SCIENCE

Light AND Sound

Matter AND Materials

Complete 4/5 Combined

Inquiry Based Unit

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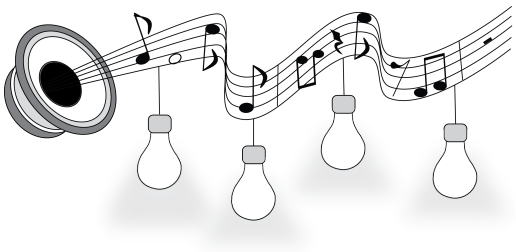


Introduction
Light and Sound

Dear Teacher,

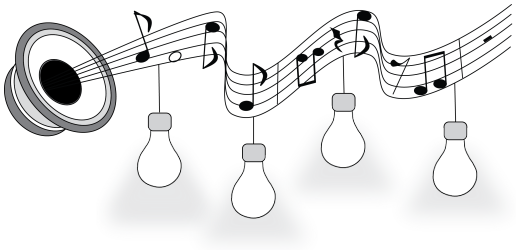
This unit has a lot of hands on experiments that will keep students excited and engaged while learning about light and sound. Wherever possible I have tried to ensure that all of the experiments use common and safe materials to accomplish the learning goals. However an important aspect of these experiments is the ability for students to reflect on their learning as some of the concepts are theoretical and some students may struggle with making these connections without your guidance. This is especially true with sound and understanding that sound travels through molecules and in waves two things which students cannot always see with their eyes.

I would also highly recommend that this is not your first unit of the year. There are many skills that students will require such as independent work skills, and a knowledge of inquiry and the inquiry process. These are skills that have to be explicitly taught, modelled, and rehearsed. It can be done in this unit but is much more easily done through other units that are more researched based and less hands on experiences.

This unit can be used by teachers at any stage of their inquiry journey. Learning how to use an inquiry approach in your classroom is a valuable and changing experience. As you begin I cannot promise you that it will all be smooth sailing as inquiry can be messy and uncomfortable as the teacher lets go of some control over student learning and the students begin to learn to take a more active role in their own learning. Understanding that this process is a journey and that this unit will help you to begin, continue or support you on that journey is paramount. If you are new to inquiry and would like more support please check out my video inquiry series on my website at http://bit.ly/ML-inquiry to learn about how I implement inquiry in my classroom with my split grade.

As always if you have any questions, concerns or comments you would like to share with me I am always available to support you. Send me an email and I will get back to you promptly. I appreciate when buyers contact me directly on any issue prior to leaving feedback.

Enjoy the unit!
Sincerely,
Patti
@MadlyLearning
EMAIL : info@MadlyLearning.com



Focus on Inquiry

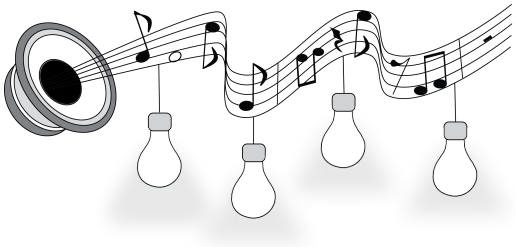
Inquiry is an approach to teaching that takes the teacher out of the role of lecturer and transitions the teacher into the guide on the side. By implementing an inquiry approach you are giving up some of the control in your classroom and over the learning.

Getting Started:

Start your unit getting to know how much your students know and what they are interested in. This is the goal of lesson one. Have them complete the arrow foldable then come and share what they know with the group. Get some of their questions and capture them on a chart paper. Have them share their ideas with the class. Students will ask questions but don't give them answers; just write them down and ask a question back that makes them think more deeply about the topic they are curious about. Get an idea on what they are interested in and what they know. Once you have captured their questions look at their list and group their questions into topics. These will serve as your lessons. Make a list of themes that students want to know. These will generally follow the lessons as they are planned out in this unit except now you have let them choose why they are learning about them.

The Lessons:

The lessons in this resource reflect the typical goals of an initial student inquiry. You will work through these lessons always referring to these as being a part of the student goals. They do not have to be done in exactly this order and you can add in other information based on student interest. You will notice that many of the pages included either activate prior knowledge or are a reflection on a hands on learning activity to ensure that students are learning from the activities what they are supposed to learn. This is where your guidance becomes and important part of the learning process.



Focus on Inquiry

The Lessons continued:

You are no longer just giving information but you are leading discussions through questioning techniques that help students to draw conclusions. Conferencing and knowledge building circles will be important activities for this to occur. Assess who is doing most of the talking? It should be the students doing the talking about their learning and not just listening. This is the goal for learning. However this may be new to many of them as they learn to listen to each other instead of just you. So train them, train them, train them by gradually releasing the control of the conversation away from you and more to them.

Final Inquiry Project:

This is the application piece of all of their learning and should take up the most of your teaching and learning time. During this time you are not teaching and lecturing but supporting, questioning and conferencing with students. If this is one of your first inquiry units you can consider a guided inquiry approach where you walk them through each step and limit their choices, or you can allow students to work as a group based on interest and use a guided reading for science model to help them through their inquiry.

Inquiry is a journey and wherever you are on your inquiry journey as a teacher is an okay place to be. Start with one inquiry task and with every new experience release a bit more control to students letting them lead. This happens over time not over night.

Properties & Changes IN Matter

Notes for the teacher:

This unit is based on a simple understanding of chemistry. Matter makes up all things and is typically in one of three states, solid, liquid and gas. Students should have background knowledge from previous grades on these states of matter however; a review will most likely be necessary. The goal of this unit is to help students begin understanding the molecular structure of these states of matter and what happens when they change states and its relation to heat. Another goal of this unit or the 'big idea' is the impact that this has on people and the environment. In our daily life we use products that have been processed into their final state, items that have generally started out in its raw form of its natural resource. Most products are then processed and changed both physically and chemically before we use them. Plastic, bread, margarine, cookies, technology devices, and paper are all examples of highly processed materials that impact people and the environment when they are made for human consumption. Understanding this big idea is the link between many other units at both the grade 4 and 5 level and allows the teacher to use this final inquiry product of this unit and integrate it into other units that are taught this year. Allowing students to make these connections is an important part of the inquiry process.

How to teach this unit:

This unit will allow a teacher to work through these activities lesson by lesson and cover all the curriculum with a focus on the teacher directed model. However this is not the intention of this unit. With an inquiry perspective the students and their interests are at the forefront. The teacher should be using these lessons in a responsive way to answer the questions that students have. The activities will naturally develop out of the student curiosity when asked the question what is matter, what is a solid, a liquid and a gas. Beginning with the wonder wall cards in lesson one each student will begin to question what is matter and see the connection of water changing states. Prompting them to ask questions about these cards will allow you to see what they are thinking. You can then choose the questions to dig deeper to get to the key concepts that you need to cover by sorting through their questions, and pulling out the key learnings. Generating success criteria that closely aligns with curriculum standards. All while having student buy in and engagement.

Properties & Changes IN Matter

Notes for the teacher:

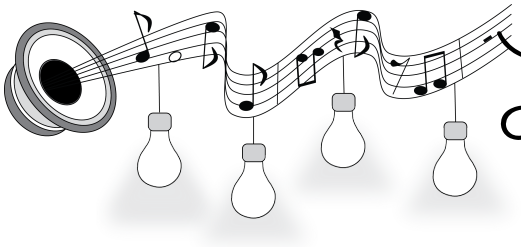
Where learning happens:
Students will not learn by simply filling out the activity pages that are in this unit. Students will learn through questioning, experimenting, connecting and reflecting. It is important that as a teacher you use knowledge building circles to sit with students to share their observations and experiences, make connections, and share reflections. The activity pages in this resource are open ended and responsive enough that students will be able to record their learning for assessment purposes. Each student and class may have different interests, experiences, and reflections so there is not always a correct answer.

Cross Curricular Links
There are many opportunities for cross curriculum links in this unit.

- Math:
  - Students will need to measure the volume and capacity of substances.
  - Students can also graph these although this is not necessary.
- Language:
  - Students can write procedural texts based on substances changing forms.
  - They can learn research skills
  - Non fiction text features
  - Synthesizing information
  - Making connections
  - Procedural writing
- Social Studies:
  - Government - how does government regulate the processing of products or the sustainable use of natural resources.

BIG IDEA

The final project of this unit can combined with the final projects of my other grade 5 **government**, and **energy conservation** units for one overall culminating task.



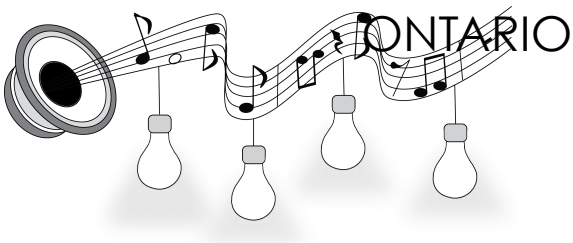
Light and Sound

Lesson Overview

	Lesson
1	Light and Sound in our World
2	Artificial and Natural Light
3	How Light Travels - Experiments
4	Light: Bend, Bounce, Absorb
5	Light and Colour
6	What is Sound?
7	How Sound Travels
8	Detecting Sound
9	Light and Sound Safety
10	**Inquiry Project** - How light and sound inventions have changed the way we live.

Properties & Changes IN Matter

	Lesson
1	What is matter?
2	Properties of solids, liquids and gases.
3	Properties of solids, liquids, and gases.
4	Changes and states in matter of water.
5	Changes and states in matter of other materials.
6	Changes in state and heat.
7	Physical and chemical changes in matter.
8	How the physical properties of certain materials help us?
9	The environmental impact of changing matter.
10	**Inquiry Project** - Identify, research, and share about a product that goes through a change of matter. Assess how the process of this product impacts people and the environment.



Curriculum Links

Ontario Curriculum Expectations	1	2	3	4	5	6	7	8	9	10
Assess the Impact on society and the environment of technological innovations related to light and sound.										
1.1 Assess the impact on personal safety of light and sound devices.	X								X	X
1.2 Assess the impacts on society and the environment of light and sound energy produced by different technologies (from different perspectives).									X	X
Investigate the characteristics and properties of light and sound.										
2.1 Follow safety procedures			X	X	X		X			
2.2 Investigate the basic properties of light: • Light travels in a straight path. • Light reflects of shiny surfaces. • Light refracts. • White light is made of many colours.			X	X	X					
2.3 Investigate the basic properties of sound: • Sound travels. • Sound is absorbed or reflected. • Sound can be modified. • Relationship between sound and vibrations.						X	X	X		
2.4 Use problem solving skills to design, build and test a device that makes use of the properties of light.			X							X
2.5 Investigate applications of the properties of light and sound.	X	X							X	
2.6 Use appropriate science vocabulary.	X	X	X	X	X	X	X	X	X	X
2.7 Use a variety of forms to communicate understanding.	X	X	X	X	X	X	X	X	X	X
Demonstrate an understanding of light and sound as forms of energy that have specific characteristics and properties.										
3.1 Identify a variety of natural light sources.	X	X								
3.2 Distinguish between objects that emit their own light and objects that reflect light.	X	X								
3.3 Describe the properties of light (travels in a straight line and can be absorbed, reflected or refracted).			X	X	X					
3.4 Describe the properties of sound (sound travels, sound can be absorbed, reflected or modified).						X	X	X		
3.5 Explain how vibrations cause sound.						X	X			
3.6 Describe how different objects and materials interact with light and sound (prisms, voice, echo, water, air).				X						
3.7 Distinguish between sources of light that give off both light and heat.					X					
3.8 Identify devices that make use of the properties of light and sound.		X							X	X

ONTARIO Curriculum Links

Ontario Curriculum Expectations	1	2	3	4	5	6	7	8	9	10
Evaluate the social and environmental impacts of processes used to make everyday products.										
1.1 Evaluate the environment impacts of processes that change one product into another product through physical or chemical changes.								X	X	X
1.2 Assess the social and environmental impact of using processes that rely on chemical changes to produce consumer products taking different perspectives.								X	X	X
Conduct investigations that explore the properties of matter and changes in matter.										
2.1 - Follow safety procedures		X		X	X	X				
2.2 - Measure temperature and mass, using appropriate instruments (thermometer, a single-pan balance).		X								
2.3 - Use scientific inquiry/experimentation skills to investigate changes of state and changes in matter: - Condensation - Solidification - Release and absorption of heat					X	X	X			
2.4 - Use scientific inquiry/experimentation skills to determine how the physical properties of materials make them useful for particular tasks.		X			X	X				
2.5 - Use appropriate science and technology vocabulary including: mass, volume, properties, matter, physical and reversible changes, chemical and reversible changes.		X								X
2.6 - Use a variety of forms to communicate with different audiences.				X						X
Demonstrates an understanding of the properties of matter, changes of state, and physical and chemical changes.	X									
3.1 - Identify matter as everything that has mass and occupies space.	X		X							
3.2 - Identify properties of solids, liquids and gases: - Solids have definite volume and hold their shape. - Liquids have definite volume but take the shape of their container or spread when they are not contained. - Gases have no definite volume and take the volume and shape of their container or spread when they are not contained.		X	X							X
3.3 - Explain changes of state in matter: evaporations, condensations, solidification or freezing, fusion or melting, sublimation, and give an example of each.				X	X	X				X
3.4 - Describe physical changes in matter as characteristics that are reversible.				X						X
3.5 - Describe chemical changes in matter as changes that are irreversible.							X	X		X
3.6 - Explain how changes of state involve the release of heat or the absorption of heat.					X	X				X
3.7 - Identify indicators of a chemical change: production of a gas, change in colour, formation of precipitate.							X	X	X	X
3.8 - Distinguish between a physical change (can be reversed) and a chemical change (new substance is created).							X	X	X	

Links and Resources

Light and Sound

LINK TO LIVE BINDER RESEARCH FILES

http://bit.ly/ML-lightsound

ACCESS CODE: MLSS&S

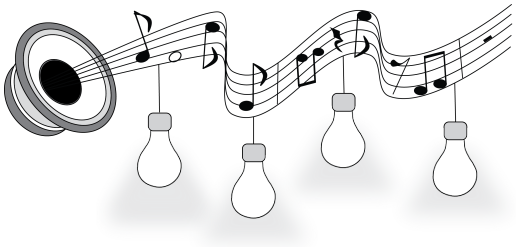
Links and Resources

MATTER

LINK TO LIVE BINDER RESEARCH FILES

bit.ly/ml-matter

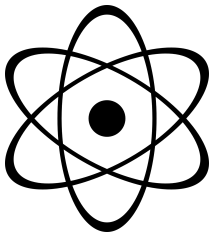
ACCESS CODE: MLSS&S



Lesson #1

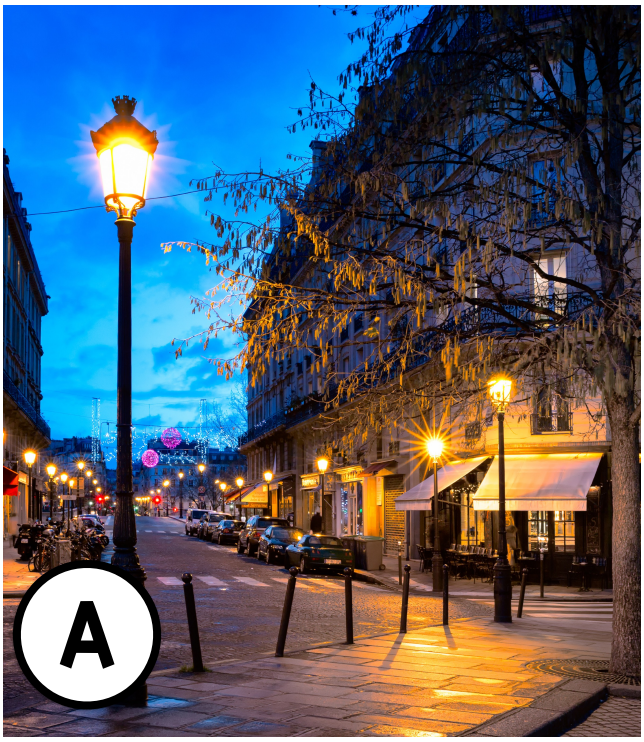
Lesson #1

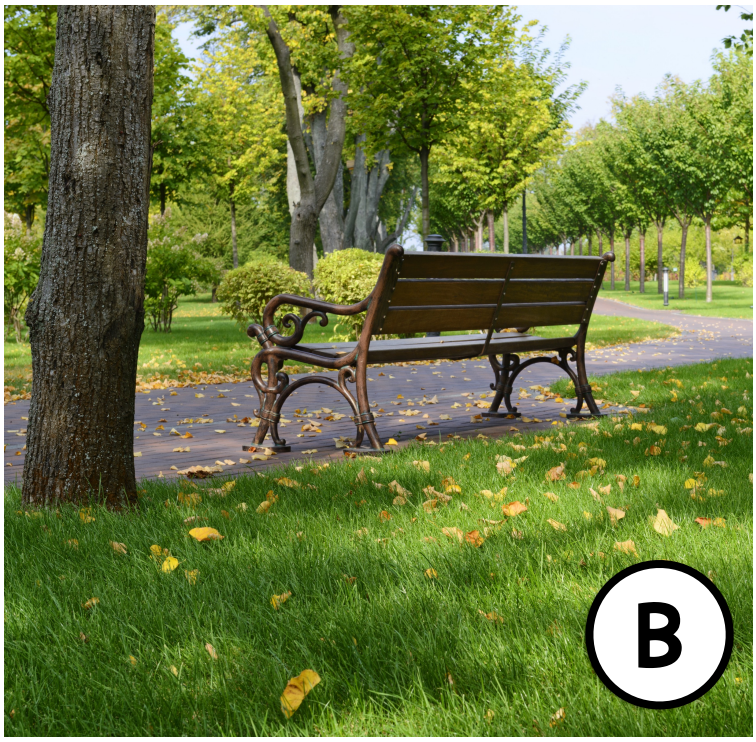
	First Half	Second Half
Prep	Gr 4: Photocopy or Colour Print the grade 4 collage of pictures of light and sound, the interactive notebook for students note-taking. Prepare chart paper to record students questions and ideas to generate learning goals and success criteria. Gr. 5: Prepare photos or artifacts for the provocation in this lesson. Prepare materials to create an anchor chart to capture learning.	
Gr. 4	Provide students with the photo collage of light and sound. **Student Activity:** Students will look at the photo and access their background knowledge to identify and sort the things in the pictures that emit light and things that make sounds. They will answer the questions on the foldable flap activity about light and sound prior to meeting with the teacher.	**With the Teacher:** Students will meet with teacher to discuss their pictures. Students will share what they saw and their answers to some of their questions. After this conversation invite the students to share their thoughts about the upcoming unit of light and sound. ○ What do they wonder about light and sound ○ What are they curious about ○ What would they like to learn more about Record students responses to create learning goals and success criteria. This will create a focus for students for the remaining parts of the unit.
Gr. 5	**Provocation/Wonder Wall** **Big idea: What is matter?** Students will look at different items to look at different changes of matter. Use either the photos provided or replace the photos with the actual objects in the pictures. Also supply them with a scale to weigh the objects and a tape measure. Begin this lesson by showing students the pictures/ objects and ask them to think about the following questions: • What are these objects? • What is different about these objects? • What is the same? • How are the objects connected to each other? Students will discuss with the teacher what they observed. ***Assessment:*** *Look for students using the words solid liquid and gas. Also can they make the connection between the ice, water, and steam and cream and butter. The fire, eggs, bread, rusted nails, and rotten bananas are examples of changes that cannot be reversed. Wax, butter and ice can melt and be returned back to their original state.*	**Independently:** After they have had their discussion about their observations give them the word cards to sort the items into the groups. First sort by solid, liquid or gas, and then align them based on types of changes that can occur. *Print the cards smaller for students to individually use in their notebooks. Select the pages and print these pages 2 pages per sheet. This can be done on most printers within the print dialogue box.*
Notes	Grade 4: Not every student needs their own picture page. You may want to print a few pages or display this page on an interactive board or Apple TV. It is important to record students ideas even if they maybe incorrect in order t to track student learning throughout the unit.	



Grade 4

Lesson #1





Instructions:

Complete the three pages of the foldable based on the pictures that you and locations that you see. Try to imagine yourself in the scene: what lights and sounds would you see. They do not necessarily need to be in the picture. When all of the pages are done then cut them out around the outside of the shape. These will be glued together and assembled after you meet with your teacher.

Answer the following questions about light and sound

Can you think of examples of natural light?

_____

_____

_____

Can you think of examples of artificial light?

_____

_____

_____

Which pictures or locations would you consider noisy? Why?

