PEAC
PRIVATE EDUCATION ASSISTANCE COMMITTEE
Trustee of the Fund for Assistance to Private Education

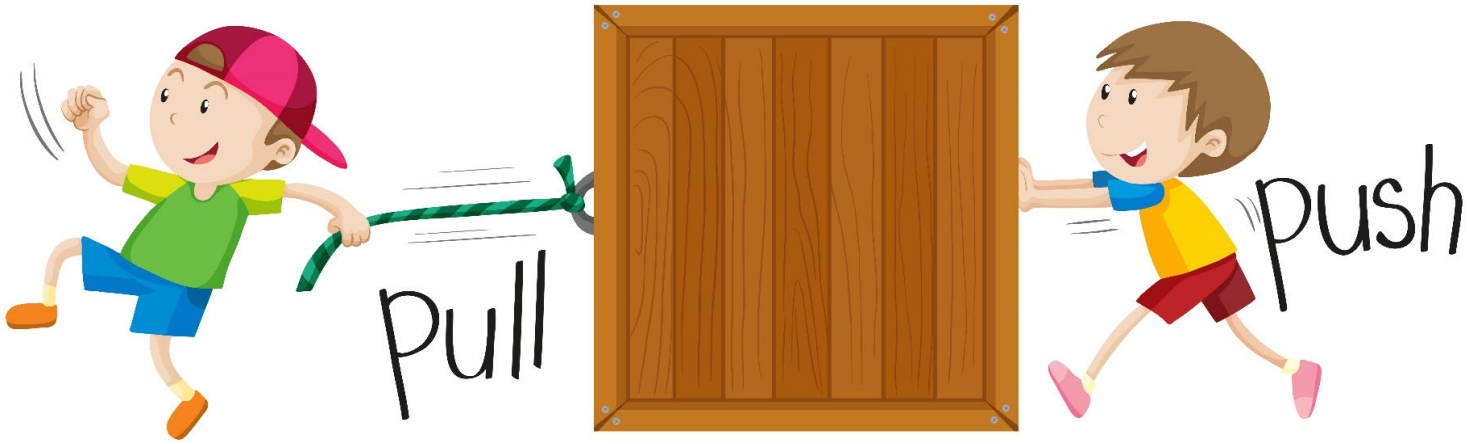
DepED
DEPARTMENT OF EDUCATION

2017

LEARNING MODULE

Science G8| Q1

Force, Motion and Energy



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NOTICE TO THE SCHOOLS

This learning module (LM) was developed by the Private Education Assistance Committee under the GASTPE Program of the Department of Education. The learning modules were written by the PEAC Junior High School (JHS) Trainers and were used as exemplars either as a sample for presentation or for workshop purposes in the JHS In-Service Training (INSET) program for teachers in private schools.

The LM is designed for online learning and can also be used for blended learning and remote learning modalities. The year indicated on the cover of this LM refers to the year when the LM was used as an exemplar in the JHS INSET and the year it was written or revised. For instance, 2017 means the LM was written in SY 2016-2017 and was used in the 2017 Summer JHS INSET. The quarter indicated on the cover refers to the quarter of the current curriculum guide at the time the LM was written. The most recently revised LMs were in 2018 and 2019.

The LM is also designed such that it encourages independent and self-regulated learning among the students and develops their 21st century skills. It is written in such a way that the teacher is communicating directly to the learner. Participants in the JHS INSET are trained how to unpack the standards and competencies from the K-12 curriculum guides to identify desired results and design standards-based assessment and instruction. Hence, the teachers are trained how to write their own standards-based learning plan.

The parts or stages of this LM include Explore, Firm Up, Deepen and Transfer. It is possible that some links or online resources in some parts of this LM may no longer be available, thus, teachers are urged to provide alternative learning resources or reading materials they deem fit for their students which are aligned with the standards and competencies. Teachers are encouraged to write their own standards-based learning plan or learning module with respect to attainment of their school's vision and mission.

The learning modules developed by PEAC are aligned with the K to 12 Basic Education Curriculum of the Department of Education. Public school teachers may also download and use the learning modules.

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SCIENCE 8

Module 1: Force, Motion and Energy

Lesson 1: Newton's Laws of Motion

INTRODUCTION AND FOCUS QUESTION(S):

Usain Bolt. Cheetah. Peregrine Falcon. Can you guess what's common among them? Yes, they are the "world's fastest". But have you ever wondered what makes them move the way they do? Why do some things move faster than the others? In an airplane and other land vehicles, we are required to buckle our seatbelts. In riding motorcycles, we adhere to the helmet policy. Do we really understand why we are asked to do such? Motion has been a very common and familiar concept to all even before one has learned to walk. But is our grasp of the concept enough to understand the different kinds of motion that is happening around us? Let us try to explore our minds and navigate through other resources and learn what we can about motion.

