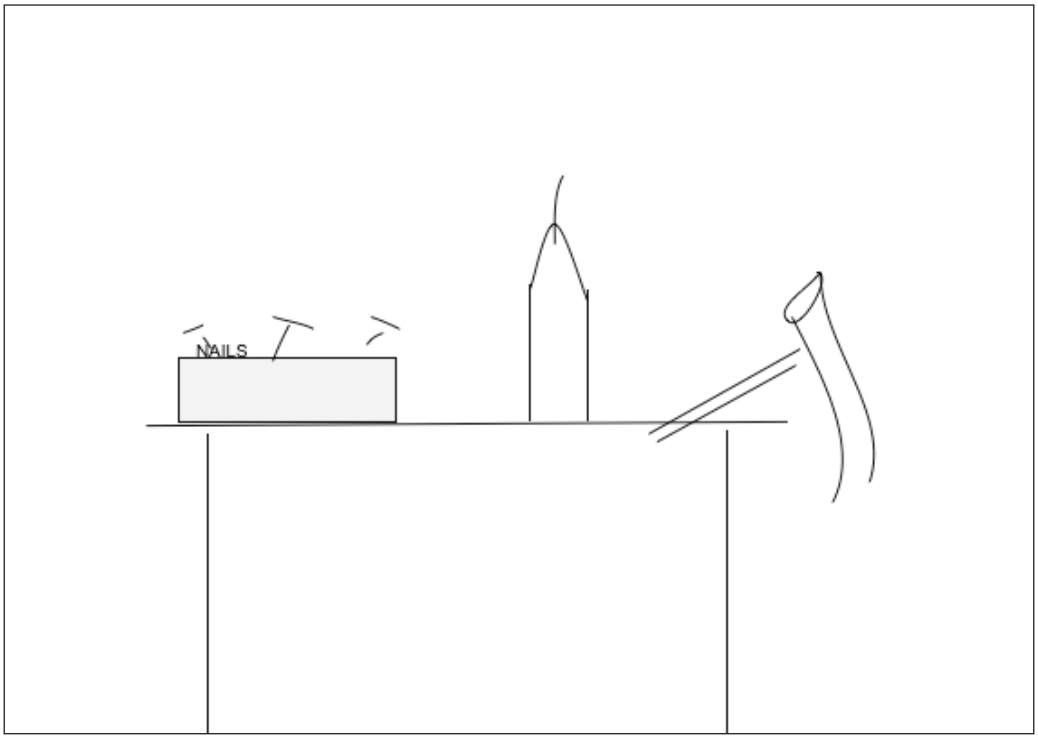
EXPLANATION

This test is still used and is scored based on four categories: fluency, abstractness of title, originality and elaboration. This is an example of a divergent test because there are an unlimited number of answers. Look around the room at how many ways such a simple line could be used!

Name _____ Date _____

3.

Below is a diagram that shows a table in front of a wall. On the table is a box of nails, a hammer, and a candle which you have matches for. Take 3 minutes to come up with a way of attaching the candle to the wall so that, when lit, no wax drips on the table.



EXPLANATION

This test was created by a psychologist named Karl Dunker. While several solutions exist, the most realistic is to take the nails out of the box, and then attach the box to the wall with a hammer and a couple of nails. Place the candle in the box and light it. All the wax will drip into the box, and not on the table. Interestingly, more people came to this solution if the nails were out of the box from the beginning, leading to the term "functional fixedness" in the psychology world. We can be much more creative with a box if we don't assume it has a specific purpose (i.e. holding nails).

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LESSON PLAN

Memory

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

i am OTHER NETFLIX ATOMIC ENTERTAINMENT

Memory
Middle School Lesson Plan

OVERVIEW OF ACTIVITY

In this activity, students will have the chance to use mnemonic techniques outlined in the Brainchild "Memory" episode to create their own custom study tools for any subject.

DURATION

This collection of activities can be used as a 2 class period activity using all of the provided centers or as a 1 class period activity if teacher chooses to isolate the forces.

STANDARDS ADDRESSED

Next Generation Science Standards

- **MS-ESS2-1 -** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- **MS-LS1-3 -** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

OUTLINE OF LESSON

- Teacher will introduce the topic of memory with a warm up considering the difference between remembering favorite song lyrics and remembering science concepts.
- Class will view the Brainchild "Memory" episode.
- Students will complete a reading and assignment, developing mnemonics for various science topics.