_____

_____

_____

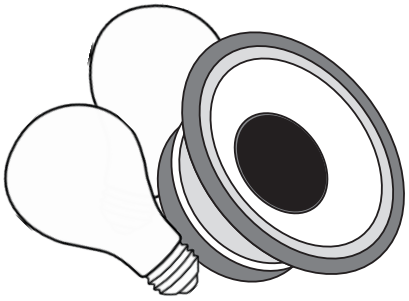
How do the lights and sounds in these locations keep us safe?_____

_____

_____

Think about it

Wondering
all about
Light AND Sound



<u>Look at Picture D&E</u>

Brainstorm a list of lights and sounds that you might see and hear in these locations.

BUSY STREET

FACTORY

pictures D&E

Look at Picture B&C

Brainstorm a list of lights and sounds that you might see and hear in these locations.

COMMUNITY PARK **AMUSEMENT PARK**

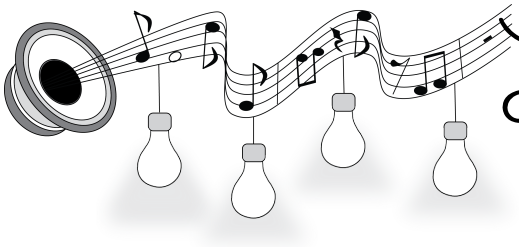
pictures B&C

Look at Picture A

Brainstorm a list of lights and sounds that you might see and hear in this location.

CITY STREET AT NIGHT

picture A

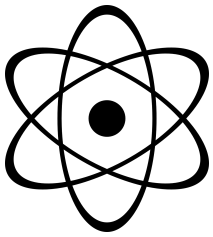


Light and Sounds All Around

After participating in the conversation with your teacher and classmates what are some of your questions about Light and Sound:

- I still wonder: _____
- What might happen if: _____
- How does? _____
- Why does? _____
- I'm curious about: _____
- I want to know more about: _____

What I Wonder



Grade 5

Lesson #1

Helium Balloons

Ice Cubes

Glass of Water

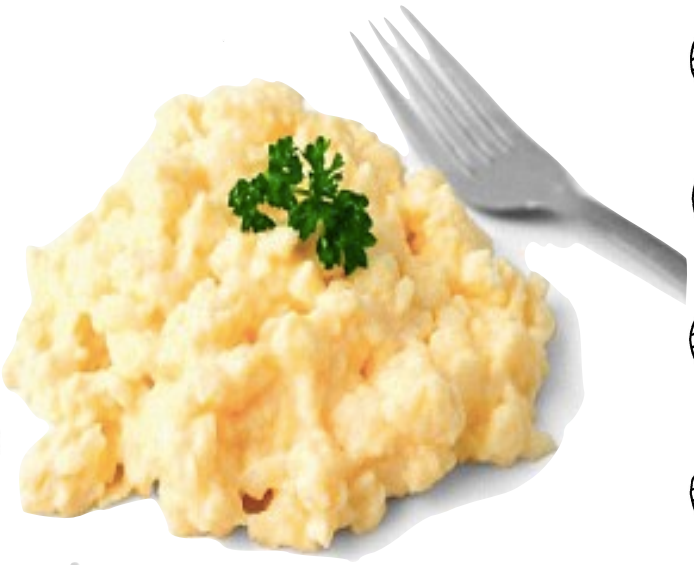
Steam (Water Vapour)

Candles

Butter

Dairy Cream

Fire



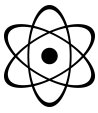
Scrambled Eggs

Baked Bread

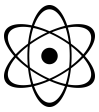
Rusty Nails

Rotting Banana

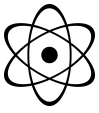
MATTER



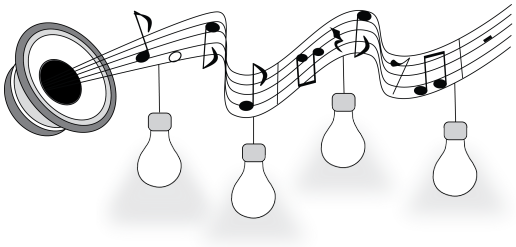
SOLID



Liquid



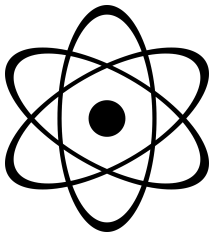
GAS



Lesson #2

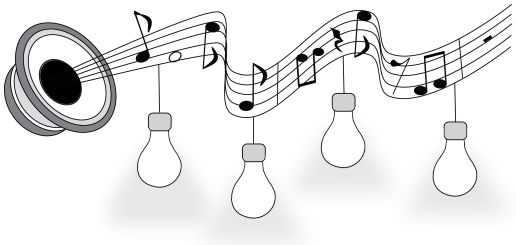
Lesson #2

	First Half	Second Half
Prep	Gr.4: Students need both sets of pages their picture sort and their REFLECTION: How does light help. Gr. 5:Gather materials as outlined in lesson #1 and review safety procedures during experiments with students prior to beginning lesson.	
Gr. 4	**Work with Teacher** Students will reflect on where light comes from. Look at the different sources of light and how they help people to live and benefit of the environment. • **Sun** - helps us see during the day. Helps us do work. Helps us grow plants. • **Lightbulb** - helps us see at night and indoors. • **Lightning -** • **Glowworm -** glow to find a mate so they can reproduce Students will then sort the light cards into two categories natural and artificial light sources.	**Independent Student Activity:** Students will read the article on natural and artificial light sources. Light Bulbs: Students will choose 4 different objects that use light and will identify what type of light and how the will help. *glue the cover light bulbs onto the answer page draw a picture of the light source on the outside on the lightbulb*
Gr. 5	**Classifying Matter:** Gather materials from your students or around home and school. Students need multiple examples of solids liquids and gases to compare. Some examples could include: water, ice, honey, cereal, ice cream, butter, balloon, helium balloon. Note trying to find examples of materials that do not typically fit in one category. **Independent Activity:** Students will openly examine the different samples that have been provided for them. Using the different tools for investigation such as a scale, ruler, syringe. Students will identify if the material they are investigating is a solid liquid or a gas.	**With Teacher:** Have a knowledge building circle where students share their thoughts. Some questions could include: • What did you notice? • How did you classify the different materials? • Highlight any areas where students had different answers. Students will then generate a list of rules that are true for solids, liquids and gases.
Notes	Grade 5: This is a discovery lesson and students are to use the tools they have access to in order to explore the properties of different materials. This activity is not designed to be a test that student need to get the 'right answer' but will explore the rules of different materials and question and discover the variety of materials. The key is to have an important discussion about the different materials and explore their thoughts and conclusions and to clarify any misconceptions after they have had a chance to explore. The answer guides provided in this lesson are for teacher use to help anticipate student answers, but are not comprehensive as student answers will vary depending on chosen materials and their independent discoveries.	



Grade 4

Lesson #2



Types of Light

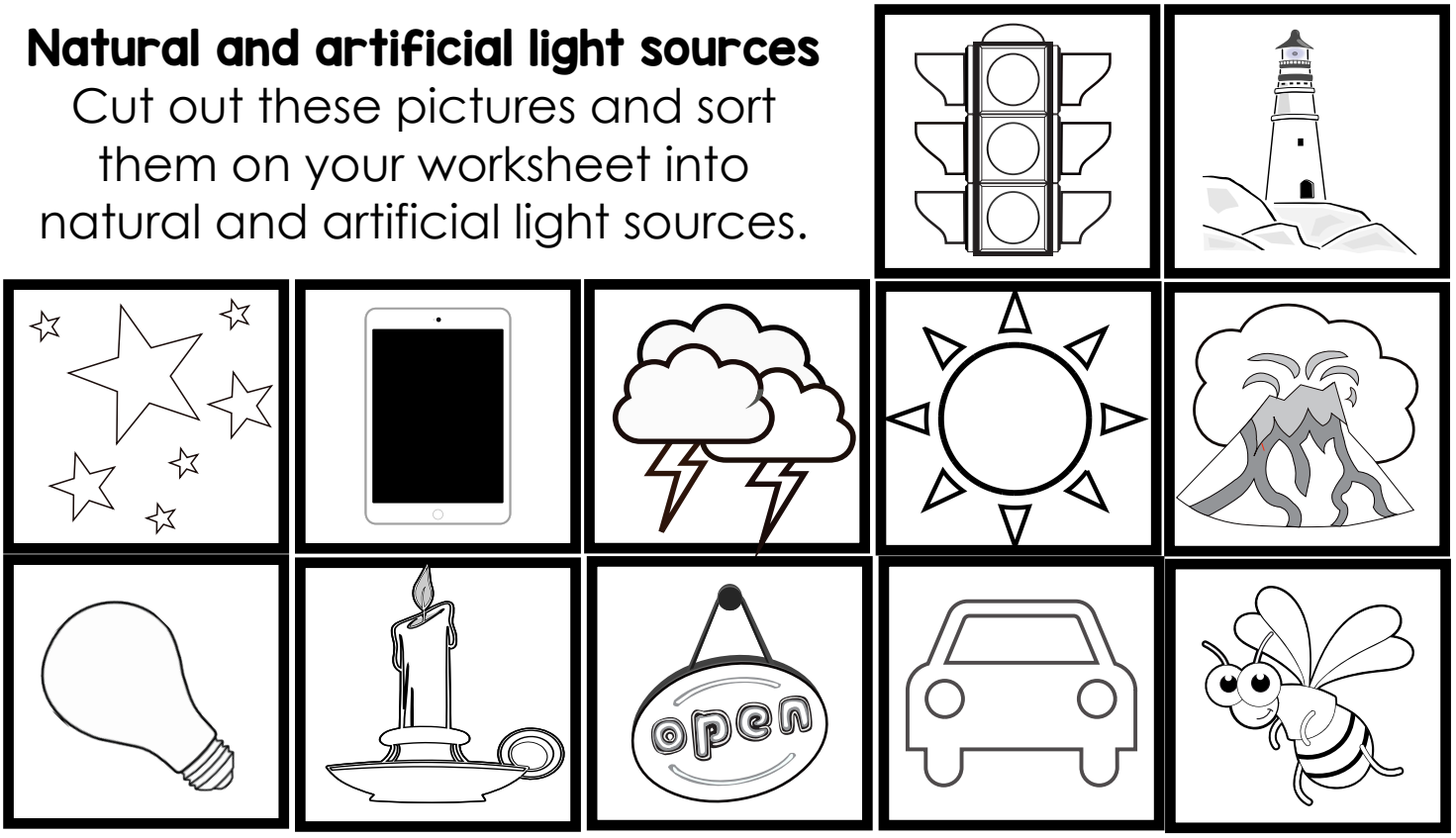
Natural and Artificial Sources of Light

We need light in our lives to do many things. There are two different types of light. Lights that occur in nature and lights that are made by or invented by people. Light invented by people is called artificial light. Can you think of and sort different sources of light?

Natural Light Source	Artificial Source of Light

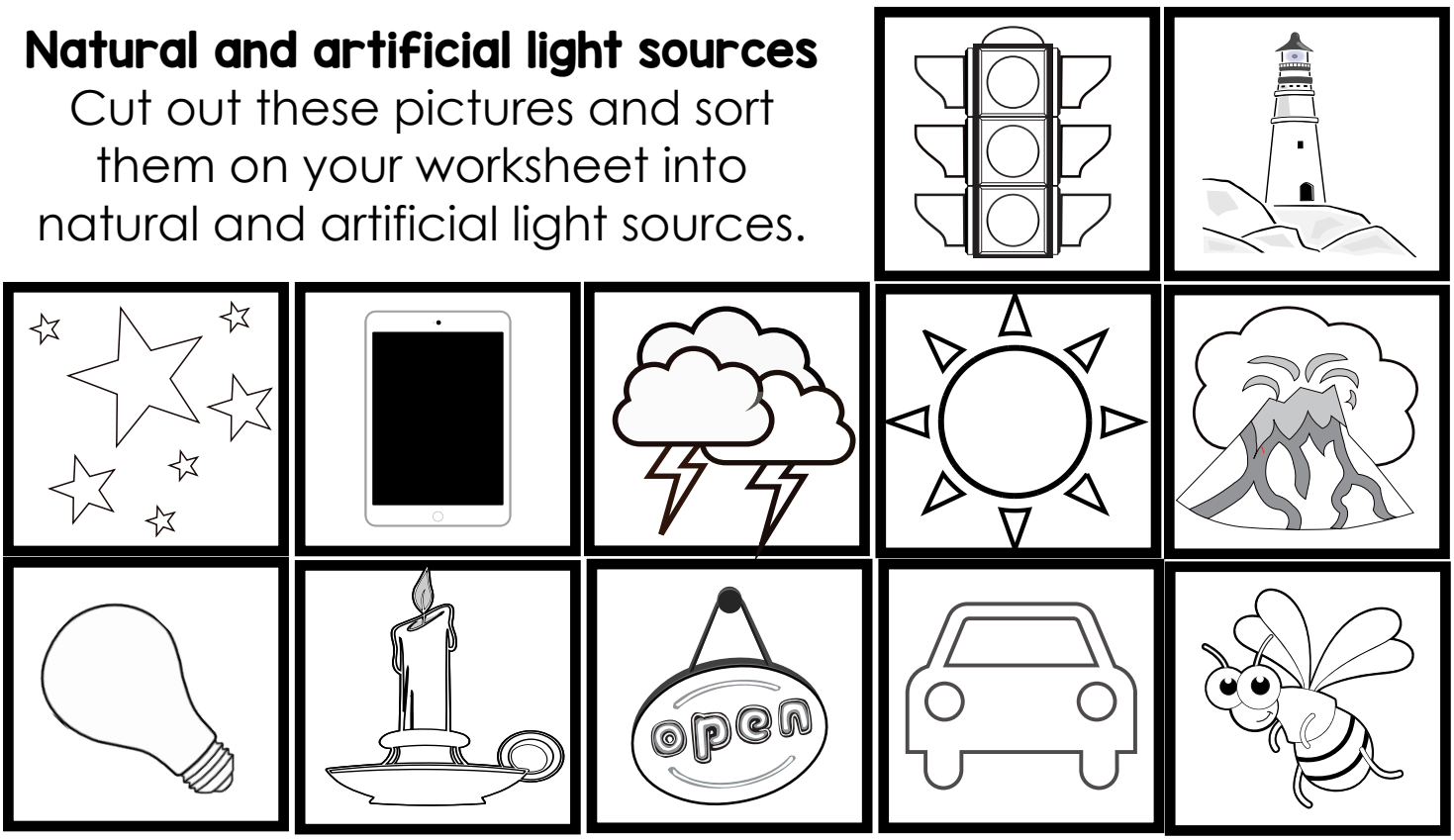
Natural and artificial light sources

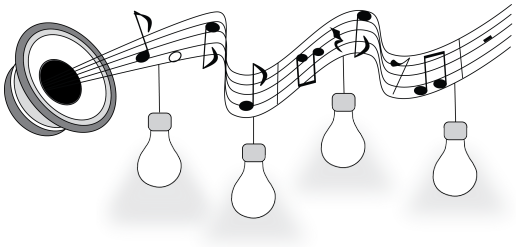
Cut out these pictures and sort them on your worksheet into natural and artificial light sources.



Natural and artificial light sources

Cut out these pictures and sort them on your worksheet into natural and artificial light sources.





Light Sources

Natural and artificial light sources

REFLECTION: How does light help?

1. Light source

_____

2. Natural or artificial?

3. How does this help?

_____

_____

_____

_____

_____

_____

1. Light source

_____

2. Natural or artificial?

3. How does this help?

_____

_____

_____

_____

_____

_____

1. Light source

_____

2. Natural or artificial?

3. How does this help?

_____

_____

_____

_____

1. Light source

_____

2. Natural or artificial?

3. How does this help?

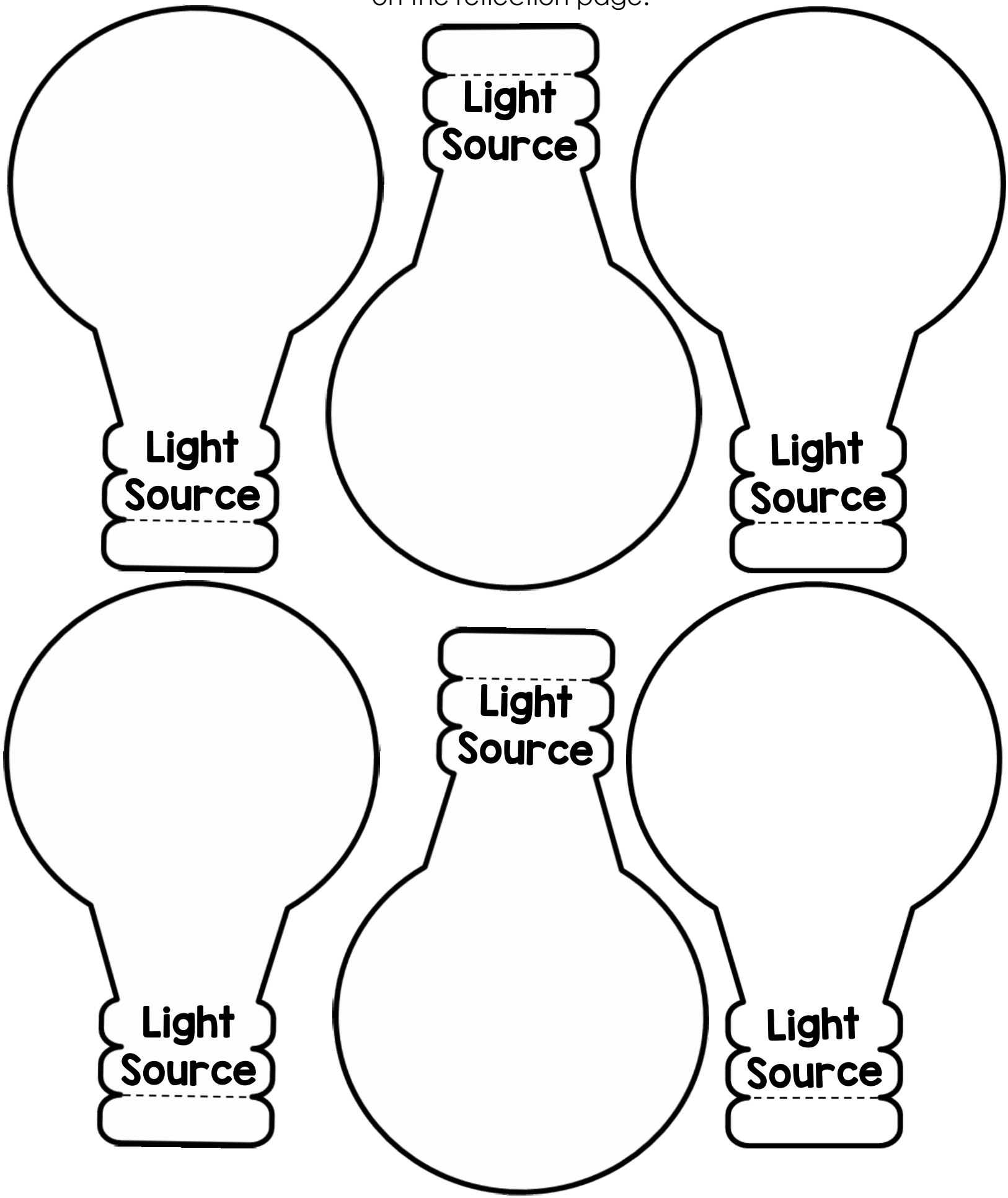
_____

_____

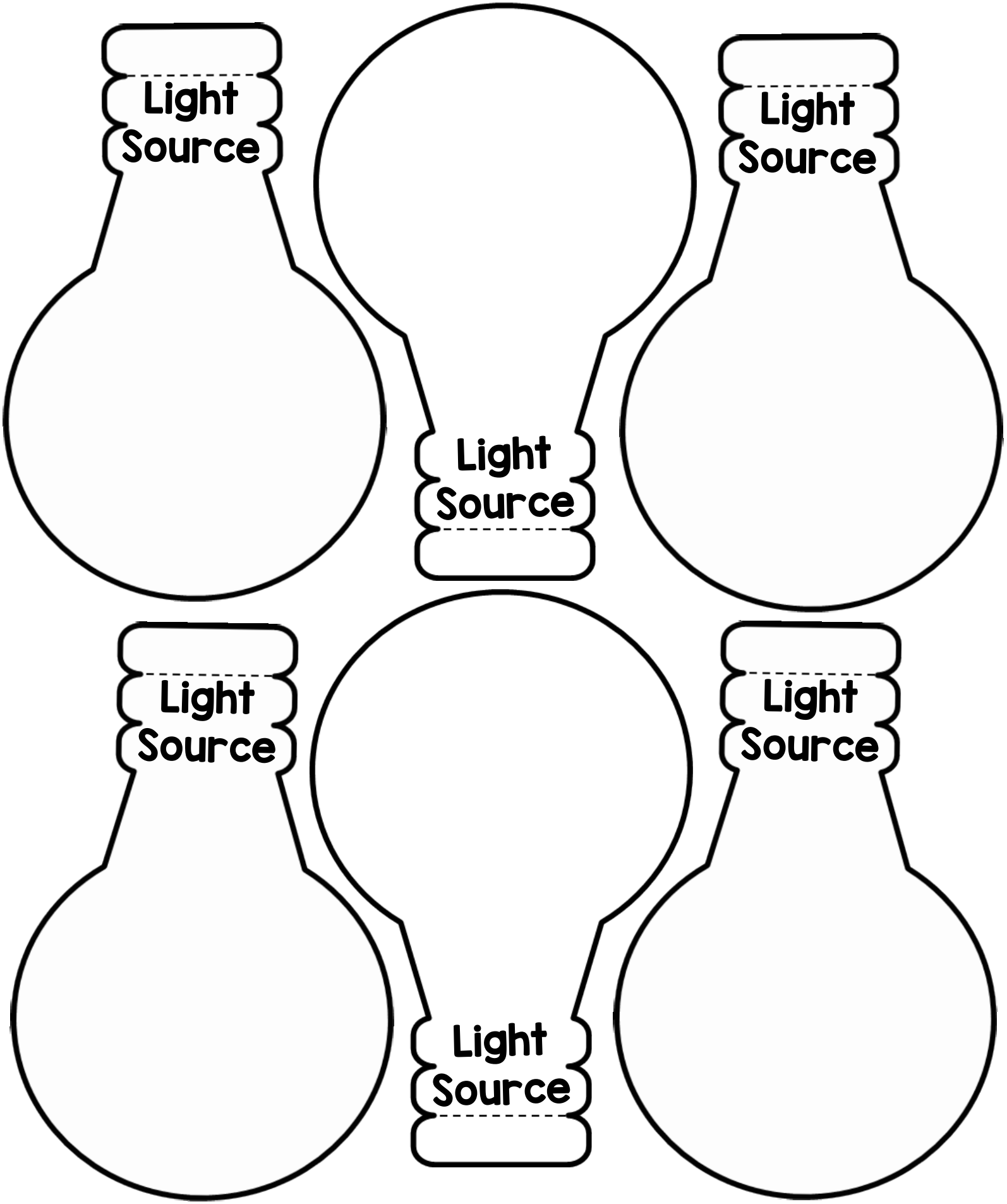
_____

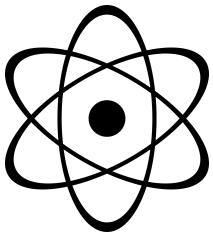
_____

Cut out four light bulbs for yourself. Draw a picture of your chosen light source. Fold each light on the dotted line and glue the tab down over the questions on the reflection page.