In this lesson, you will find out the laws governing motion. These are the Law of Inertia, Law of Acceleration and Law of Interaction, which were formulated by Sir Isaac Newton. As you go through the lesson, remember to search for the answer to the following questions: What does force have to do with motion? How can motion be controlled? How can we take advantage of our knowledge on motion?

LESSON COVERAGE:

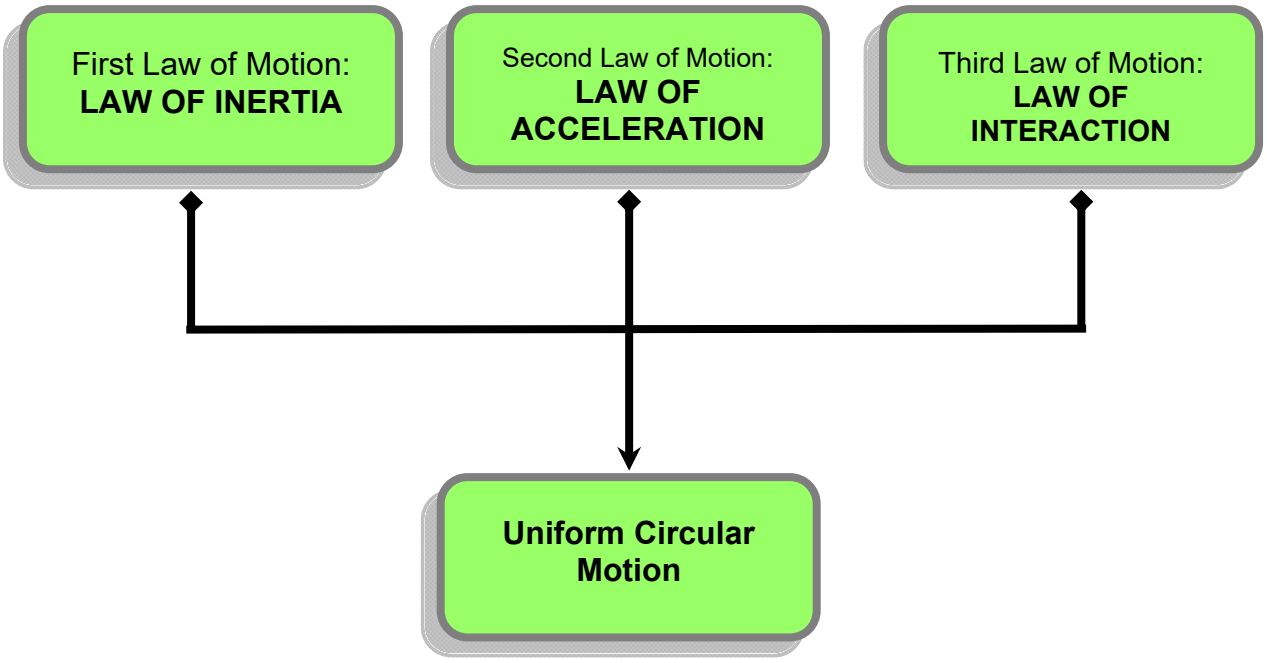
In this lesson, you will examine the following questions:

a. What does each law of motion state?
b. What does force have to do with motion?
c. How can motion be controlled?
d. How can we take advantage of our knowledge on motion?

In this lesson, you will learn the following:

- investigate the relationship of the amount of force applied and the mass of the object to the amount of change in the object's motion
- infer that when a body exerts a force on another an equal amount of force is exerted back on it
- model passengers' body response to changes in motion
- relate the laws of motion to bodies in uniform circular motion
- infer that circular motion requires the application of constant force directed toward the center of the circle

LESSON MAP:
Here is a simple map of the topics you will cover:



EXPECTED SKILLS:

To do well in this lesson, you need to remember and do the following:

- ▣ Familiarize the scientific terms and principles.
- ▣ Perform conscientiously all the tasks as instructed in every part.
- ▣ You may collaborate with other online students or consult other references, should you deem it necessary.
- ▣ Take down some notes which you find important and interesting. These may come in handy when you need to review.
- ▣ Keep a journal of your insights as well as questions.
- ▣ Determine the learning style and environment where you learn best so as to maximize your learning.
- ▣ Lastly, enjoy what you are doing and be inspired to study well.

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

1. What is the measure of an object's inertia?
   a. interaction
   b. net force
   c. acceleration
   d. mass

2. What causes an object to accelerate?
   a. inertia
   b. net force
   c. acceleration
   d. mass

3. What relationship exists between mass and acceleration?
   a. direct
   b. inverse
   c. direct square
   d. inverse square

4. How would you compare the force you exert on pulling the hand of your friend compared to the resistance your friend is offering?
   a. greater
   b. equal
   c. lesser
   d. zero

5. Which of the following is a reaction when swimming?
   a. Hand pushes the water backwards.
   b. Water flows backward.
   c. Hand extends forward.
   d. Water pushes the hand forward.