ACTIVITY PROCEDURE

- Teacher will introduce the topic of the "Memory" episode by posing the questions: ***Why is it easier to remember lyrics to a song than it is to remember concepts in science?*** Class will discuss their responses.
- Whole class will view the "Memory" episode, while considering the class discussion topic.
- Teacher will distribute the Student Activity Resources. Students will independently, in partnerships, or as a whole group read the background on mnemonic techniques. Students will complete the Student Activity Resource, independently creating acronyms or phrases to act as mnemonics for the branches of science, a unit conversion, and levels of cellular organization. Students should be encouraged to look back in their notes to develop lasting mnemonics. **Note: for question #2 on the activity resource, it might be helpful to remind students of the mnemonic peg system used by Spidey to remember all twenty of the objects.
- Students will share with a partner before volunteering to share their best mnemonic with the whole class.

FOLLOW-UP

Students can complete the Rock Formation (#4) challenge mnemonic on the Activity Resource for homework and rehearse #1-3. Share out any successes the next day.

MATERIALS LIST

• Student Activity Resource

Name _____ Date _____

Memory: Creating Mnemonics

BACKGROUND

Memories are created and stored in vast networks of neurons inside our brains. Memories serve an important role in many of our daily cognitive tasks, like using passwords, following schedules, and shopping. It becomes crucial that we not only store memories, but have a way of later **retrieving** those memories when we need them. It is in memory retrieval that **mnemonic techniques**, or using codes, retrieval clues, and imagery to allow for efficient storage and retrieval of memories, become extremely useful. Mnemonic techniques can take many forms, from acronyms like PEMDAS (Please Excuse My Dear Aunt Sally- Parentheses, Exponents, Multiply, Divide, Add and Subtract) to the code Spidey used to remember everyone's object in the episode. Mnemonics are powerful tools for learning new information, like in school! A mnemonic technique can be as creative and personal as you like. What's important is that it works!

INSTRUCTIONS

Five different science topics you have learned are outlined with the important vocabulary that accompanied the topic below. You will develop a mnemonic device for each of the topics. Use your notes as a reference if you need to. You will share out your technique with the class. If you have time, try out the challenge or another topic!

1. Branches of Science

Task: If you ever forget the 6 elements that make up almost all biological molecules just remember the **acronym** CHNOPS (carbon, hydrogen, nitrogen, oxygen, phosphorus, sulfur). Try to come up with an **acronym** that people can use to remember the following branches of science. Work through as many combinations as you can until it sounds like a word you would remember (you might need the first two letters to make it work).

Physics Chemistry Biology Geology Astronomy Meteorology

Acronym: _____

Name _____ **Date** _____

2. Unit Conversion

Task: While scientists can always look a number up, it can be very helpful to commit some numbers to memory. In the episode, you saw a technique where Spidey used imagery to remember objects that people named. See if you can use imagery to remember how many centimeters are in one inch (for example, to remember the conversion for feet to inches, the image might be a foot with twelve toes).

1 inch = 2.54 centimeters

Image:

_____

_____

3. Astronomy

Most people have learned classification of life through the phrase "King Phillip Came Over For Good Spaghetti" or some similar phrase. We then go through life never forgetting the order from most general to most specific: kingdom, phylum, class, order, family, genus, species. Use a similar mnemonic technique to organize the following structures from smallest to largest.

Galaxy **Planet** **Solar System** **Universe**

Acronym/phrase: _____

_____

Challenge: **Rock Formation**

Task: The three major rock groups we study: Metamorphic, Sedimentary, and Igneous, all form through very different processes. Try to develop an acronym/phrase or other technique to match the three processes listed below to the rock types they form.

compaction/cementation **solidification** **heat and pressure**

Acronym/phrase: _____

_____

LESSON PLAN

Beat the Parents

GRADE LEVEL: MIDDLE SCHOOL

brainchild.com | grades 6, 7, 8

Beat the Parents

Middle School Lesson Plan

OVERVIEW OF ACTIVITY

Students will explore properties of sound and waves such as pitch and frequency by creating their own wind instruments.

DURATION

Approximately 1 class period

STANDARDS ADDRESSED

Next Generation Science Standard

- **MS-PS4-1A** - A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.

OUTLINE OF LESSON

- Introduce the Brainchild "Beat the Parents" episode.
- View episode.
- Students read background information, create straw wind instrument, and explore the relationship between frequency and air column length.