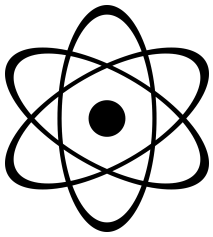
Cut out four light bulbs for yourself. Draw a picture of your chosen light source. Fold each light on the dotted line and glue the tab down over the questions on the reflection page.





Grade 5

Lesson #2



Glue the three pockets on top of the outlines on this page. Fold the flaps back and glue them down to create a pocket.

Sort the sample tubes into the correct category and describe the properties of the sample that you looked at.

As you look at your samples think about what is the same and what is different about each sample in the category.

SAMPLE NAME: _____

OBSERVATIONS

SAMPLE NAME: _____

OBSERVATIONS

SAMPLE NAME: _____

OBSERVATIONS

SAMPLE NAME: _____

OBSERVATIONS

SAMPLE NAME:

Air

PROPERTIES

SAMPLE NAME:

Helium

PROPERTIES

SAMPLE NAME:

Ice

PROPERTIES

SAMPLE NAME:

Water

PROPERTIES

SAMPLE NAME:

Ketchup

PROPERTIES

SAMPLE NAME:

Sugar

PROPERTIES

SAMPLE NAME:

Plastic Spoon

PROPERTIES

SAMPLE NAME:

Metal Spoon

PROPERTIES

SAMPLE NAME:

Oobleck

PROPERTIES

SAMPLE NAME:

Sand

PROPERTIES

Observation Questions

1. What colour is it?
2. Does it pour? Describe it.
3. How much does it weigh?
4. What is the volume of the sample?
5. Describe the shape of the sample. Try it in different containers.
6. Can you compress the sample?

Answers

Materials:

Found examples of: Solids liquids and gases.
Measurement tools: Scale, ruler, tape measure, graduated cylinder, large syringe.
Recording materials: Pencil, scissors, eraser, glue etc.

	SOLID	LIQUID	GAS
Color	Answers will vary.	Answers will vary.	Answers will vary.
Viscosity: Does it pour?	Are not at all viscous.	Viscosity will vary.	Very high viscosity
Weight	Measure each sample with a standard measurement and weigh on a scale.	Measure each sample with a standard measurement and weigh on a scale. Subtract the weight of the container.	May be difficult to weigh could weigh air and helium in a balloon. Weigh the balloon with and without the air inside to compare. Try to ensure the balloons have the same circumference.
Volume	Measure volume using formula for 3-D shape.	Measure capacity using a graduated cylinder.	Measure the volume of a gas using a balloon.
Shape	They do not take the shape of their container.	Will take the shape of the container. Shape of the liquid changes based on containers they are in.	A gas has no definitive shape and spreads out to fit the space
Compression	Cannot usually be compressed further. Can test for this by using manual compression with a pushing force. Also can use a syringe by filling the syringe and blocking the other output hole.	Is not compressible. Can use a syringe filled with liquid then try to compress.	It is compressible. Use a syringe and fill with some air then try to compress.

Answers

Examples of solids

Ice: Ice is a solid and is the solid version of water. Ice can be described as white or clear. It is not compressible has no viscosity and does not take the shape of its container. Ice will melt when the temperature is above 0°C and turn into water.

Sugar and Sand: Sugar and sand are solids. Think of these as their similar grains like a bucket full of tennis balls. Each piece is a solid but when combined with millions of other pieces it has properties similar to a liquid. Sugar and sand range from white to brown. They are not easily compressible and it has very low viscosity and does not alter its shape to fit its container. When sugar or sand are used in our daily life by combining millions of little pieces it does appear to have some viscosity some compressibility and does take the shape of its container however sugar and sand are not considered a liquid.

Metal and plastic spoon: The colour will vary depending on the material that you choose. The weight of the metal spoon will be more than the plastic spoon. This is due to the density of the materials used to make them. When the particles are closer together the material is more dense which makes it weigh more. The spoons have no viscosity, no compressibility and do not take the shape of the container they're in. Both materials are considered solids.

Examples of Gas

Air: The air that we breath generally consists of three elements, nitrogen (78%), oxygen (21%) and the remainder consists of argon (1%), water vapour, carbon dioxide (0.04%), and other trace elements. These elements make up the atmosphere of the planet. Air is compressible, is very viscous, has no definitive shape, and spreads out to fill the space.

Helium: This gas is lighter than the air in our atmosphere which is why it floats when in a balloon. This gas is compressible, is very viscous, spreads out within its container and has no definitive shape.

Answers

Examples of Liquids

There are two different types of liquids NEWTONIAN FLUIDS AND NON-NEWTONIAN FLUIDS. A non newtonian fluid is a liquid whose viscosity changes when force is applied. Newtonian fluids are regular liquids whose viscosity is consistent like water, oil, and vinegar. Other non newtonian fluids are oobleck, ketchup, and toothpaste.

NEWTONIAN FLUIDS

Water:

This is the most familiar example of a liquid. It takes the shape of it's container is poured easily. Maintains a consistent viscosity and is not compressible.

NON-NEWTONIAN FLUIDS

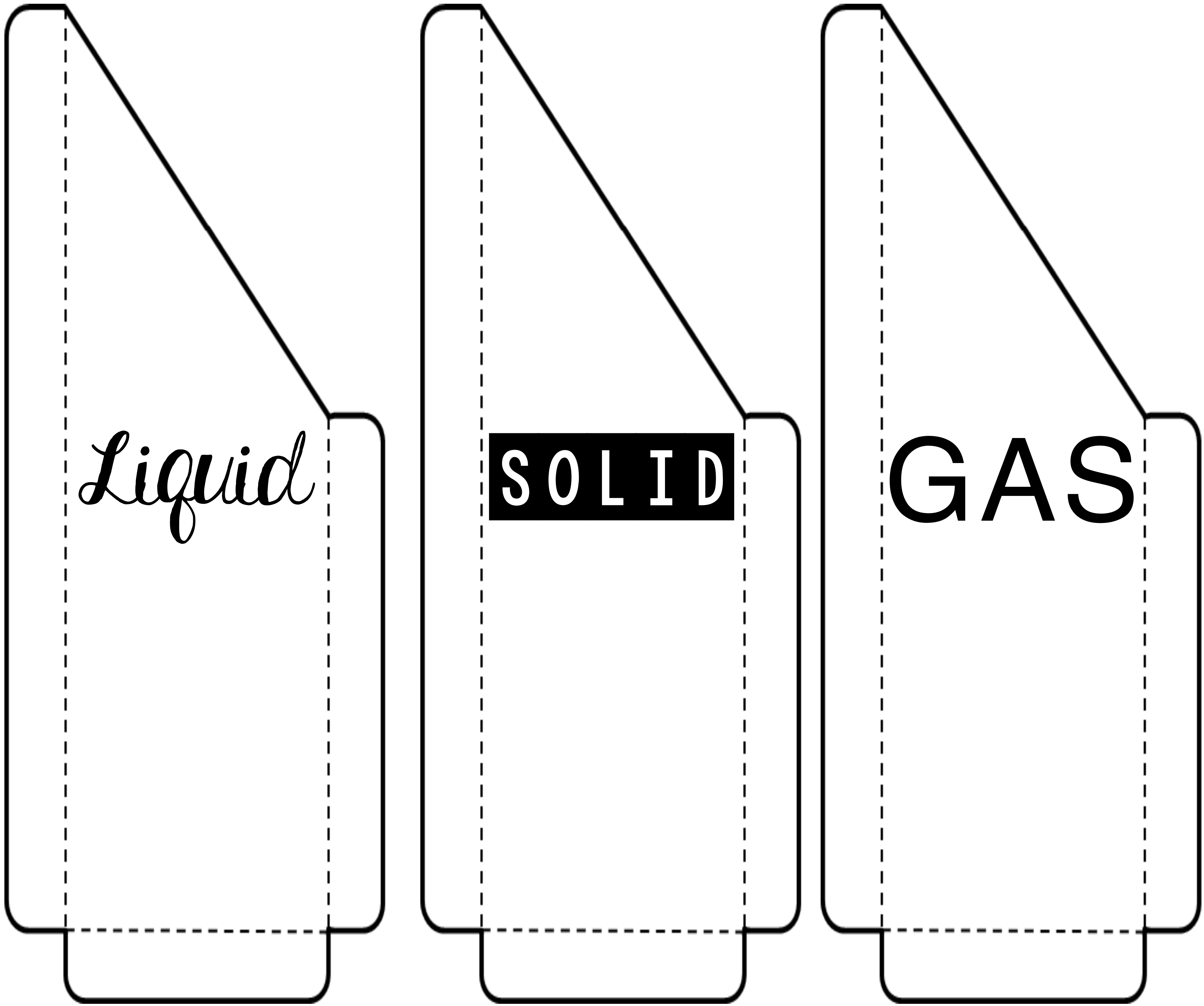
Oobleck:

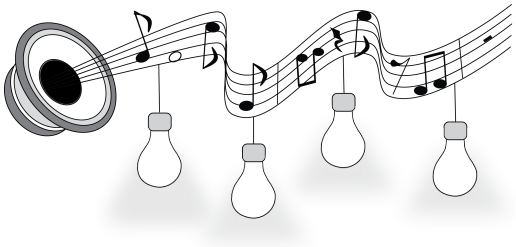
This substance is made by mixing cornstarch and water. Fill a bowl with a reasonable amount of cornstarch. Add water to the cornstarch slowly while mixing until it is gooey.

This substance will take the shape of its container and pour easily like a liquid. However when compressed it will act like a solid until that force is removed when it will return to a liquid form.

Ketchup:

Ketchup is also considered a non-newtonian fluid. It's viscosity changes when pressure is applied. This is why it does not flow out of a ketchup bottle like water would. You need to apply pressure to squeeze or force the ketchup out. With this applied force and compression the ketchup flows more easily. Ketchup fits the container that it is put in and will pour like a liquid however it does have higher viscosity as it does not pour as easily as other liquids like water. It cannot be compressed but the viscosity of this liquid does change when compression is applied.

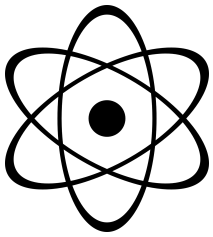

Liquid
SOLID
GAS



Lesson #3

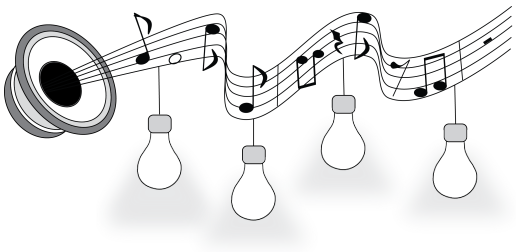
Lesson #3

	First Half	Second Half
Prep	Gr.4: Students need both sets of pages their picture sort and their REFLECTION: How does light help. Gr.5Prepare the microscope article for each student and have materials prepared to create an anchor chart.	
Gr. 4	**How Light Travels:** students will begin to understand that light travels in a straight line. The experiments that are designed for this will help them to see this concept however they may need support to draw this conclusion. Reflection will be necessary. **Work with Teacher:** Talk with students about how light travels. Have them generate a hypothesis together. Ask the following questions to prompt them to draw a hypothesis. You may want to actually draw pictures to help students visualize what they are trying to convey. • How does light travel from the sun to the earth? • How does the light travel out of a flashlight • What path does light take.	**Student Activity** students will participate in three experiments. (these can be done either as demonstrations, whole group, or small group centers depending on the needs of your class) There are three experiments 1) Light through cards - Materials (index cards or card stock, single hole punch, modelling clay, straw) 2) Light around a corner (cardboard box- cereal box or bigger, mirrors, flashlight)
Gr. 5	**Student Activity:** Students can finish and compare the information from the materials that they worked on from the previous lesson including any changes they may need to make after the discussion that they had together with the teacher. Students will read the article to discuss what happens when they look at these substances through a microscope.	**Teacher Directed:** Have students use their hands to show two molecules. Put fists together and make small vibrations with your hands keeping your hands together. This represents a solid bond. Now separate your hands slightly and imagine that they are linked together with a string. Sway your hands back and forth like you are a liquid flowing. Now with your hands independent of each other swing them around bouncing off of each other and your body. This is a gas. Students will then reflect on what they learned and make notes about what they learned from the last two lessons.
Notes	Gr.5: through this lesson students learn about the molecules in matter through a physical demonstration. After this demonstration, it would be helpful to create an anchor chart for students to reference that shows the molecular difference between solid, liquids and gases.	



Grade 4

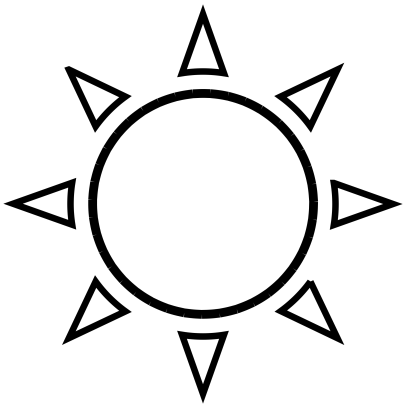
Lesson #3



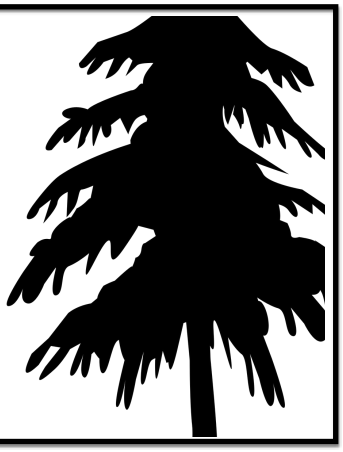
Traveling Light

How does light travel?

Have you ever thought about how light gets from the sun to the earth or how a flashlight is able to light your path in the dark. Think about what you know about light. Can you make a hypothesis (an educated guess) about the path that light travels to get from one point to another? Look at the pictures below and draw the path that light travels to help you make your hypothesis.



Hypothesis: Describe how the light travels



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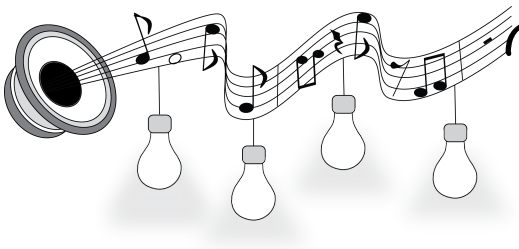
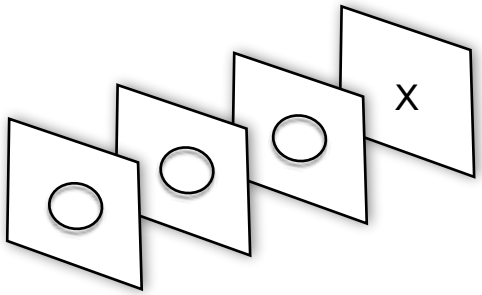
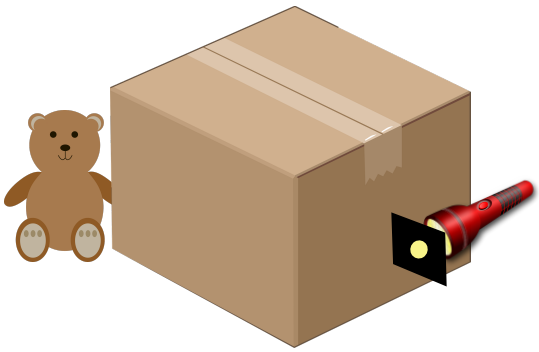


Traveling Light Experiments

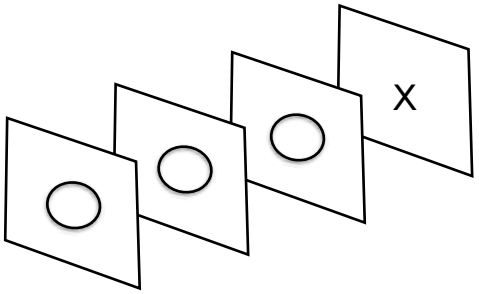
Light Through Cards



Light Around Corners



Light Travels
Experiment #1



1. Question

How does Light Travel?

2. Hypothesis:

I think _____

_____

_____

3. Experiment

Follow the instructions to test your hypothesis then draw a picture of your results.

Light Through Cards

You will need:

4 index cards
One Hole Punch, Modeling clay
Straw and Flashlight

Getting Ready:

Punch a hole in the middle of three of the cards in the same place. Using one of the punched card as a guide place it over the unpunched card and make a mark on the blank card in the middle of the hole.

Test It:

Using the flashlight try to get the light to pass through all three cards to hit the target spot on the last hole.

4. Results

Describe your results. How did you have to set up the cards to hit the target?

_____

_____

_____

_____

_____

What does this tell you about how light travels?

_____

_____

_____

5. Reflection

After meeting together and sharing the test results as a class what did this experiment teach you about how light travels?

_____

_____

_____

Light Travels
Experiment #2

1. Question

How does Light Travel?

2. Hypothesis:

I think _____

_____

_____

3. Experiment

Follow the instructions to test your hypothesis then draw a picture of your results.

Light around Corners

You will need:

Black Construction paper with a hole in the middle, Flashlight, cardboard box, mirrors (2-3)

Getting Ready:

Take the black construction paper about the size of the end of your flashlight and cut a hole in the middle of the paper. Place the black paper in front of the light. Place a target object at a different corner of the box

Test It:

Place your target at one corner of your cardboard box. Starting your flashlight at a different corner to light up your target. Try to get the light to move around all four corners of the box using the mirrors to help if needed.

4. Results

Describe your results. How did the light travel around the box?

_____

_____

_____

_____

_____

What does this tell you about how light travels?

_____

_____

_____

5. Reflection

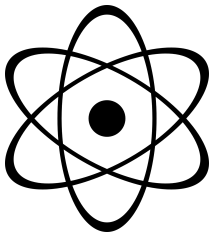
After meeting together and sharing the test results as a class what did this experiment teach you about how light travels?

_____

_____

_____

_____



Grade 5

Lesson #3

Matter THROUGH A Microscope

Matter is everywhere. Matter refers to anything in our world that can take up space and something that we can weigh.

The smallest piece of matter is called an atom. Atoms are so small that they can only be seen by very powerful microscopes. Atoms are made up of spinning protons, electrons and neutrons that spin around a nucleus. Atoms are pure substances like hydrogen, oxygen, carbon, nitrogen and helium. When atoms combine together like hydrogen and oxygen they form molecules. When hydrogen and oxygen combine in the correct way that makes water.