6. In a game of tug-of-war, the stronger team pulls the rope with a force that is
   a. greater than the pull of the opponent.
   b. equal to the total weight of the members in the opposing team.
   c. equal to the force that the weaker team exerts on them.
   d. double the amount of that the opponent pulls on them.

7. What concept may explain why you are thrown off a motorcycle as it speeds round a curve?
   a. action-reaction
   b. law of acceleration
   c. friction
   d. inertia

8. Which statement is true about a moving spaceship which runs out of fuel in the empty outer space?

a. It will slow down and eventually stop.
b. It will wander in any direction.
c. It will accelerate.
d. It will move at a constant velocity.

9. Which statement is FALSE when a bus is overloaded?
a. Its mass is increased.
b. Its acceleration is increased.
c. It requires greater force to keep moving.
d. Its inertia is increased.

10. Which of the following is TRUE about a person sleeping motionlessly on the bed?
a. His inertia decreases.
b. No force acts on him.
c. Bed pushes the person with a force equal to his weight.
d. Only force weight acts on the person.

11. Which of the following allows the Earth to revolve around the Sun?
a. its well-designed orbit
b. the gravity of the Sun
c. the gravitational pull of the Earth
d. the similar movement of the other planets

12. What makes a horse move forward when it draws a carriage?
a. the carriage
b. the feet of the horse
c. the ground
d. the wheels of the carriage

13. Which of the following will NOT prevent injury on passengers riding a moving vehicle?
a. handrails
b. headrest
c. airbags
d. GPS

14. Which of the following may NOT increase the speed of a race car?
a. Make it lightweight.
b. Change engine with a more powerful one.
c. Lower its body more closely to the ground.
d. Reduce air drag.

15. Which vehicle moving at the same speed may drag a food cart at a farther distance upon collision?
a. bicycle
b. train
c. taxi
d. minibus

16. Which of the following will NOT help a sprinter?
    a. strength training
    b. running speed training
    c. mass gain
    d. none of the above

17. How will you remove a ply of tissue from a roll with only one free hand?
    a. employ sudden pull on the ply
    b. twist the tissue ply
    c. pull the tissue slowly sideways
    d. none of the above

18. In terms of motion, which may offer an advantage to an extremely obese person?
    a. setting one's self to run
    b. climbing a flight of staircases
    c. to be dislodged by others out of place by shoving
    d. to be carried in someone else's arms

19. What makes a butcher knife effective in cutting through bones?
    a. It is sharper.
    b. Force is increased when using it.
    c. Its greater mass makes it more difficult to stop.
    d. It is actually equally effective as a smaller knife.

20. How could an astronaut in empty space get back inside the space shuttle if his rocket backpack runs out of fuel?
    a. He should swim towards the stationary space shuttle.
    b. He should throw the backpack opposite the space shuttle's direction to propel his body back to the shuttle.
    c. He should start spinning as it creates a motion just like a typhoon and continue to do so until he reaches the shuttle.
    d. It would be impossible for him to get back.

EXPLORE

:

Have you ever wondered why our body tends to move forward when the vehicle we are riding suddenly stops? Have you ever thought what makes a massive rocket fly into space? Are there laws governing such actions? How do we take advantage of our knowledge on motion? Find out as you journey to a world of learning in this lesson.

ACTIVITY 1: Caught on Camera

Let's begin our journey with a video clip showing a compilation of road accidents. As you watch the clip, keep this question in mind, ***"How can we control motion and use it to our advantage?"***

Click this link: http://www.youtube.com/watch?v=Xtz6laJXMMg
This video shows several road accidents.

Process Questions:

1. How did you feel about the victims? the culprits?
2. What causes of accidents are shown in the video?
3. In the video, what pieces of advice are implied to avoid getting into horrific accidents?
4. ***Can we control motion? In what way?***
5. ***How can we take advantage of our knowledge on motion?***

How much do you know about motion and the laws governing it? Let's find out as you answer the next activity.

ACTIVITY 2: Anticipation-Reaction Guide

Below are statements pertaining to situations that involve the concept of Newton's Laws of Motion. On the column before the statements, put a check [✓] mark if you agree with the statement and an X mark if otherwise. Do not answer the column after the statements yet. Click the **SUBMIT** button when you're done.

BEFORE	STATEMENT	AFTER
	1. With a jerk, a piece of cloth underneath a wine glass may be removed without toppling the glass off.	
	2. You are thrown backward if the vehicle you are riding suddenly stops.	
	3. An empty grocery cart runs faster than the loaded one because it is easier to move.	
	4. The engine of a jeepney uses more energy in traveling when it is overloaded with passengers than when it is only loaded to its seating capacity.	
	5. Upon collision, a car receives a greater force of impact than the wall it crashed into.	
	6. Every time you push the wall, it also pushes you back with equal force.	