ACTIVITY PROCEDURE

- Teacher will introduce episode topic and ask students to pay special attention to the segment on sound.
- Whole class views the "Beat the Parents" episode.
- Students independently, in partnerships, or as a whole class read background information regarding sound waves.
- Students independently sketch sound waves for each of three sound descriptions. Students need to match volume and pitch to amplitude and wavelength.
- Teacher will check work and select students to sketch the three sound waves on the board. Students will discuss sketches and practice use of content vocabulary.
- Students will predict how air column length affects pitch, then create their own straw wind instrument to play. They might need a partner to safely cut the straw as air column length is tested.
- Students will reflect on the activity and prediction.

FOLLOW-UP

Students can explore common wind and brass instruments through the concepts explored in this activity. Instead of cutting the instrument everytime a new tone is desired, students can look into the early technologies of holes and slides to change the length of a column of air in an instrument. Students can use holes to create 4+ different tones out of their straw wind instruments.

MATERIALS LIST

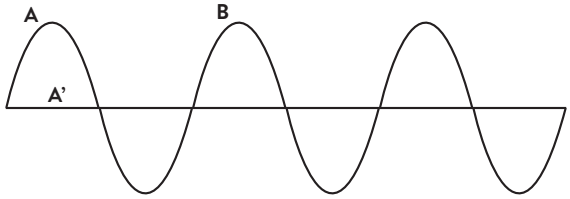
- Student Activity Resource
- Straws
- Pliers (optional)

Name _____ Date _____

Beat the Parents: Exploring Sound

BACKGROUND

In the episode, we learned about sound frequency, and that, as we age, we perceive sound differently than when we are younger. We learned that a sound is produced by a vibration that, in turn, vibrates the air molecules around it. The vibrations cause air molecules to compress or to spread apart, called **compressions** and **rarefactions**, which results in areas of higher and lower pressure. This pattern of high and low pressure repeating and traveling through the air is a **sound wave**. The figure below represents a small segment of a sound wave graph. If we imagine hearing a single note, there are two basic characteristics of that note that directly correlate to components of the sound wave graph. Whether the note is low like a deep voice or high pitched is dependent on the **frequency** of the wave or how often a wave cycle passes a given point. A wave cycle in the diagram would be from point A to point B (or any two consecutive high points or low points on the graph). What determines frequency is how close together those two points are. This distance is called the **wavelength**. When the wavelength is small (points are close together), more waves pass by in a given time, which means high frequency and the pitch is high. A large wavelength gives a low frequency and a low pitch. How "tall" the wave is, or how far A is from A' in the diagram, is called the **amplitude** and is what determines the volume of the note. A large amplitude correlates to a louder note and a smaller amplitude to a softer note.



INSTRUCTIONS

Complete the table below by drawing the wave that would correlate to the given sound description.

Sound description	Sound wave sketch
Soft high pitch	
Loud high pitch	
Soft low pitch	

Name _____ **Date** _____

TASK

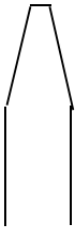
Follow the procedure below to create a basic wind instrument out of a plastic straw. You will then alter the straw and see what happens to the pitch of the sound produced.

PREDICT

How will changing the length of the straw affect the pitch produced?

PROCEDURE

1. Use your teeth or pair of pliers to flatten about one inch of the end of your straw.
2. Cut the corners off of the flattened end to create the shape shown at the right.
3. Place the cut end of the straw between your lips and press down gently with your lips.
4. Blow through the straw to create a tone. You may need to move it around slightly to get a tone. You are trying to get the cut ends to vibrate.
5. Once you are able to get a tone, have a partner snip off about 1 cm of straw from the bottom. Continue to cut off pieces of straw while you make the note. Observe what happens to the pitch.



CONCLUSION

How does the length of a column of air (the straw) affect the pitch of sound produced?

_____

_____

_____

_____

FOLLOW-UP

Wind instruments produce different pitches using the same principle you explored with the straw. Through the use of keys, valves, and slides, the size of a column of vibrating air is changed and therefore the pitch or note played is changed. **See if you can:**

- Create a basic wind instrument that plays 4 or more different notes with a straw by adding holes instead of cutting off segments (see figure at right).
- If you have a straw that fits snugly in another, you can make the air column longer and shorter like a trombone!