When many molecules are tightly packed together they form a solid substance. There is not a lot of space through the molecules and they are often put together in an organized pattern. They keep their form and shape.

When molecules are loosely packed together but still connected they form a liquid. They flow together easily and can be poured. They fit the shape of their container.

When molecules are full of energy and move freely they are called a gas. The molecules in a gas spread out and fill the space they take up completely.

Matter THROUGH A Microscope

Using the foldable activity from the next page please follow the instructions below to assemble your foldable.

1) Answer the page and complete all of the questions for a solid, liquid and gas.
2) Cut out around the outside of the foldable along the dark line. **Do not cut where you see the dotted lines.**
3) Fold the outside tabs towards the middle on the dotted lines.
4) On the outside of the folded tabs you will need to put the titles provided. Cut them into two pieces and glue them on the outside of the tabs.
5) Glue the back of the foldable on top of this instruction box.

What is Matter?

What have I learned?

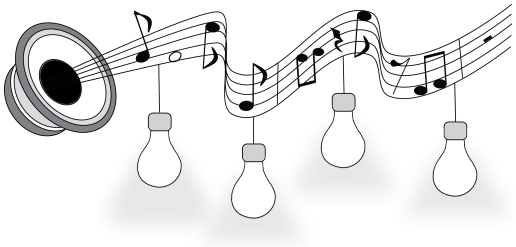
Questions?

DRAW IT	DESCRIBE IT	EXAMPLES
DRAW IT	DESCRIBE IT	EXAMPLES
DRAW IT	DESCRIBE IT	EXAMPLES

GAS

SOLID

Liquid



Lesson #4

Lesson #4

	First Half	Second Half
Prep	Gr 4: Ensure you have the materials for the experiments. Mirrors, Flashlights, clear cups, straws, oil and water. Alternatively aluminium foil can also work instead of mirrors. Gr 5: Prepare interactive notebook papers each student	
Gr. 4	**Light: Bend Bounce Absorb:** **Student Activity:** <u>All students together:</u> Students will read the article about bending, bouncing and absorbing light. To learn more about how light reflects, refracts and absorbs light. Students begin to answer the questions on the foldable and will continue to consolidate their learning through the demonstration experiments.	*This activity allows you to model for students the scientific process. These quick experiments should be modelled for students as a large group. I would recommend blowing up the experiment guide pages to the largest size available on your school photocopier* **<u>Experiments</u>** **Light Bends:** a pencil looks bent when light travels through different substances at different rates **Bouncing Light** using a strong source of light and mirrors to **Absorbing Light**
Gr. 5	**<u>Water changing states</u>:** Have a knowledge building circle with students to discuss how water changes states? Many students will be familiar with how water changes states so there should be a good amount of background knowledge here. Make an anchor chart with the knowledge that they know and identify some information that they do not know, such as the terms used to describe these changes.	**<u>Student Activity:</u>** Students will be learning how water changes states. They will be learning the vocabulary that describes these changes. Students will read the description cards. Then using the information on the cards and the information from your knowledge building circle to label the interactive notebook foldable.
Notes	**See teacher notes on light experiments.** **It may be helpful for this lesson to demonstrate water changing from one state to another. This will help students visualize what is happening as water changes states. If you choose to add this additional step to this lesson please prepare the materials required such as a heat source and/or a freezer.**	

Teacher Notes

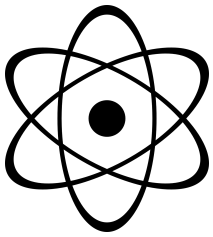
Light Bends: mix oil and water together to see how light bends. When you look at the straw or pencil in the cup straight on from the side it will look like the straw is cut into two. This is said to have a bent (or broken) appearance. This happens because in order for our eyes to see an object, light hits the object and bounces off of it then hits our eyes so we can see it. When the straw or pencil passes through substances with different densities like oil and water, the light travelling to our eyes makes it look like the object is broken. The light travels slower through substances like oil that are more dense than it does through water. That is the light bending because the image we see doesn't look continuous. It is altered due to the different speed in which the light bounces off the object to our eye.

Bouncing Light

You will need at least one strong source of light (good flashlight would work) and mirrors for students. Follow the instructions to bounce the light around from person to person. The reflectivity of light off a mirror will lose about 10% of its energy when bouncing off the mirror. If using aluminium foil you can expect a 12% loss of energy. This will affect the amount of students that are able to bounce the light off the objects. Therefore this game should have a maximum of about 6-10 people to work properly. Students should be able to notice that through this experiment there is energy loss as the beam of light is less bright as it bounces from person to person.

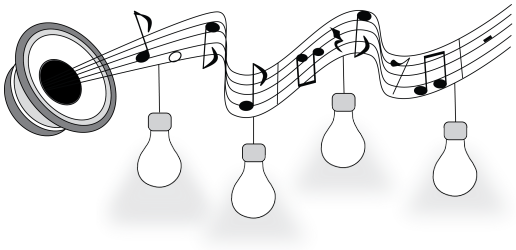
Absorbing Light

White light is made up of all of the colours of the rainbow. When you see the colour white all the colours of light are reflected and nothing is absorbed. With black all the colours of the rainbow are absorbed and the energy from the light is converted into heat. This is why black objects are hotter in the sun.



Grade 4

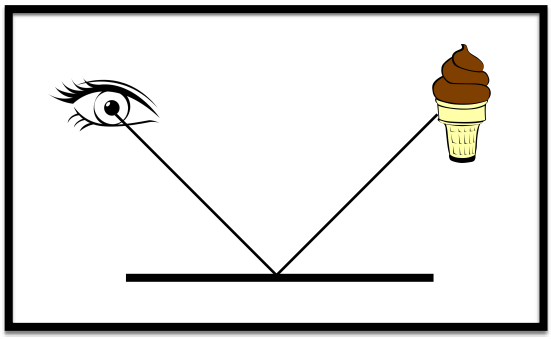
Lesson #4



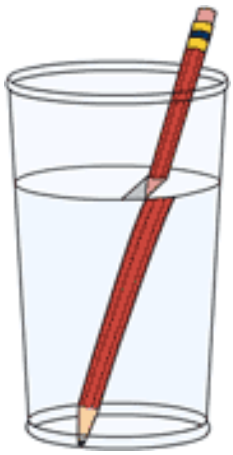
Altering Light

Bend, Bounce, and Absorb

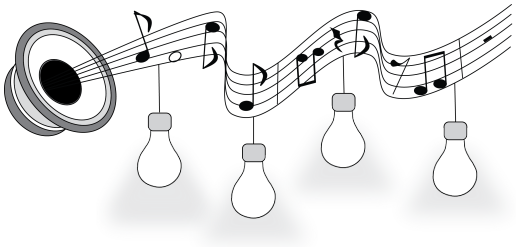
Light travels in a straight line. However when rays of light bump into things or pass through things sometime the ray of light changes and can bend, bounce or be absorbed by the object it ran into.



When a light ray bounces off of an object that is called reflection. Reflection helps us to see things in our world. When light hits a smooth surface at an angle (the angle of incidence) the light is then reflected in the opposite direction at the same angle. When light hits surfaces that are not smooth the reflected angles may scatter all around. Objects that do not produce their own light like walls and desks need to reflect the light that bounces off of their surfaces into our eyes so that we can see the object.

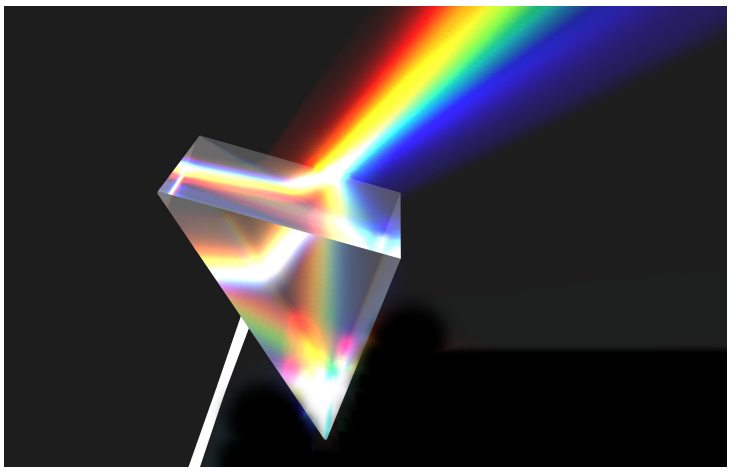


When a light ray passes through different materials with different densities it is bent or refracted. If you put a pencil into a glass of water it looks like the pencil is bent or distorted. This is because the light ray is travelling at one speed through the air but when it hits the denser water it slows down. Just like when you try to run through water in a pool you are much slower than running on land. As the light ray hits the water it slows down and bends altering the direction it was travelling.



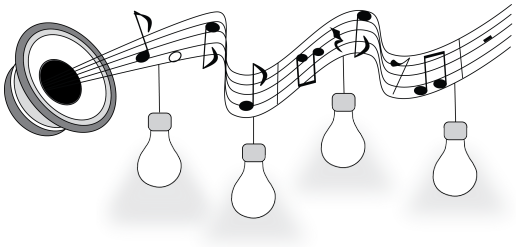
Altering Light

Bend, Bounce, and Absorb



So if light bounces off of surfaces to help us see, why are things different colours? Light is made up of many different colours that when combined look like white light. When a light ray hits your red shirt It absorbs all of the colours in the light ray except the red colour. The red colour is bounced back and reflected back to our eye. Some colours are absorbed more than others. Black objects absorb all colours of light. When colour is absorbed by an object the energy from the light is changed into heat. This is why on a hot day the black asphalt road is too hot to walk on with your bare feet. It is also why white objects are not as hot because white absorbs less colours.

Reflection	Refraction	Absorbing
When light hits an object and the light bounces off in the opposite direction	When light bends as it passes through an object with a different density	Light is absorbed by an object to help us see colour. All colours of light are absorbed except the colour we see.



Altering Light Experiments

1. Question

How does light bend as it passes through substances with different densities?

2. Hypothesis:

I think _____

_____

_____

3. Experiment

Part 1: Rate the substances for density

Least dense:

_____

Somewhat dense:

_____

Most dense:

_____

Part 2:

Describe what the straw looked like in the cup:

_____

_____

_____

Light Bends

You will need:

Three clear cups, oil, water and a straw

Part #1:

Take three clear cups and fill one with 2/3 water, fill another clear cup with 1/3 of the oil and leave the third cup empty. Dip the straw in each cup and move it around. Notice the different densities of each substance. Which was thicker?

Part #2:

Mix the oil, and water into the empty cup and wait until is settles and separates. Put the straw into the cup. Look at the straw in the cup what do you notice?

4. Results

Draw the results of your experiment for part 2.

5. Reflection

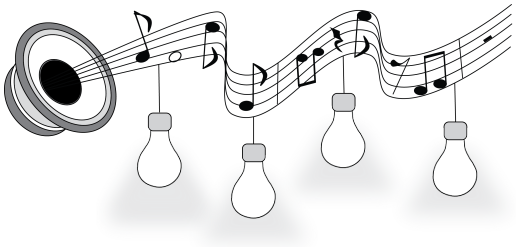
What did you learn about refraction from this experiment?

_____

_____

_____

_____



Altering Light Experiments

1. Question

How do mirrors help to move light?

2. Hypothesis:

I think _____

_____

_____

3. Experiment

Draw a picture of a successful round of your game.

Bouncing Light Game

You will need:

A mirror for each student and a light source.

Instructions:

Have students play a game where one student starts with a light source (flashlight) The light has to be passed around in a circle to eventually return to the person with the flashlight.

Rules:

You may not pass the light to the person next you. Everyone in the group must help to pass the light before it is returned to the sender. Start with a small group of 3 people and then increase the size of your group.

4. Results

Choose a round of your game and describe what happened

Number of people:____

What did you notice about how the light travelled in your group?

_____

_____

_____

_____

_____

5. Reflection

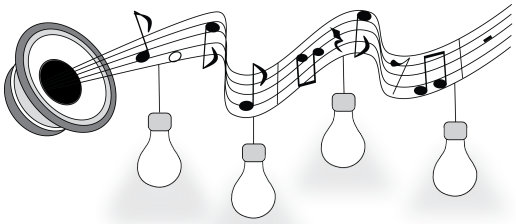
What did you learn about reflection from this experiment?

_____

_____

_____

_____



Altering Light Experiments

1. Question

How do mirrors help to move light?

2. Hypothesis:

I think _____

_____

_____

3. Experiment

You will need

Four pieces of paper (red, blue, green and white), 4 flashlights, cellophane paper in red, blue and green

Getting Started

Line up all four pieces of paper in a row. Shine each flashlight on each piece of paper. What do you notice? Record the colours you see in the chart to the right.

Absorbing Light

Record what colour you see when you shine each colour of light on different colours of paper.

	White Paper	Green Paper	Red Paper	Blue Paper
White Light				
Green Light				
Red Light				
Blue Light				

4. Results

Digging Deeper

Take two flashlights and shine both colours of light onto the white paper what do you notice.

What did you notice about combining the light rays?

_____

_____

_____

_____

_____

_____

5. Reflection

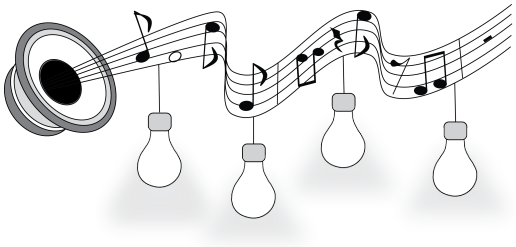
The colour you see is the light that is not absorbed by the object. How did this experiment show light being absorbed?

_____

_____

_____

_____



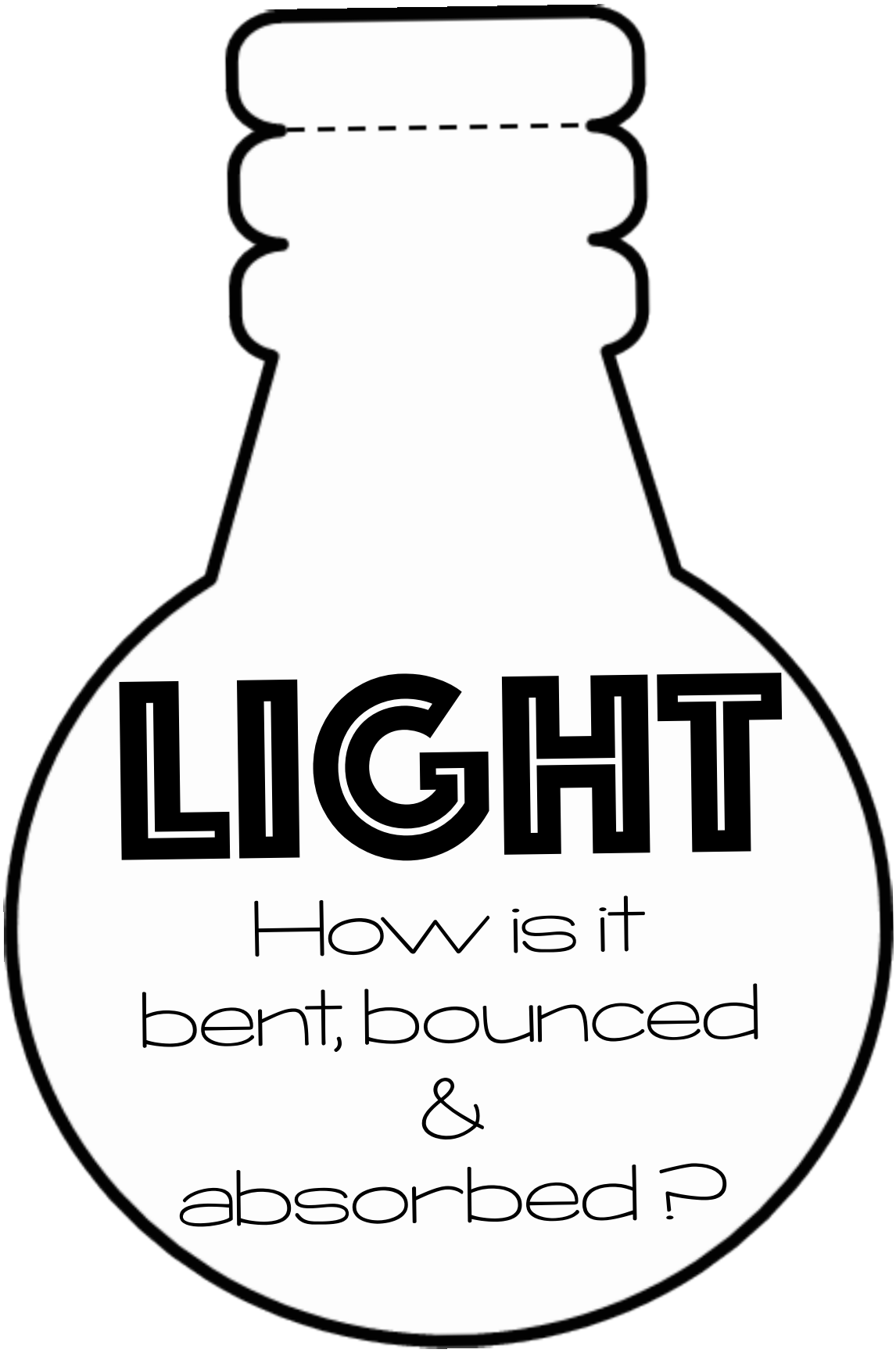
Altering Light

Bend, Bounce and Absorb

Create your light bulb foldable
Complete the four question pages on bending light, bouncing light and absorbing light.

Cut them out around the outside of the shape and stack them together.
Place the title page on the top of the stack of question pages and fold the top tab back covering the top of the question pages. Staple the booklet together at the top.

Put glue on the back of the last page of the booklet and then glue on top of these instructions


LIGHT
How is it
bent, bounced
&
absorbed ?

How does light bend?

Another name for light that is bent is called:

What causes light to bend/refract?

Give an example of light refraction:

How does Light Bounce?

Another name for light that is bounced is called:

Reflection occurs when:

How does reflection help us see?

Give an example of light refraction:

How is light absorbed?

When light is absorbed how does it help us to see colour?

When more light is absorbed what happens to the surface of the object absorbing the light?

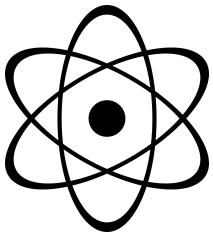
Give an example of how light being absorbed helps us to see colour:

Draw It

Reflection

Refraction

Absorption



Grade 5

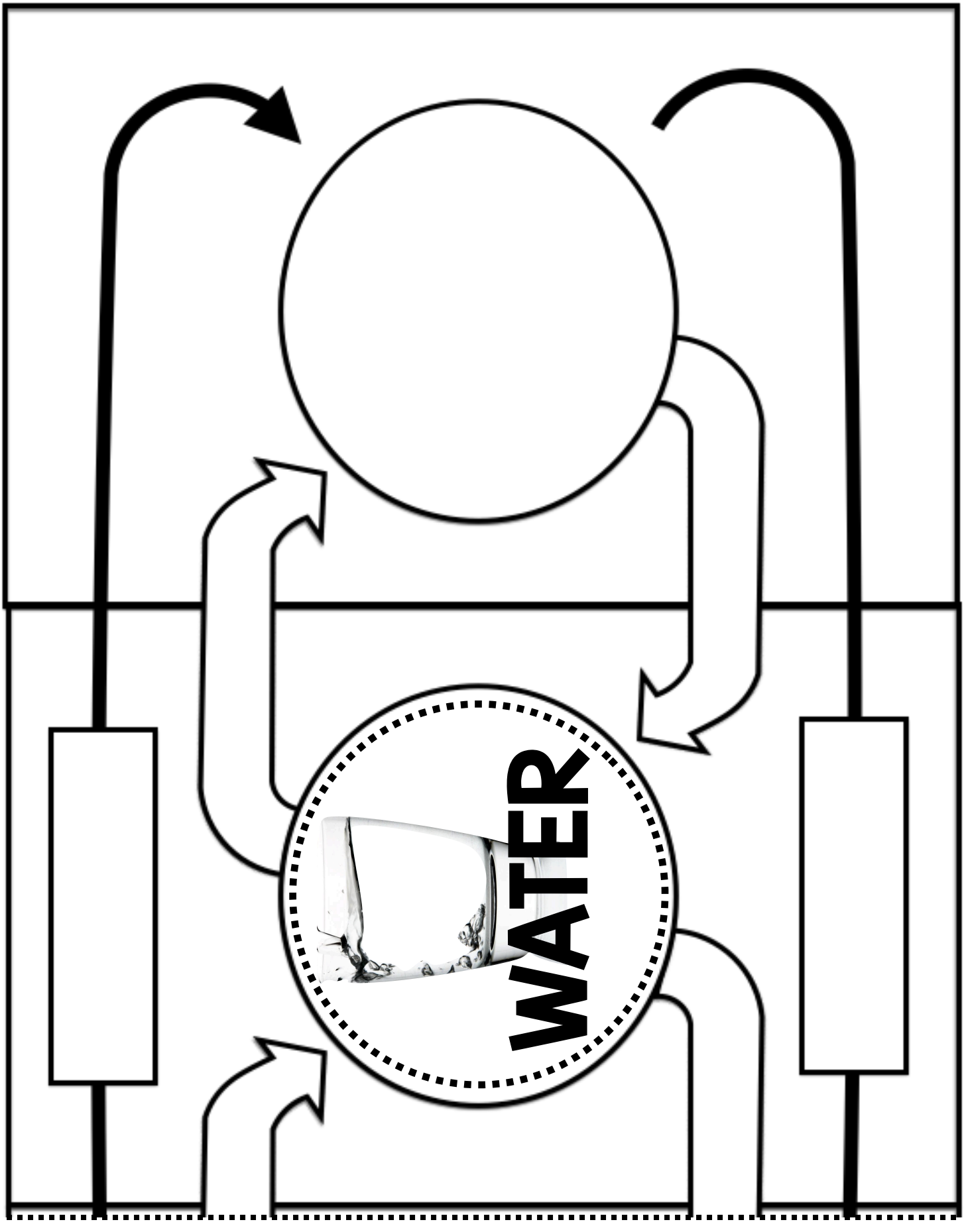
Lesson #4

Water Changing States

Instructions

- Glue the two pieces of the trifold together.
- Read the information cards. Use the clues from the cards to help you label the trifold.
- Glue the labels on the correct location on the trifold card.
- Using red and blue coloured pencils, colour the type of changes that require heat red and blue for the changes that use cold or the removal of heat.

Water Changing States



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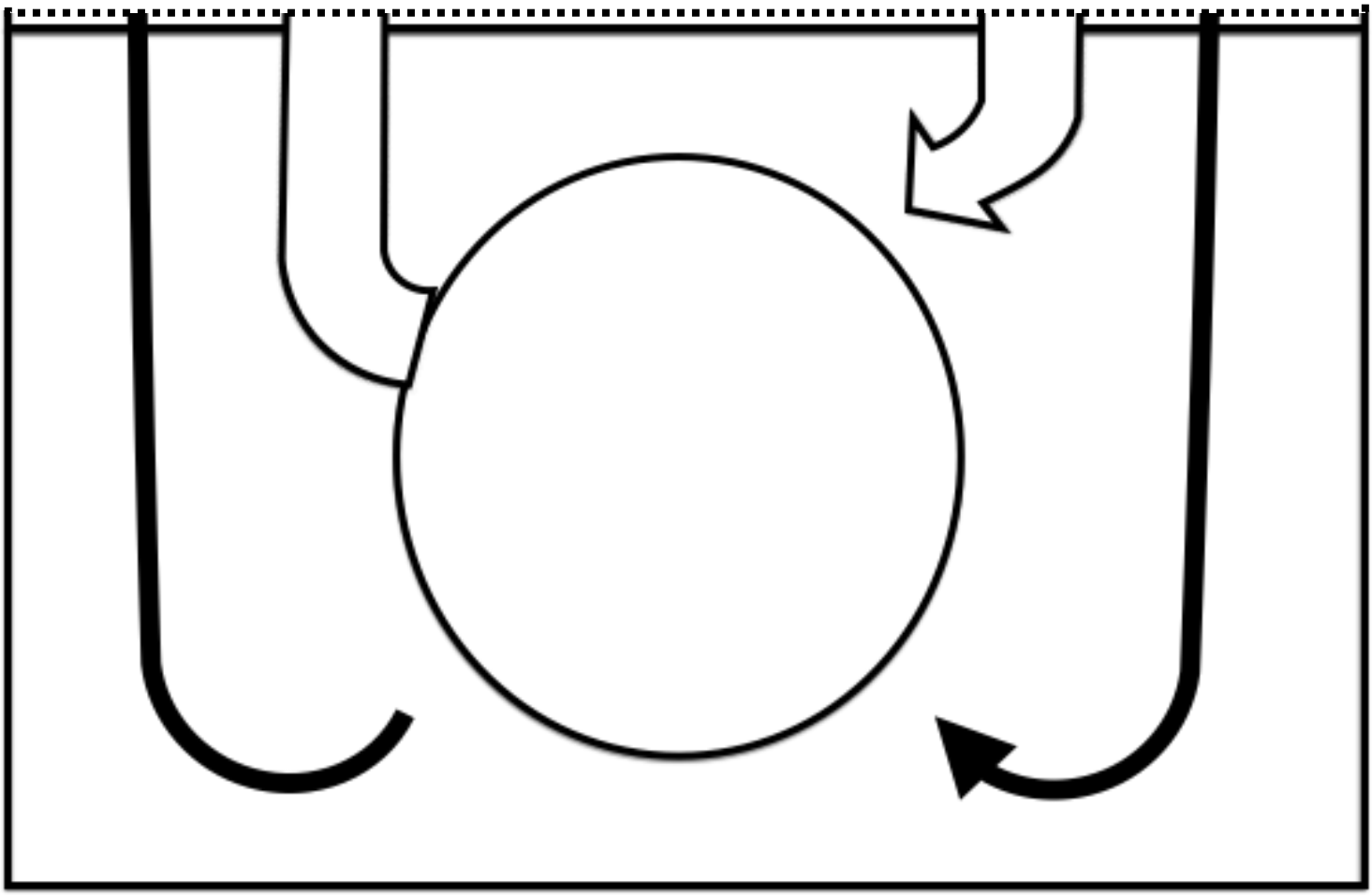


GAS

LIQUID

SOLID

FREEZING

MELTING

EVAPORATION

CONDENSATION

DEPOSITION

SUBLIMATION

FREEZING

Freezing is what happens to a liquid when it cools. Water freezes and turns into a solid at 0°C. Most modern homes in North America have freezers. Freezers are designed to cool food to the point of freezing. This helps to keep the food fresh for longer.

MELTING

Melting is what happens to a solid when heat is added. Ice melts back into water when the temperature is above 0°C. Other solids melt too. Different solids melt at different temperatures. Aluminium (like in aluminium foil) has a melting point of 660°C. This is why it works well in our ovens because it has a melting point that is hotter than our ovens will reach.

DEPOSITION

Deposition describes how a gas turns into a solid without becoming a liquid first. Deposition is opposite sublimation. This process describes how snow and ice are created. In very cold temperatures, water vapour freezes into snow and ice automatically. You will also see examples of deposition on windows, or grass on a cold day when you wake up and see frost. The water vapour in the air, in the cold overnight temperatures, deposits directly onto your window or grass without ever being a liquid first.

CONDENSATION

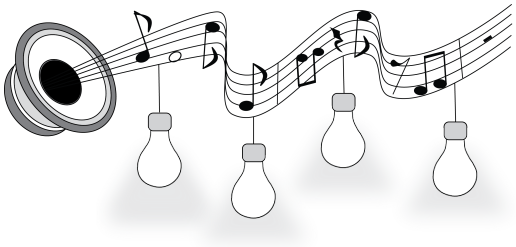
Condensation is opposite evaporation. Condensation happens when a gas turns back into a liquid. It does this as gases are cooled. This happens with rain. After water has evaporated into the air it is cooled and will condense and turn back into a liquid, for example: rain. Condensation is another important process in the water cycle. Condensed water droplets in the sky are what forms clouds.

SUBLIMATION

This is what happens when a solid turns into a vapour/gas without first becoming a liquid. The water evaporates in freezing temperatures. This is difficult to see with water but some examples include freeze drying food, or even when food gets freezer burn. This is why we put food in a container before we freeze it. Dry ice is another example of sublimation. Dry ice is frozen carbon dioxide. When dry ice is exposed to air warmer than-78.5oC it begins to sublimate.

EVAPORATION

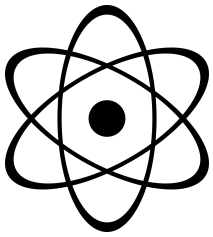
Evaporation happens when liquids turn into gas. This will happen when heat energy is added to a liquid. With water it begins to boil at 100 °C. As water gets hotter and reaches it's boiling point water vapour or steam begins to escape off the top of the water. This water vapour is a gas. Evaporation is an important part of the water cycle. Water, with the heat of the sun evaporates slowly into the air. Eventually this water will fall back to earth as rain.



Lesson #5

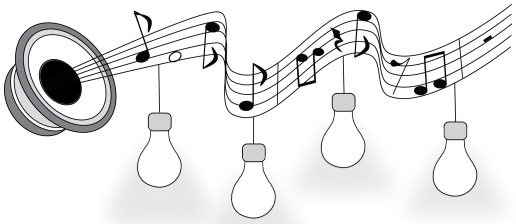
Lesson #5

	First Half	Second Half
Prep	Both grades will be conducting experiments during this lesson. Set up the experiments for students and begin both groups together. Outline the experiments, then let them begin. You will need a few periods to complete these activities. End this lesson series with a knowledge building circle with both groups. Gr. 5:Prepare enough ice for students to use in this experiment; you will need approximately 4 to 5 ice cubes in a baggie per group of students.	
Gr. 4	**Light and Colour:** ***Big Idea:*** that the colour they see is not separate and distinct colours but a result of light either reflecting or being absorbed. **Experiment Activities** - These can be done as centers, demonstrations or you can pick and choose a few to do. This should take a few days. To complete. You may want to practice these prior to doing them with students You will need: • food dye • water • glass jars / cups (x4) • large glass bowl • mirror • coffee filter • pencil • black washable markers • flashlight with a strong beam • rubber bands • black and white paper	***Making Black-*** *Using food dye, have students drop in one colour at a time into a clear glass jar to try to make black water. This can also be done with paint.* ***Seeing colours in black*** Using coffee filters and a clear cup with some water in the bottom. Mark a coffee filter with washable markers just above the water line. As the filter is dropped in the water it will wick water up and as it hits the black spot the colours in the black marker will separate. ***Rainbow Making*** Using a glass bowl, a mirror, water, and a flashlight. Place the mirror in the bottom of the bowl and cover with water. Shine the light at the mirror through the water and look for the rainbow reflected on the walls or ceiling. ***Light Colour & Heat*** Wrap two glass one with black paper and the other with white paper and secure with rubber bands. Let them sit in the sun or under direct light and then measure the heat of each jar Meet as a group to consolidate their learning.
Gr. 5	**Big Idea:**Students will explore the impact that heat has on changing states of matter. Students will conduct an experiment to see how matter can change states and what impact heat has on this. Break students into groups of 3-4 and give each group a bag of ice. Tell students that they are to find the fastest way to melt the ice into water. Provide students with a table full of objects (hair dryer, hot coffee, mittens, lamp, styrofoam cup, aluminium foil, their hands) that they can choose which will help them to melt the ice. They should brainstorm which object would be most effective and least effective to melt the ice.	Once their brainstorm/prediction is complete have groups choose one or a few of the objects to test. Ensure that you have a base line test where the ice is set to melt with no intervention. (place ice on a dish and don't touch it). **Changing Ice:** Give the group their bag of ice and a timer and have them time how long it takes to get their ice to change states into a different state of matter. They can test multiple objects either at once or over a few periods (or to match the time required by the grade 4 students). Students should meet as a whole group to share their results. They should notice that adding heat will melt the ice quicker. Help them to form this conclusion.
Notes	Gr. 5: This lesson's goal is for students to understand that heat is applied to help ice change states. They should also learn, through their experiment and class discussions that different objects transfer this heat easier than others. They are not making things in this lesson just using them as is and recording the different results. A class discussion will be necessary to discover that the rate at which ice melts can be manipulated with different objects and how they transfer and conduct heat. If you find that the grade 5s are finished ahead of the grade 4 students then I would recommend that grade 5 students move ahead into the activities of the next lesson early.	



Grade 4

Lesson #5



Making Black

1. Question

What colours make black?

2. Hypothesis:

I think _____

_____

_____

Instructions

You will need:

a glass jar, water, food colouring

Instructions:

Fill a glass jar just over half full. Add one drop of dye to the cup of water at a time. Tally the number and colour of drops in the chart. Try to make the water to turn black in colour.

Making Black
3. Experiment

Record your dye drops in the chart below

Colour	Tally of Dye Drops

4. Results

Were you able to make black? Explain how you did it.

_____

_____

_____

_____

_____

_____

_____

How could you make black in the least number of dye drops?

_____

_____

_____

5. Reflection

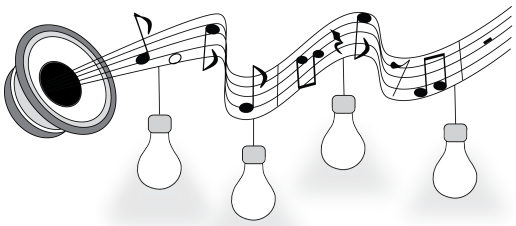
What did you learn about light and colour from this experiment?

_____

_____

_____

_____



Seeing Colours

1. Question

What colours make black?

2. Hypothesis

I think _____

_____

_____

Instructions

You will need:

A glass jar, water, washable black markers, coffee filter, pencil.

Instructions:

Cut the filter into strips and secure one around pencil with a tail hanging down to touch the bottom of the cup. Mark a solid circle on the strip 6 cm from the bottom of the strip. Fill the cup with water 5 cm deep.

Seeing Colours in Black 3. Experiment

Watch what happens to the coffee filter when you add the water.

BEFORE	DURING

4. Results

Draw what happened after.

AFTER

5. Reflection

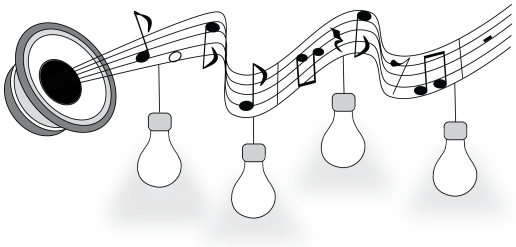
What did you learn about light and colour from this experiment?

_____

_____

_____

_____



Rainbow Making

1. Question

What colours make up white light?

2. Hypothesis:

I think _____

_____

_____

Instructions

You will need:

A glass bowl, water, mirror, flashlight.

Instructions:

Fill a glass bowl just over half full. Add the mirror to the bottom of the bowl. Shine the light through the water at the mirror and look for the reflection of light on the wall or ceiling.

Making a Rainbow
3. Experiment

Draw a picture of the experiment and what you observed.

4. Results

Describe what happened to the light that was reflected onto the wall or ceiling?

_____

_____

_____

_____

_____

_____

Why did this happen?

_____

_____

_____

_____

5. Reflection

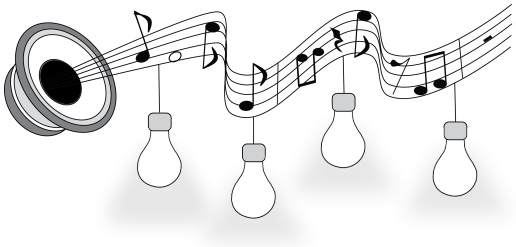
What did you learn about light and colour from this experiment?

_____

_____

_____

_____



Light, Colour and Heat

1. Question

How does colour affect heat?

2. Hypothesis:

I think _____

_____

_____

Instructions

You will need:

Two glass cups, black and white paper, elastics, thermometer.

Instructions:

Wrap one cup in white paper and the other in black paper. Secure the paper with elastics or tape. Fill the two cups 3/4 full of water. Put the cups in direct light (sunlight or artificial light) Record the temperature of each cup over time.

Light, Colour, Heat
3. Experiment

Record your dye drops in the chart below

Time Interval	White Cup Temperature	Black Cup Temperature
Start		
30 min		
1 hour		
Over 2 Hours		

4. Results

Describe how the temperatures change over time

_____

_____

_____

_____

_____

_____

_____

_____

Why do you think happened?

_____

_____

_____

_____

5. Reflection

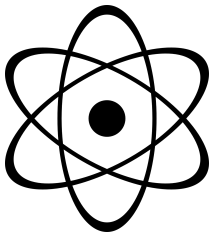
What did you learn about light and colour from this experiment?

_____

_____

_____

_____



Grade 5

Lesson #5

glue or staple the other tabs here

Which materials/object that you used helped to melt the ice fastest? _____
Explain why:_____
_____
_____
_____

Which was the slowest? _____
Explain why:_____
_____
_____
_____

How does heat and temperature effect how quickly ice melts? _____
_____
_____

What have you learned? _____
_____
_____
_____
_____

Conclusions

How might you use everyday things that you find around your home or classroom to increase how quickly an ice cube melts?

Question

Materials:

- Found objects/materials provided by teacher
- Ice cube
- Timer

Instructions:

- Find a group of 3-4 people
- Choose 3-4 objects/materials that are provided by your teacher
- Start timer
- Using one ice cube per object try to melt the ice cube as quickly as possible.

Instructions

Water AND Ice

INQUIRY IN SCIENCE

BEFORE YOU BEGIN

Look at the objects that your teacher has provided.
Sort the objects into the categories below.

SLOW TO MELT	SAME AS CONTROL	FAST TO MELT

Explain why you think some objects/materials will help the ice to melt faster? _____

_____

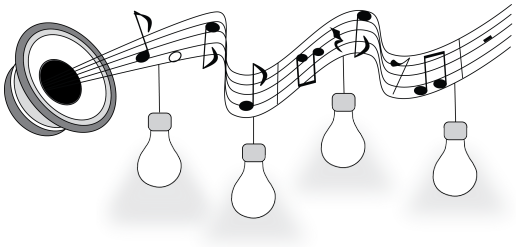
_____

Hypothesis

Record the results of your experiment with your different materials/objects in the boxes below. Record the name of the material or object, the time it took to melt, and a picture.

Object: _____  time: _____	Object: _____  time: _____
Object: _____  time: _____	Object: _____  time: _____

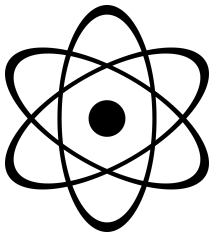
Experiment



Lesson #6

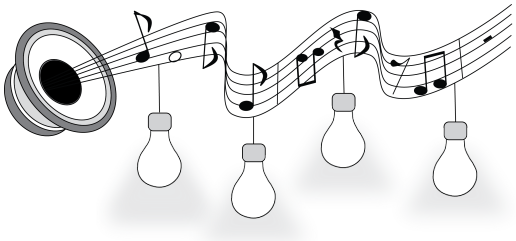
Lesson #6

	First Half	Second Half
Prep	This lesson builds on Lesson #5. Students will be using the materials from the previous lesson and supplementing with other materials. Examples include styrofoam and plastic cups and containers, aluminium foil and containers, tape, glue, paper, fabric (various weights), sponge, wooden craft sticks, wool and cardboard.	
Gr. 4	**Sound: What is Sound** Students will discover the answer to the question what is sound. They will read the article on sound then complete the activity based on what they read. This lesson will help to reinforce the concept 'how to research' helping students to understand how to extract information.	After students read the article meet with them to discuss what they learned. There is an interactive notebook that will ask them to interpret the information that they read and answer the questions asked. Students cut our the flaps, fold on the dotted line then glue the back of the top tab down on top of the answer box on the first page. Answers have been provided. Any extra time can also be used to catch up and reflect on previous learning
Gr. 5	**Grade 5:** Using the knowledge that they learned from the previous lessons students can use the ice to see what they can make: • To keep their ice last longer before melting. • Make something that would melt ice quickly. • Increase the temperature of water. Students will construct this with found materials. Give each student a plastic cup have them use different found materials to make their ice last longer. They could research different insulators and construct their device that meets their goals.	Students will work on a build their device, test it and share their results and findings with the class. What you need: • A plastic cup of ice • Paper • Styrofoam (cups, plates) • Aluminium foil • Cloth • Sponge • Other materials that will help or inhibit heat loss that are easily accessible. • Tape • Scissors Prior to constructing their devices students should brainstorm using the information they learned from the previous lesson and conduct preliminary research on how those different objects transfer heat. This will ensure that the construction of their devices are better planned out and based on acquired knowledge and not simply a guess and check strategy.
Notes	Gr 5 - This second lesson with ice and water is designed for students to use what they learned about how different materials conduct heat and transfer this knowledge into making something that accomplishes their goal. Understanding that as humans we need to invent things to use things or maintain things in certain states. A freezer and cooler is an important invention because it allows us to ship, and store products in our homes. Reflecting on different products and inventions that we use that allow us to change, keep, and store objects and how it impacts our daily lives will help prepare them for their final independent inquiry project at the end of this unit.	



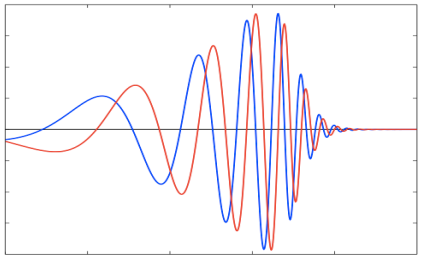
Grade 4

Lesson #6



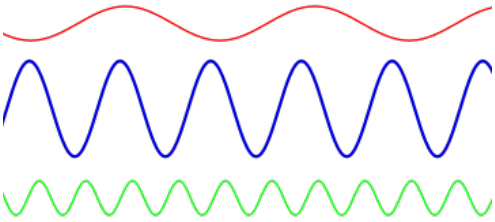
What is Sound

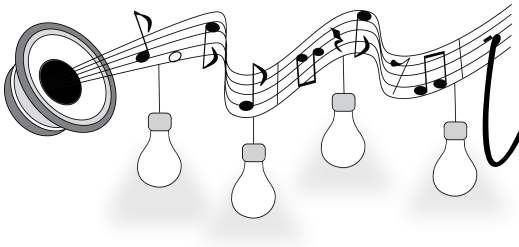
Close your eyes and listen to the world around you. What do you hear? Depending on where you are you may hear different things. Could you figure out where you are based only on the sounds that you hear? Sound helps people and animals everyday. To recognize their surroundings, keep them safe, and even to listen to others so that you can learn.



But what is sound? Sound is what you hear around you. Sound is caused by vibrations that travel through the air. When the waves reach your ear you can hear the sound. When something moves or vibrates it creates waves that travel though a gas (air), a liquid (water), or a solid (through walls or floors). Sound vibrations ripple though the molecules in solids, liquids, and gases by pushing and pulling on the molecules as it travels past. Sometimes these sound waves travel in a regular pattern. This regular looking wave creates a note, like a musical note. An irregular looking wave creates noise.

The word frequency describes the number of waves that happen in a set time. If there are more waves then the sound that is made is a high pitch. If there are fewer waves in the same time then the sound you hear is a lower pitch. These sound wave keep moving until they run out of energy. This is why when someone is too far away from you, you struggle to hear them. These waves will also lose energy quicker if it has to travel though something that is more dense than air like water, or a brick wall.





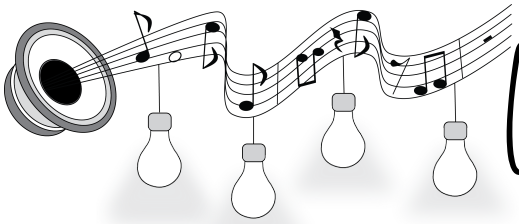
What is Sound?

Sound is important but it can also be dangerous to people. Since sound is a type of energy the force that a sound travels through the air can hurt us. Very loud sounds can damage our ears. Amplitude is the amount of force or pressure that a sound wave has as it moves through something. The more force and pressure that a sound uses to travel through the air the louder it is for our ears. To measure the amplitude of a sound wave we use decibels to compare sounds. Look at the chart to see some common sounds measured in decibels.

Sound	Decibels
Soft whisper	25dB
Soft talking	50dB
Normal talking	60dB
Shouting	100dB
Ear pain	140 dB

Sound	Decibels
Breathing	10dB
Toilet flush	70 dB
Ambulance siren	115dB
Fighter jet takeoff	140dB
Perforation of ear drum	160dB

As you can see from the chart some sounds have so much force and pressure as they travel that when they hit our ear they can damage our hearing, cause pain or even perforate our ear drum (make a hole). Sometimes, if you spend too much time in a loud environment (like loud music in your headphones or in a crowded sports arena) with sounds above 85 dB you will suffer tinnitus. Tinnitus is a ringing in the ears. If this happens too much you could permanently damage or lose your hearing.

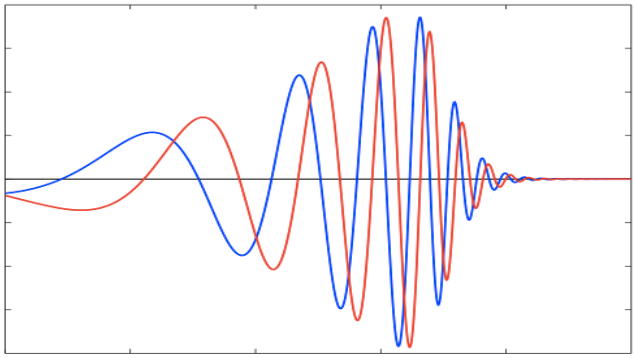


What is Sound?

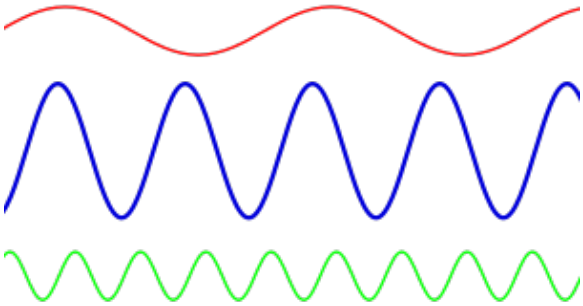
The Ear

Cut out around the shapes below. Fold on the dotted line and glue on the underside of the top tab. Glue this tab above the box on the notebook template base. Write your answer to the question on the lines below the tab.

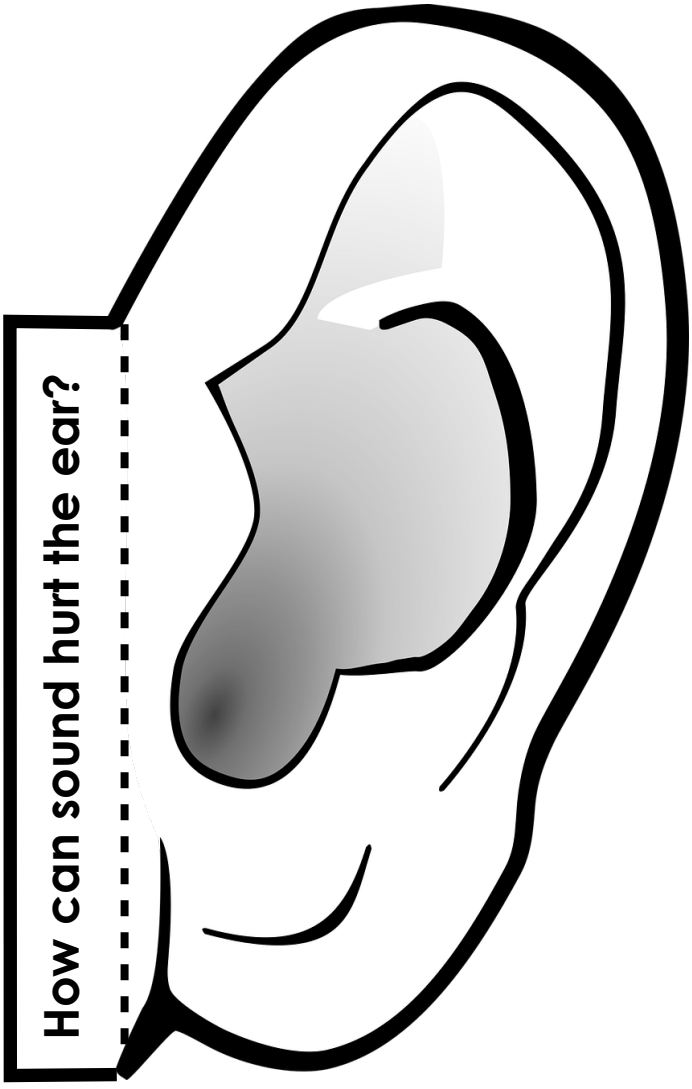
Describe how sound travels?



Describe what frequency means?

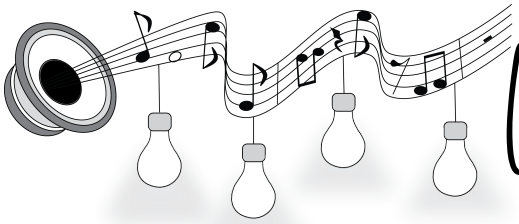


How can sound hurt the ear?



How does sound help people?

What is amplitude?



What is Sound?

ANSWER PAGE

Describe how sound travels?
Sound travels in waves. A regular wave pattern will make a consistent note and an irregular wave makes noise. When the sound reaches the ear we hear the sound.

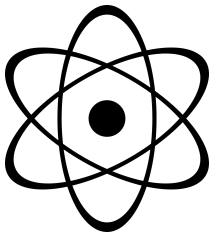
Describe what frequency means?
The word frequency describes the number of waves that happen in a set time. The more waves there are the higher the pitch. The fewer waves the lower the pitch of the sound.

The Ear

How can sound hurt the ear?
Loud sounds can hurt the ear by causing damage or breaking an ear drum. The force and pressure from the sound can hurt the ear. At 85 dB the ear can have tinnitus and 120 dB will cause pain in the ear and 160dB will perforate the ear drum.

Describe how helps people?
We can use sounds to alert us We can use sound to figure out where we are and what is happening. We can use sound to learn - students can also use their own ideas and connections to expand on ideas here.

What is amplitude?
Amplitude is the amount of force or pressure that a sound wave has as it moves through something. Amplitude is measured in decibels. Loud sounds have more amplitude.



Grade 5

Lesson #6

My Ice Device
STEM CHALLENGE

DEFINE THE PROBLEM: _____

_____

_____

RESEARCH: _____

_____

_____

_____

_____

_____

_____

_____

_____

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DESIGN REQUIREMENTS:

materials	size	other

My Ice Device
STEM CHALLENGE

PLAN IT OUT: *Use the planning page and include measurements and materials.*

My Ice Device
STEM CHALLENGE

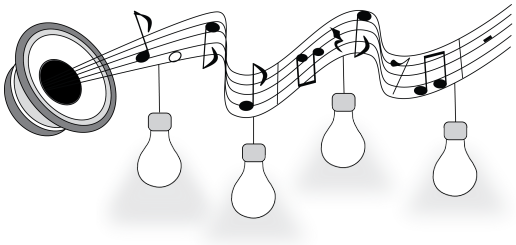
BUILD PROTOTYPE: *List your materials.*

TEST AND RESULTS: Test you design did it solve your problem? Explain:

REDESIGN: *What will you change to improve your design?*

FINALIZE: *Use what you learned to create your polished design. Include elements of artistic design to improve the look of your device.*

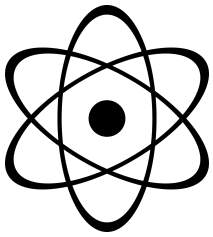
RESULTS: *Explain how your device solves your problem:*



Lesson #7

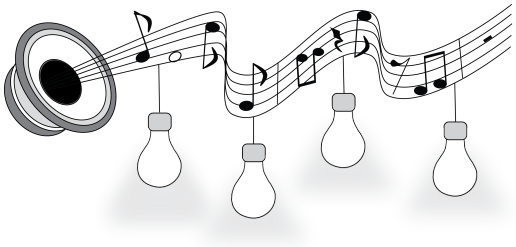
Lesson #7

	First Half	Second Half
Prep	For this lesson you will need: Access to technology to link to live binder research; or if this is unavailable access the information in the live binder prior to teaching this and print articles out for students and save videos for offline use.	
Gr. 4	**Sound: Can sound travel through solids liquids and gases** Explain to students that they will be conducting a few simple experiments to see if sound can travel through solids liquids and gases. Students will record their hypothesis prior to beginning their experiments with their partners. Depending on student readiness students can complete these activities with no teacher support, some teacher support or through teacher demonstrations. These experiments would also work well if done outside where students can spread out.	**Experiments** **Can sound travel through air?** Take two metal spoons and have students bang them together. Can they hear them? Ask students to walk further and further apart to hear the sound. What do they notice about the sound as it travels through the air? **Can sound travel through water?** Fill a large bucket with water. Cut the bottom off a jug to use a listening device. Take two metal spoons and submerge them in the water and bang them together. Students will listen to the banging of the spoons at various distances. Use the jug with the bottom removed to listen at the surface of the water. **Can sound travel through solids?** Using a barrier like a door, table or desk. Students bang a set of spoons on one side of the barrier where another student is on the other side.
Gr. 5	**Big Idea:** Students will explore the difference between a physical and a chemical change in matter. **Student Research Activity:** They will use the link in the live binder to conduct research. They will be looking at the definitions of what is a physical change in matter and what is a chemical change in matter. The will be able to define these two different terms and give an example of each. Students will complete the interactive notebook with their research.	**Knowledge Building Circle:** Students will meet with the teacher to discuss what they learned from this lesson. Topics for discussion include: • - What are physical/chemical changes? • What are some examples of each type of change? • Describe the changes. • How can you tell if something is a physical or chemical change? Students will need this knowledge of a physical and chemical change in order to complete further activities. **Assessment: Student can describe what a physical and chemical change is and provide an example of each type of change.**
Notes	**Grade 4 Experiments:** Students can do this experiment with a partner but it can be noisy. Larger groups of students will mean less sound being created by the spoons. This is a consideration if teaching a split grade. Students will need to reflect on their learning at the end of this. Questions include: What did you notices? Did the force you banged the spoons impact the volume of the sound? Why? What happened as you moved further away? What happened when the sound travelled through more dense material? How might this knowledge of how sound travels impact inventions that need to dampen or amplify sounds? The live binder can be found here: bit.ly/ml-matter	



Grade 4

Lesson #7



Sound Experiments

Can you hear the sound?

Sound through AIR

Stand back to back with a partner at the distance specified. One person is the sound maker and the other person the listener. The sound maker will bang the spoons together. Record your results in the chart to the right and then write down your observations of the differences in sound at each distance.

Back to back:	2m apart:	5m apart:

_____

_____

_____

_____

_____

Sound through WATER

With a large bucket filled with water put your spoons near the bottom of the bucket under the water. Bang your spoons together underwater. The listening partner will try to hear the spoons banging together underwater with their ear at the distances listed (use the plastic jug provided by the teacher). Record your results in the chart to the right then write down your observations of the differences in sound at each distance.

Above the bucket:	Ear pressed to outside:	Jug on water surface:

_____

_____

_____

_____

_____

Sound through SOLIDS

With your spoons tap the bottom of a desk or table. The listener will listen at the distances specified. Record your results in the chart to the right and then write down your observations of the differences in sound at each distance. This experiment can also be done through a closed door to compare how the sound travels.

Ear to surface directly over top of spoon:	50cm-1m away ear to surface:	2m away from surface:

_____

_____

_____

_____

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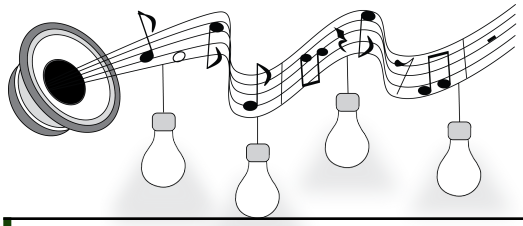
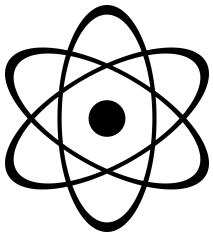


Teacher Notes

Experiment	Conclusions
Sound through AIR: Stand back to back with a partner at the distance specified. One person is the sound maker and the other person the listener. The sound maker will bang the spoons together. Record your results in the chart to the right and then write down your observations of the differences in sound at each distance.	*Students should conclude that the closer they are to the spoons the louder and more clear the sound. As they get further away it is harder to hear. In a noisy classroom it may be even harder to hear due to the volume of the noise surrounding them.* *Students could be asked to clarify what they could do to make the sound travel more clearly or to focus the sound so that it travels a longer distance.* *Why does sound get quieter the further away I am? - Sound waves lose their energy as they travel. The molecules in air are further apart so the sound wave travels slower through those molecules losing energy quicker.*
Sound through WATER: With a large bucket filled with water put your spoons near the bottom of the bucket under the water. Bang your spoons together underwater. The listening partner will try to hear the spoons banging together underwater with their ear at the distances listed (use the plastic jug provided by the teacher). Record your results in the chart to the right then write down you observations of the differences in sound at each distance.	*In water the molecules are closer together so the sound travels faster (4x faster than air) However the force needed to generate that sound is higher because of the density of the water.* *Students should have noticed that when the jug was in the water the sound was clear and louder than when they listened to it through the air. As well compared to the 'sound through air' test the sound in the water should have appeared louder. Students can discuss if sound travels in water better than air.* *Does sound travel better in water than air? - **YES*** *How could sound traveling in water impact the living things in the water particularly in the deep ocean? - Due to the darkness in much of the ocean animals depend on sound to navigate and find their prey. Many have specifically adapted to have a keen sense of hearing such as sharks.*
Sound through SOLIDS: With your spoons tap the bottom of a desk or table. The listener will listen at the distances specified. Record your results in the chart to the right and then write down your observations of the differences in sound at each distance. This experiment can also be done through a closed door to compare how the sound travels.	Students should notice that through this experiment when their ear is to the table the sound is louder than when they are 1 m away. This is because sound travels faster through solids than it does through the air. This happens because the molecules in a solid are packed tightly together. It travels faster because there is less distance between molecules so it takes less time for the sound wave to cause them to bump into one another. This can lead to conversations about buildings and how walls are made especially in a classroom. If sound travels faster through solids than gases how should walls between classrooms be designed to keep the sound from one classroom out of another classroom. Why does it seem quieter in our classroom with the doors closed if people are making noise in the hallway? The architectural acoustics in a classroom or other environments make a difference in noise transmission. Acoustic ceiling tiles absorb sound from within a classroom. Doors often have an air gap/hollow. Walls have sound absorbing insulation or an air gap to reduce noise transfer.



Grade 5

Lesson #7

cut around the outside of each box

PHYSICAL CHANGES of matter

http://bit.ly/2hFuiKd

definition

EXAMPLE #1

EXAMPLE #2

EXAMPLE #3

CHEMICAL CHANGES of matter

http://bit.ly/2hFuiKd

definition

EXAMPLE #1

EXAMPLE #2

EXAMPLE #3

cut around the outside of each box

PHYSICAL
CHANGES
of
matter

http://bit.ly/2hFuiKd

definition

EXAMPLE #1

EXAMPLE #2

EXAMPLE #3

CHEMICAL
CHANGES
of
matter

http://bit.ly/2hFuiKd

definition

EXAMPLE #1

EXAMPLE #2

EXAMPLE #3

Changes in Matter

Glue here

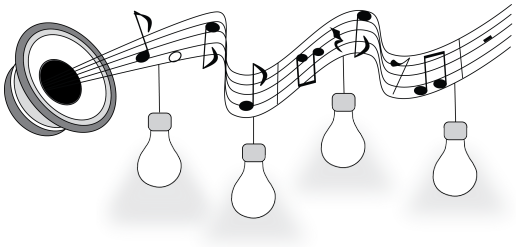
Glue here

Changes in Matter

ANSWERS

Glue here	A physical change happens when change takes place but nothing new is created. The molecules stay the same before and after the change. Physical changes can be reversed like in the examples below:
	Ripping paper
	Water changing from ice to water to vapour.
	Salt water

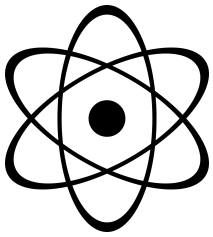
Glue here	In a chemical change, a new something new is created. The molecules rearrange and a new substance is formed. When there is a chemical change often energy such as heat is given off or absorbed. Chemical changes cannot be reversed. You will see a change in temperature, colour, or odour, like in the examples below:
	Burning paper
	Baking cookies
	Rusting bike



Lesson #8

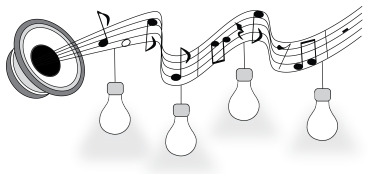
Lesson #8

	First Half	Second Half
Prep	Gr5: For the grade five part of this lesson you will need whipping cream and a hand mixer. An orange and jug (orange juicer if available). Bread and a toaster as well as a balloon, vinegar, and baking soda. If you have access to a microwave you can add additional examples such as melting butter, cooking an egg, making Rice Krispies squares.	
Gr. 4	How Sounds are Heard Students will read about three different animals (Human, shark and) and discover how they hear. They will then compare how the hearing of these animals are the same and different.	**Reflect on Learning** Students will discuss the similarities and differences of animals and how they hear. Complete the summary page.
Gr. 5	**Student Activity:** Students will conduct simple experiments to see examples of physical and chemical changes. Review the definition of chemical and physical changes. Students will determine if the example that they are making is an example of a physical or chemical change. (A blank page has been included in case you have alternate materials depending on what you have access to.) • Orange - Orange Juice • Heavy Cream - Whipped Cream • Baking Soda and Vinegar - Carbon Dioxide Bread - Toast	Once students have seen some objects change both physically and chemically they can write out their observations on the observation tracking page.
Notes	Gr. 4 - This lesson is a great link with music on how sound is created and amplified. Looking at different musical instruments and the materials that they are made out of will help students to see how sound is amplified, transmitted, and reflected to create music. Gr. 5 - As an alternate inquiry activity you may want to ask students to explore examples of physical and chemical changes themselves and then as a group demonstrate these to others explaining how the substance changed. They can record four of the presentations on the blank page provided.	

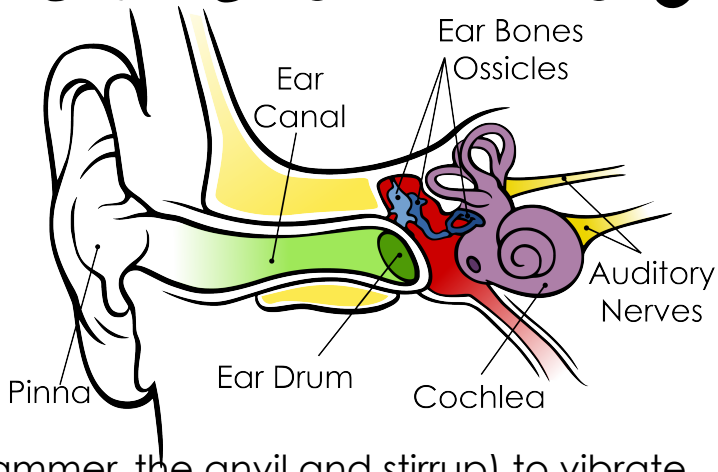


Grade 4

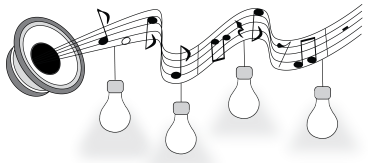
Lesson #8



The Human Ear

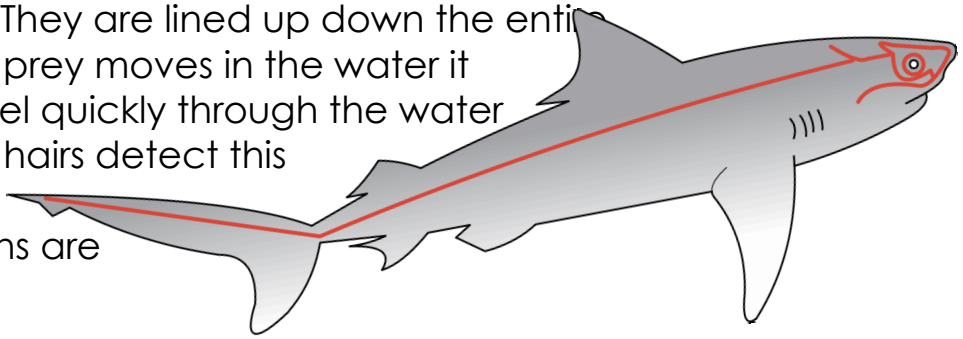


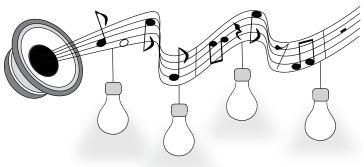
The human ear is made up of a system of parts that work together to get sounds into our brain so we can understand what we are hearing. First the sound hits our PINNA. This is the outside of our ear that we see on the side of our head. Next the sound travels down our EAR CANAL to our EAR DRUM. When the sound hits our ear drum it causes the three bones in our ear (the hammer, the anvil and stirrup) to vibrate. These vibrations reach the cochlea. The COCHLEA looks like a seashell and is filled with liquid and little hairs. When the 3 ear bones called the OSSICLES begin to vibrate, the liquid in the cochlea begins to move and swish past the little hairs. These hairs are called the stereocilia. These little hairs convert the vibrations and movement into electrical impulses that are sent along the auditory nerves to the brain. Our brain then understands what is hearing.



Shark Senses

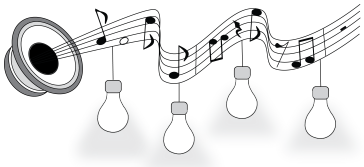
When you look at a shark you will probably not see ears sticking out on the side of their head like humans have. However sharks do have ears. Their inner ear has three different ear canals that allow them to stay balanced in the water and hear sounds. Sharks can hear low sounds in the water from over two football fields away. Their ears are lined with little hairs that help them to sense these vibrations to hear under water. However a shark hears with more that just its ears. They also have another way to detect the vibrations of very deep sounds that happen under water called the LATERAL LINE. The lateral line is a line of jelly filled tubes that are connected to vibration sensing hairs. These tubes are found just under the skin of the shark. They are lined up down the entire length of a sharks body. As prey moves in the water it makes vibrations which travel quickly through the water towards the shark. The little hairs detect this movement telling the shark which direction the vibrations are originating.





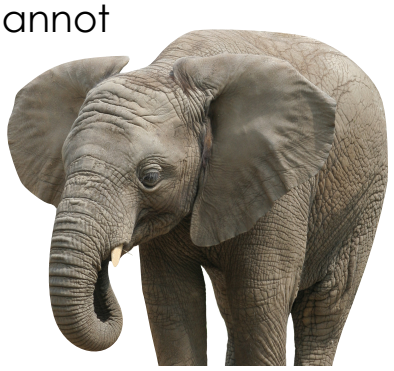
Bats in the Dark

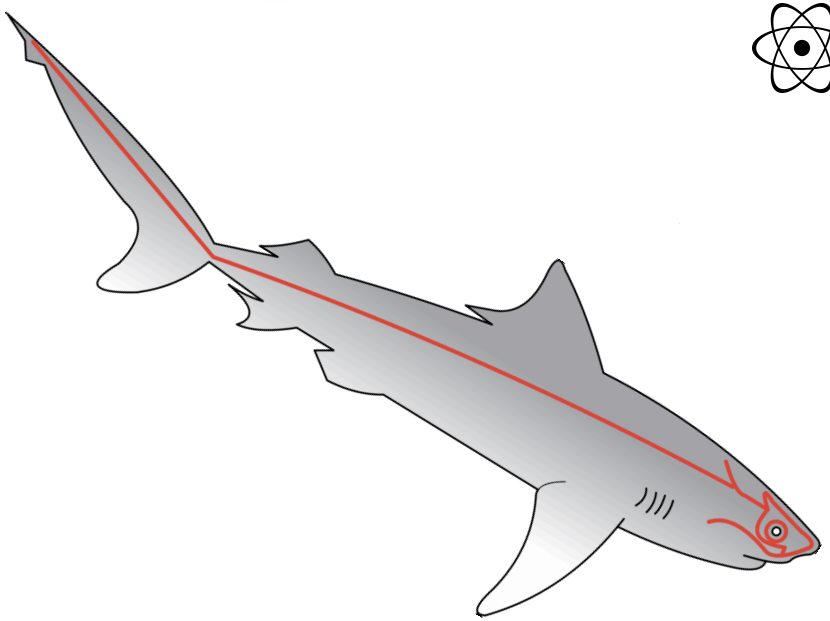
Bats have great hearing. They hunt for their food at night so they can't use their eyes to see their prey. They instead use their ears and their voice to find their prey. They make high pitched sounds that bounce off the cave walls like an echo. This is called echolocation. When a bat sends out a sound and it bounces back their ears can detect the slight changes in the sound wave as it is stopped by an insect the bat wants to eat. A bat's ears are specially designed to hear these echoes. When a bat screams out its call to find prey its ear temporarily goes deaf so that the call doesn't cause ear damage. Muscles in the ear separate the ossicles bones (the hammer, the anvil and the stirrup) so the sound cannot travel to the bat's cochlea. The bat will 'turn' their hearing back on after their sound is made so that they can hear the echo. A bat's ear is similar to a human ear because both bats and humans are mammals. A bat's brain will interpret the echolocation signals to learn how to far prey or other objects are. Their ears are highly sensitive to hearing slight changes in the frequency of the echo.

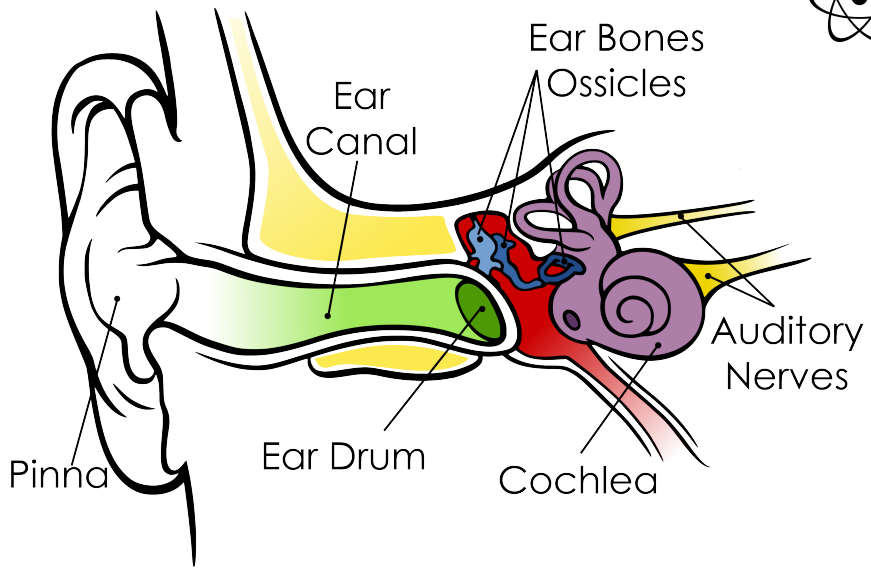


Elephant Ears

Elephants have big gigantic ears that help them in many ways. Elephant ears help to keep an elephant cool in the hot dry temperatures of the African Savannah. Elephants also have a large range of hearing and can hear sounds made at higher and lower frequencies than even humans can hear. Elephant ears can detect sounds and recognize voices and other elephant calls that are used to communicate. Their ears also act as a large funnel that help to filter sounds into their ears which helps them to hear sounds from further away. Elephants can communicate with other elephants from far away. Much of an elephants 'talking' is at a low frequency that human ears cannot hear. These low sounds are hard for mammals to hear but the elephant ear has adapted to hear these sounds. It has a very large ear drum that is protected by a longer ear canal that protects the delicate and larger ear drum. An elephant's cochlea is also adapted to ear these low frequency sounds. Much is still being discovered about how well and elephant can hear.







Ears Can Hear

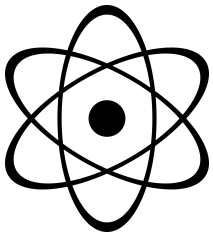
SUMMARY OF LEARNING

1. What did you learn about how people and animals hear?

2. Why do you think it is important for people and animals to hear sound?

3. Why can some animals hear better than others?

4. What might happen if an animal stopped being able to hear?



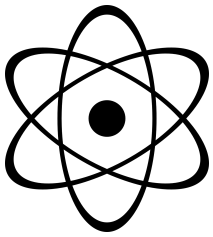
Grade 5

Lesson #8

Physical and Chemical Changes

List the substances that you are using to observe their physical or chemical changes.

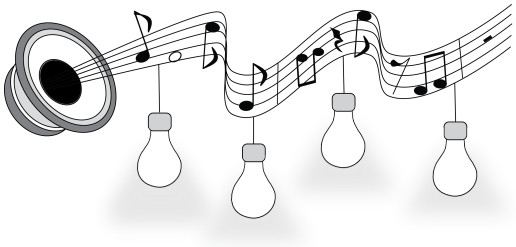
Ingredients	Instructions	Observations
Heavy cream and mixer	Pour one cup of heavy cream in a bowl. Using a hand mixer beat the cream on high for 8-10min.	
Bread and toaster	Take two slices of bread and place in a toaster. Begin toasting the bread as per your toasters instructions.	
Orange and juicer	Cut an orange in half. Using the juicer or your hand begin squeezing the orange over a bowl.	
Baking soda, vinegar, balloon, bottle.	Using a water bottle, pour 1/3 cup of vinegar in the bottle. When this is done place 3 tbsp of bakings soda into a balloon. Using a string tie around the middle of the balloon to keep the baking soda inside. Place the mouth of the balloon over the open end of the water bottle without spilling any of the soda into the balloon. When ready untie the string and holding the balloon firmly onto the bottle pour the baking soda into the vinegar.	



Physical and Chemical Changes

List the substances that you are using to observe their physical or chemical changes.

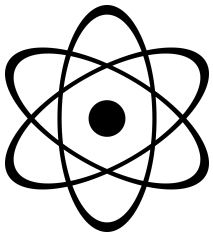
Ingredients	Instructions	Observations



Lesson #9

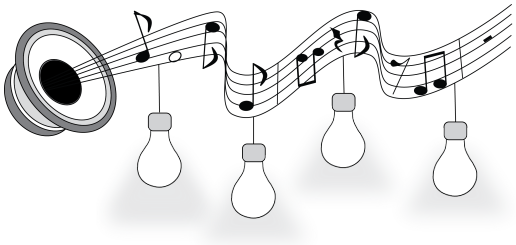
Lesson #9

	First Half	Second Half
Prep	Before the lesson, gather materials for creating anchor charts and make sure you have access to technology for student research. If you don't have technology available during lessons, follow the live binder link ahead of time and print off materials as needed.	
Gr. 4	**Light and Sound Safety** Students will work together to come up with a list of things that use light and sound to keep us safe. Together with students have them brainstorm a list of things that help to keep them safe in the different areas that are listed. For students that may struggle with this concept they can use the sorting cards to help to get them started.	Have a knowledge building circle with the students about the light and sound safety devices. Talk about what life would be like… • Before this device? • Why might this device have been invented? • How does this help to keep people safe? • How does this device use light and sound to keep us safe? This lesson will help student to activate some of their knowledge of light and sound devices which will help them for their final inquiry project.
Gr. 5	**Big idea:** Students will look at how we use different materials in our every day lives and how the properties of those materials help us. **Knowledge building circle:** brainstorm common products that students use each day in the classroom. Some examples are: • Bread • Paper • Plastic • Margarine Record student answers on an anchor chart. Ask students if they know If they know the process these products go through to be manufactured?	Students will conduct research using links from the live binder to determine the life cycle of common everyday products. Students complete the life cycle diagrams of these every day materials based on their research. (Research links provided in the live binder.) They will take an initial look at how products are changed from one product to another. Students will put the lifecycle cards in order on the interactive notebook. At this point students are not looking at whether or not a chemical or physical change has occurred.
Notes	The four products that are covered in this lesson could also be used by students as the topic of their individual inquiry projects. This is especially helpful for students that require more scaffolding and support. The live binder can be found here: bit.ly/ml-matter	



Grade 4

Lesson #9



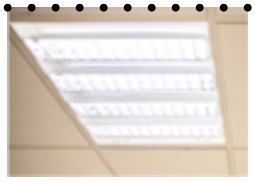
Light & Sound Safety

Home	School

Community

Light and Sound Safety Items

PA System



Florescent Lighting

Emergency Exit Signs

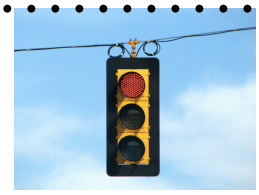
Fire Truck

Safety Vest

smoke

Home Alarm

Fire Alarm



Traffic Light

Street Light

Lamp

Insulation

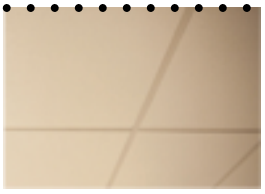
School Bell

Railway

Car Lights

Cell Phone

Alarm Clock



Acoustic

Light and Sound Safety Items

PA System

Florescent Lighting

Emergency Exit Signs

Fire Truck

Safety Vest

smoke

Home Alarm

Fire Alarm

Traffic Light

Street Light

Lamp

Insulation

School Bell

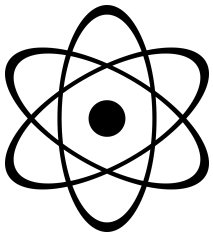
Railway

Car Lights

Cell Phone

Alarm Clock

Acoustic



Grade 5

Lesson #9

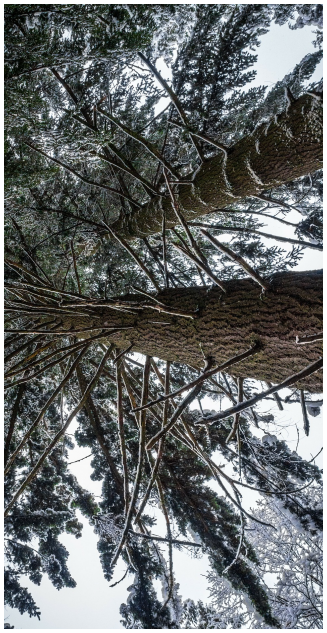
Making Everyday Products

Choose two everyday products and research how they are made.

- Choose two of the four foldable topics that interest you or make your own.
- Cut out around the outside of the foldable and fold on the dotted line.
- Cut down the skinny lines on either side of the lined boxes. Do not cut in the picture section.
- Put glue on the back of the pictures and glue on top of this box.

- Choose two of the four foldable topics that interest you or make your own.
- Cut out around the outside of the foldable and fold on the dotted line.
- Cut down the skinny lines on either side of the lined boxes. Do not cut in the picture section.
- Put glue on the back of the pictures and glue on top of this box.

Wheat	Dough
Flour	Bread



Trees

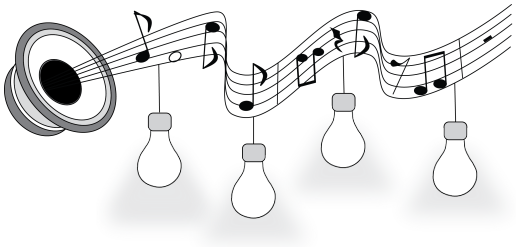
Wood chips

Pulp

Paper

Crude Oil	Oil Refinery Ethane/Ethylene
Polyethylene Resin	Plastic

Palm Oil Tree	Palm Fruit
Palm Oil	Margarine



Lesson #10

INQUIRY BOOKLETS

Lesson #10

	First Half	Second Half
Prep	Prepare inquiry booklets with students. This can be done in one of two ways. First, print out the pages double-sided on an 8.5 x 11 piece of paper and bind papers together in a booklet putting staples up the left side. Additionally, using the settings of your printer, select only the pages of the inquiry booklet from the PDF to print. In the print dialog box, select the option to print as a double-sided booklet.	
Gr. 4	Choose one of the following lines of inquiry as a group. Depending on student readiness you could also allow for students to choose multiple lines of inquiry. After choosing a line of inquiry, build background for each line of inquiry to help students choose a topic. Students could look at systems that use either light or sound and brainstorm how to use both to make them safer.	Students will then complete the rest of the inquiry report booklet eventually creating a device that meets their line of inquiry. Then they can explain how they could improve this system and then present their findings to the class. From there an extension activity would be to choose one of them and make it as a large group together. Students complete their inquiry booklet working through the research steps Teacher will conference with students frequently throughout their completion of the inquiry booklet.
Gr. 5	Depending on your students comfort with independent inquiry you may choose to do a model or guided inquiry first with your students. Students will explore what impact of using different materials and processing these materials into different types of matter effect and impact people and our natural environment. Use the following inquiry booklet and student conferences to help students work through their inquiry.	Students • Choose one environmental issue and learn about the problem, • Pick a product involved • Identify how it is produced and what impacts this production has on the environment. • Identify physical and chemical changes involved in making this product • Balance this issue with sustainability and with human need. • Students will show you what they learned as a part of the culminating task of this unit. • Students will develop an action plan of something they can do to make an impact on this issue. Can use the site "the story of stuff" particularly the podcast or ecokids.ca. They will present to others attempting to persuade their peers to up one of these issues as a class cause.
Notes	Use this final project to make a difference in your community. This can be combined with the other grade 5 "Energy Conservation" unit and "Government" unit. It can also be integrated well with the corresponding units with the grade 4 program of "Habitats", "Physical Regions," and "Rocks and Minerals".	

Student Inquiry

The purpose of student inquiry is to allow students to explore concepts of light and sound or matter that interests them. To learn more, to solve problems, look at an issue from different perspectives and develop solutions.

There are many ways that this can be done. Included for grade 4s are a few inquiry pathways that you can use to help students explore ideas in light and sound. Grade 5's can use the materials from the previous lesson to explore further. Students should be encouraged to work beyond these topics for inquiry if they're ready and capable. Teachers should avoid placing limits on reasonable topics, providing narrow selection of topics, or discouraging student creativity. Instead teachers are encouraged to support students in choosing topics that are interesting, relevant and timely for them.

The steps of inquiry that students can follow include:

- Develop an idea/Brainstorm
- Ask questions
- Research and grow background knowledge
- Apply learning
- Evaluate learning and draw conclusions
- Share their learning

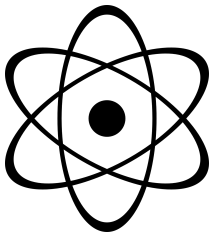
Each grade level has an inquiry booklet that that will help to scaffold their inquiry. As the teacher it is important that you conference with students to ensure that they are moving through their inquiry journey appropriately. At times you may need to stop a group of students for a guided inquiry lesson on topics such as brainstorming, how to research, and how to synthesize information. Lessons during your other areas of instruction such as during your language arts time will help to support students in understanding how to do many of these things successfully. A cross curricular approach is very helpful when conducting inquiry projects.

The end of the student inquiry research, students will share what they have learned along with a plan of action outlining steps that can be taken to improve the situation. Teachers should again avoid restricting students creativity by planning how students will present this information. An extension activity the class can choose one of the proposals and follow through with the winning students plan of action.

(5) Inquiry Sample Guide

FOR TEACHER USE

For This Inquiry	For Example
1. Students will look for an environmental issue or a controversial product. They can look at the podcast: The Story of Stuff or ecokids.ca/take-action to find an issue that interests them	Students may be interested that an animal in the rainforest is losing their habitat due to deforestation for farming.
2. Identify products involved that create this issue.	Rainforests are cut down to grow palm oil trees. Palm oil is used to make many processed foods such as margarine, and cookies
• Research the process that is involved in procuring, processing and disposing of this product.	To make cookies: Palm oil fruits are picked, steamed, crushed, refined*, emulsification mixed with other ingredients*, baked, and packaged
• Identify the physical and chemical changes that this product takes to be processed from the raw material to the final project.	refining oil - physical emulsification - physical mixing - physical baking - chemical
• identify the variety of stakeholder perspectives that may be involved	Nutritionists - palm oil has no trans fats like other oil. farmers - able to make money with farm land environmentalist - destroying habitats
3. Apply and Evaluate	students will identify how to reduce deforestation caused by palm oil plantations. IE: sustainable forestry and replanting cycles



Grade 4

Lesson #10

LIGHTING

First: Choose an invention that uses light to help us.

Then: Decide how you could use this device in a new way to fix a problem.

ACOUSTICS

First: What things are used to improve or adjust the acoustics in an environment.

Then: How could you improve the acoustics in a home, school or community location?

HOME OR SCHOOL DEVICES

First: Choose an invention that uses light or sound in your home, classroom, or community.

Then:
How could you make a classroom or school safer for someone who is blind or deaf?

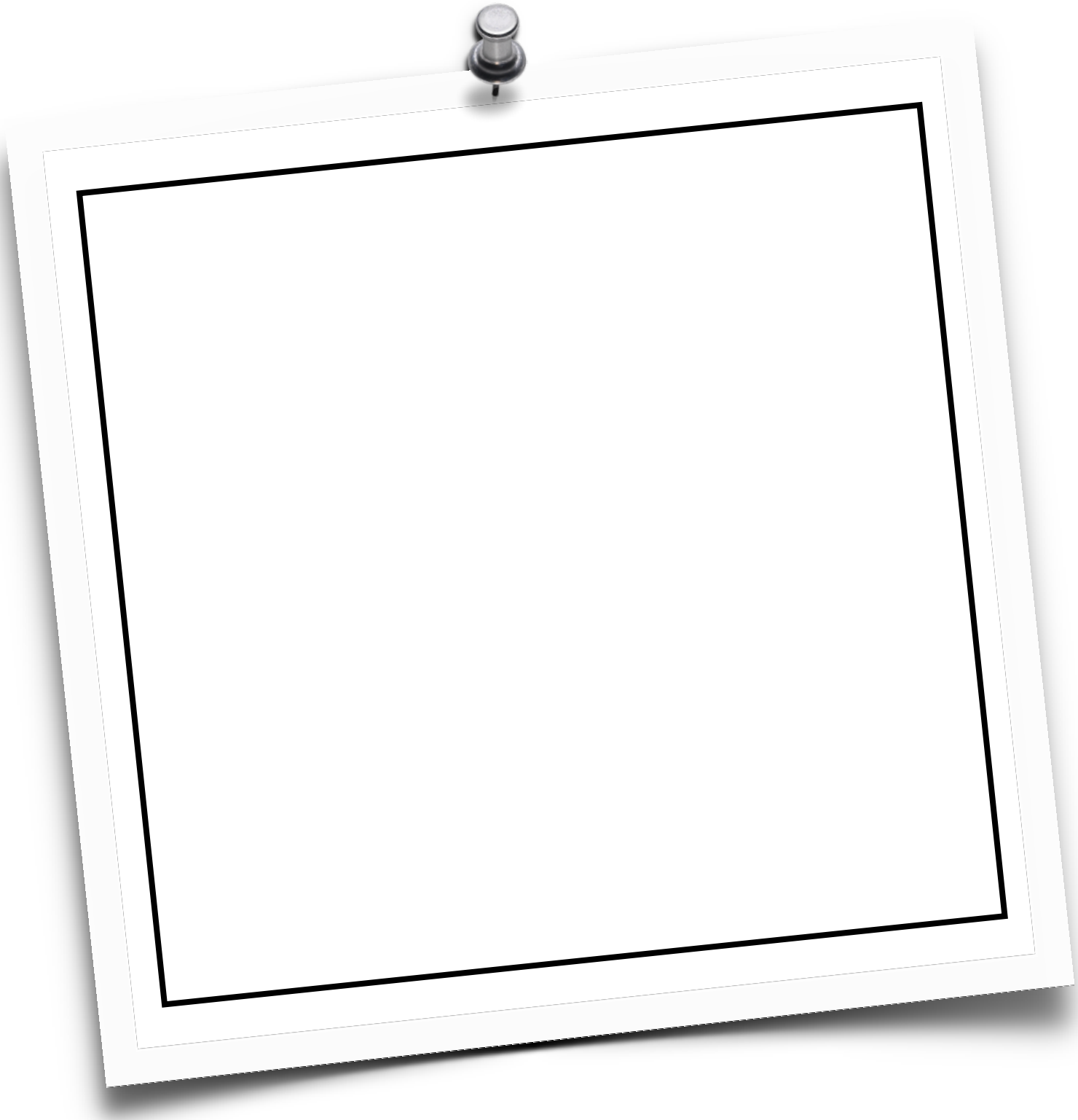
COMMUNITY

First: Think of a device in your community that uses light and/or sound and keeps people safe?

Then: How could you use light or sound to improve the safety of something in our community?

MY INQUIRY

Grade 4



NAME: _____

<< BRAINSTORMING >>

Grade 4

Think about 4 topics that interest you.
List what you already know or think about each topic:

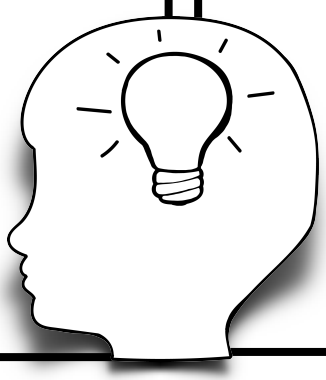
<<<<< PLANNING >>>>>

Grade 4

BIG IDEA

Success Criteria

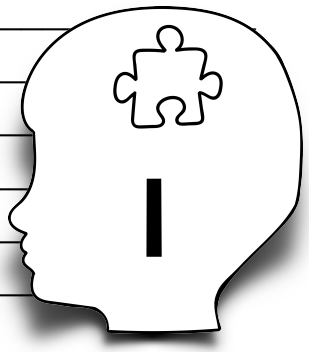
Questions



<<<< RESEARCH >>>>

Grade 4

Source/Notes	Research



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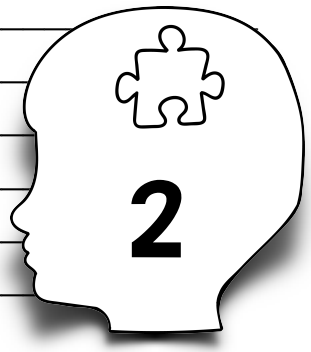
Grade 4

Source/Notes	Research



<<<< RESEARCH >>>>

Grade 4

Source/Notes	Research

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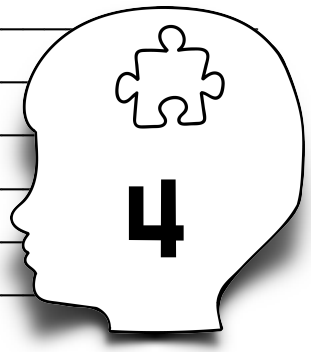
Grade 4

Source/Notes	Research



<<< SUMMARIZE >>>

Grade 4

Questions from success criteria	**Research** summarize your research

<<<<<<< ACTION >>>>>>>

Grade 4

Using part 2 (THEN statement) from your line of inquiry copy it below.

_____

_____

_____

Think about what you researched. How could you apply what you learned to solve the problem from your 'THEN' statement?

_____

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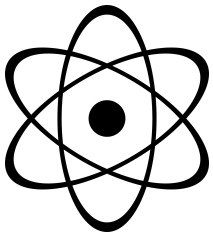
<<<<<< SHARING >>>>>>

Grade 4

Sketch your version of a product that could be used to solve your problem.

How will you present this information? Make a plan here:

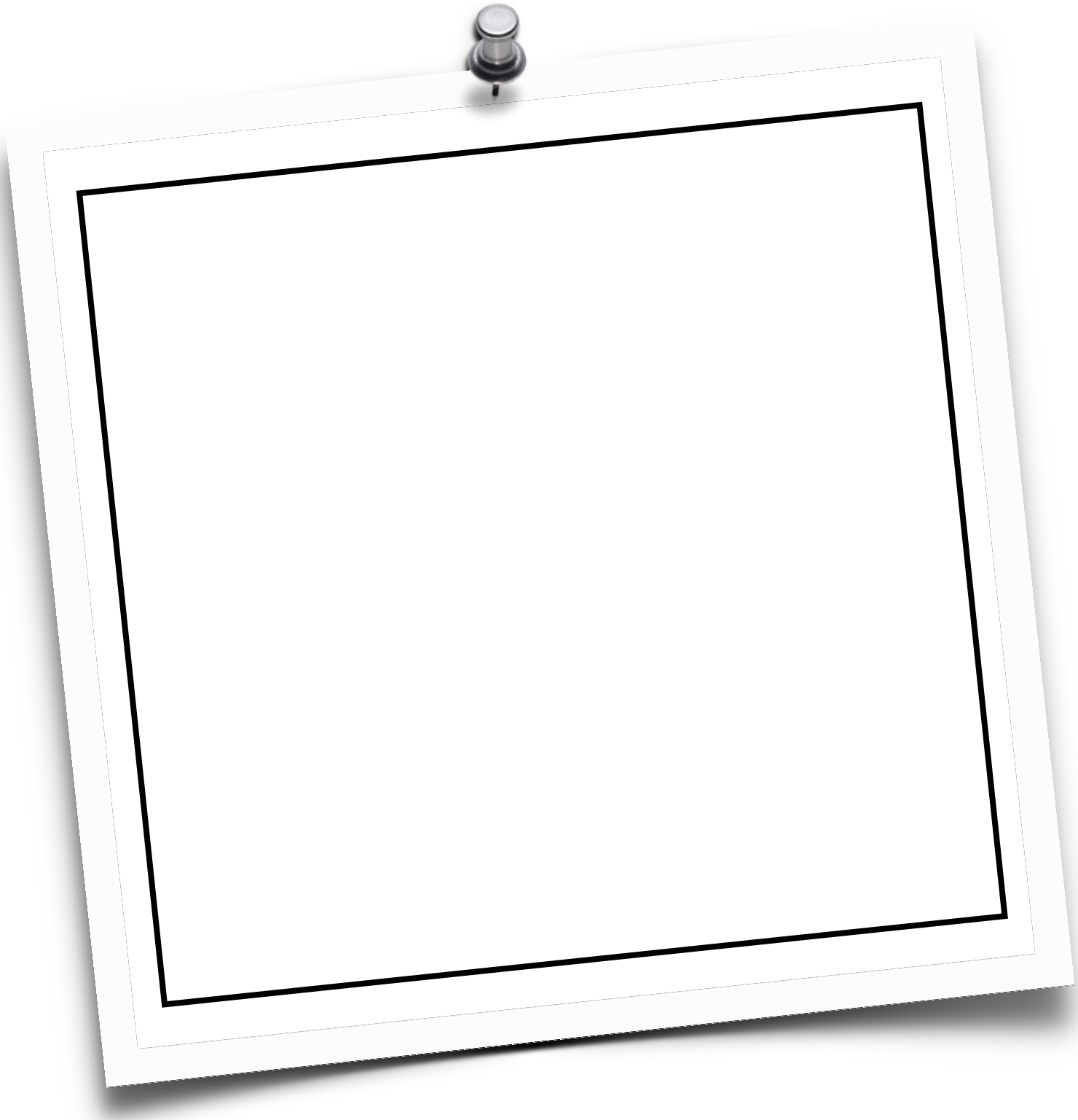


Grade 5

Lesson #10

MY INQUIRY

Grade 5



NAME: _____

<< BRAINSTORMING >>

Grade 5

Think about 4 topics that interest you.
List what you already know or think about each topic:

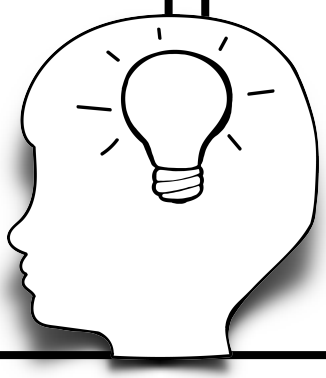
<<<<< PLANNING >>>>>

Grade 5

BIG IDEA

Success Criteria

Questions



<<<<< PLANNING >>>>>

BIG IDEA

Making products we use everyday involves both physical and chemical changes. How does making these everyday products impact the environment

Success Criteria

I can identify an environmental issue

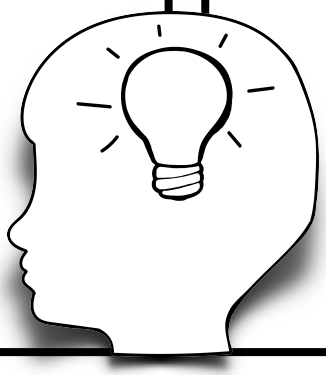
I can identify a product that is involved with this issue

I can describe the basic steps to make this product

I can identify the physical and chemical changes that are used to make this product

I can identify ways to reduce the impact making this product has on the environment

I can make a plan to teach others about this topic or issue

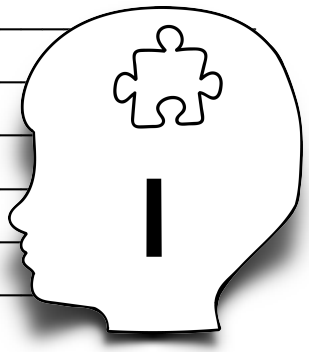


Questions

<<<< RESEARCH >>>>

Grade 5

Source/Notes	Research



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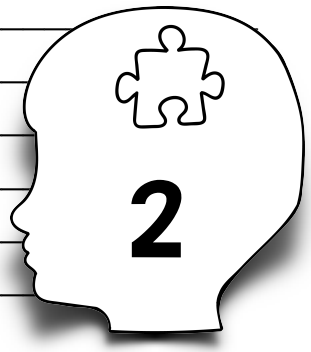
Grade 5

Source/Notes	Research



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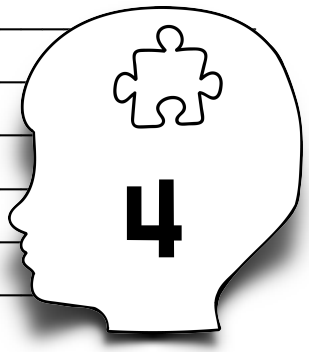
Grade 5

Source/Notes	Research

<<<< RESEARCH >>>>

Grade 5

Source/Notes	Research



<<< SUMMARIZE >>>

Grade 5

Question	Research
What are the steps to make the product?	
What chemical and physical changes occur?	
What impacts are there to people and the environment?	
What are the stakeholders perspectives?	

<<<<<<< ACTION >>>>>>>

Grade 5

What's the problem/issue?

Think about what you researched. What action could you take to make a change or raise awareness about the impacts that processing your product has on people and the environment? Explain why/how there is a problem and a possible solution below.

<<<<<< SHARING >>>>>>

Grade 5

Write a persuasive paragraph to your classmates convincing them to take action on your issue.

How will you present this information?

Assessment Pages

Light and Sound

Presenters Name: _____

What are they presenting? _____

_____

	Level 1	Level 2	Level 3	Level 4
Knowledge and understanding of **key features** light and sound	Very poor understanding of light and sound properties.	Student has some knowledge and understanding of light and sound properties.	Students has a good knowledge and understanding of light and sound properties.	Student has a thorough understanding of light and sound properties.
Thinking: Student is able to describe how light and sound impacts people in positive and negative ways.	Students can describe with limited effectiveness how people are impacted by light and sound.	Students can describe with some effectiveness how people are impacted by light and sound.	Students can describe with considerable effectiveness how people are impacted in various ways by light and sound.	Students can describe with thorough effectiveness how people are impacted in various ways by light and sound.
Application: Students can apply their knowledge of light and sound and propose solutions to improve or solve problems in everyday life.	Student struggles to apply their knowledge of the basic features of light and sound and identifies a limited understanding of light and sound technologies, and solutions or improvements to problems in everyday life.	Student applies their knowledge of the basic features of light and sound and identifies some understanding of light and sound technologies, and solutions or improvements to problems in everyday life.	Student applies their knowledge of the basic features of light and sound and identifies a good understanding of light and sound technologies, and solutions or improvements to problems in everyday life.	Student applies their knowledge many features of light and sound and identifies a superior understanding of light and sound technologies, and solutions or improvements to problems in everyday life.
Communication: Quality of Presentation	Student shows poor speaking skills. Student struggles to explain their work in a clear way.	Student shows some speaking skills. Student can explain some of their work clearly.	Student is easily heard by audience. Student can explain their work clearly.	Student shows excellent speaking skills. Student can explain their work in a clear and organized way.

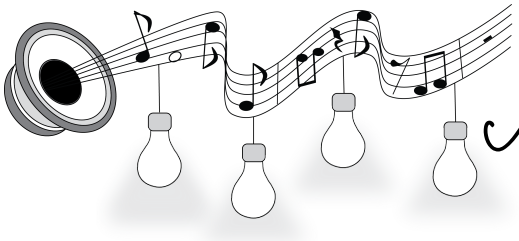
2 stars and a wish _____

_____

_____

_____

This presentation was assessed by: _____



Assessment Tracking

	Lesson / Student name					
1	Light and Sound in our World					
2	Artificial and Natural Light					
3	How Light Travels - Experiments					
4	Light: Bend, Bounce, Absorb					
5	Light and Colour					
6	What is Sound?					
7	How Sound Travels					
8	Detecting Sound					
9	Light and Sound Safety					
10	**Inquiry Project-** How light and sound inventions have changed the way we live.					

Assessment

	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding: • Physical and chemical changes • Properties of solid, liquids and • Changes of state	Student has a limited understanding of key concepts learned and with significant support.	Student has a basic understanding of key concepts learned in uses them appropriately some of the time.	Student has a solid understanding of key concepts learned and uses them appropriately most of the time.	Student has a deep understanding of key concepts learned and uses them appropriately all of the time.
Thinking: • Research skills • Analyze and synthesize information • Make connections and inferences	Student requires a high degree of support to research and struggles to analyze and synthesize what they read to answer inquiry questions.	Student demonstrates basic research skills and with some support can analyze and then synthesize what they read to answer questions.	Student demonstrates good research skills by analyzing and synthesizing what they read to answer inquiry questions.	Student demonstrates excellent research skills by analyzing and synthesizing what they read to answer inquiry questions.
Communication: • Appropriate terminology/ vocabulary • Communicate and collaborate with others	Student rarely uses subject specific vocabulary correctly. Student rarely communicates and collaborates with others to share ideas and insights.	Student uses a few subject specific vocabulary correctly. Student communicates and collaborates some of the time with others to share ideas and insights.	Student uses some subject specific vocabulary correctly. Student communicates and collaborate effectively with others to share ideas and insights.	Students uses most subject specific vocabulary correctly. Student communicates and collaborates effectively with others to share ideas and insights.
Application: • Make connections between research and real life	Student struggles to use the information from their research to identify a problem and possible solutions.	Student partially uses the information from their research to identify a problem and possible solutions.	Student sufficiently uses the information from their research to identify a problem and possible solutions.	Student comprehensively uses the information from their research to identify a problem and possible solutions.

Assessment Tracking

	Lesson / Student name					
1	What is matter?					
2	Properties of solids, liquids and gases.					
3	Properties of solids, liquids, and gases.					
4	Changes of states in matter: water.					
5	Changes of states in matter: other materials					
6	Changes in state and heat.					
7	Physical and chemical changes in matter.					
8	How do the physical properties of certain materials help us?					
9	The environmental impact of changing matter.					
10	**Inquiry Project-** Product under going a change and its impact					