End of EXPLORE:

Let's try to find out how many of your initial ideas are valid and correct by doing the next set of activities. As you learn in the next section, go over your answers in the previous section and compare your initial ideas with your learned concepts. And try to find out ***what the laws that govern motion are and how we can try to control it to our advantage.***

FIRM-UP

Your goal in this section is to learn and understand key concepts by answering the questions:
1. How do the 3 Newton's laws of motion differ from one another?
2. In what situations can we take advantage of our understanding of these laws?

ACTIVITY 3: Predict - Watch - Explain: Law of Inertia

Read the situation below. PREDICT what would happen, WATCH the video clip to verify your answer and EXPLAIN your observation based on the given reading article.

Consider a ladder placed unstrapped at the top of a moving truck. When the driver suddenly slams on the brakes, which car would more likely be in danger of a falling ladder – the one in front or at the back of the truck? Explain your answer by filling out the first two columns of the table below. Do not answer the last two columns yet as those will be filled out at a later time. Click on **SUBMIT** *when you're done with the first two columns.*

PREDICTION	EXPLANATION	OBSERVATION IN THE VIDEO	EXPLANATION AFTER READING SOME TEXT AND WATCHING RELATED VIDEOS

Now, click on the link below to know the answer. Use the reading article in this site, as well as the other related links below, to understand the reason for your observation. Then answer the process questions in your journal notebook.

http://www.physicsclassroom.com/mmedia/newtlaws/il.cfm
This video clip shows in which direction the unstrapped ladder on top of a truck falls off.

Process Questions:

1. On which side did the ladder fall --- the car at the back or the car in front?
2. What explains your observation?
3. Would there be a possibility that the unstrapped ladder would fall to the back part of the truck? Why or why not?
4. How do we avoid such scenario?

To verify your answers and explain what you have observed in the video, read the following links and take note of important ideas about the Law of Inertia.

ACTIVITY 4: Reading Activity ~ Law of Inertia

1) http://www.physics4kids.com/files/motion_laws.html
This describes the law of inertia.

2) http://www.biologycorner.com/worksheets/articles/newtons_laws.html
This article briefly talks about each Newton's law of motion.

3) http://www.encyclopedia.com/topic/Newtons_laws_of_motion.aspx
In this article, the law of inertia is explained by citing situations in the outer space.

ACTIVITY 5: Video ~ Law of Inertia

Let's try to delve in a little deeply into this law of motion. Here are some videos that discuss the law of inertia more lengthily. While watching the videos, take note of the answers to the set of guide questions.

Click on the links one at a time and answer the process questions on your journal.

http://www.youtube.com/watch?v=2QAVAdq5aAE
This website explains Newton's 1st Law of Motion and the difference of the inertia of varying masses.

http://www.youtube.com/watch?v=u6rbrFgudLg
This video shows the effect of inertia when you are riding a vehicle.

http://www.youtube.com/watch?v=xyKkyFqKbX4
This video explains the diff types of forces that make objects move.

Process Questions:
1. What is inertia?
2. Which has a greater inertia --- a small stone or a huge rock?
3. What does the Law of Inertia state?
4. Why are we thrown forward if the vehicle we are riding suddenly stops?
5. Is there a way for us to control motion?
6. How can we use our knowledge on the Law of Inertia to our advantage?

Now that you have browsed several reading materials and video clips about the Law of Inertia, let's go back to the scenario where there is an unstrapped ladder on top of a truck. Use the concept of the law of inertia in explaining why the car in front of the truck is in greater danger than the one behind the truck. This time, fill out the third and fourth columns of the table below and click SUBMIT*.*

PREDICTION	EXPLANATION	OBSERVATION IN THE VIDEO	EXPLANATION AFTER READING SOME TEXT AND WATCHING RELATED VIDEOS

After submitting your answers, click on the box below to compare and verify your explanation for the truck-and-ladder situation.

COMPARE YOUR ANSWER:

As the truck moves down the road, the ladder moves with it at the same speed. If the truck abruptly stops then the unstrapped ladder which is in motion would continue its motion because there is no strap (therefore, no force!) to stop it. The ladder will slide off the top of the truck and be hurled into the air. It slides forward because that is the direction to which both the truck and the ladder were previously going. Therefore, it is the car in front of the truck which is in greater danger of being hit by the ladder.

COMPARE YOUR ANSWER:

Now that we have examined Newton's first law of motion (Law of Inertia), let's try to move on to the second law. If in the first law we looked at how moving and stationary objects behave in the absence of external force, in the second law of motion, we will study at how force, as well as the object's mass, can influence the movement of an object. Let's begin by studying the situation below.

ACTIVITY 6: Law of Acceleration: Dump Truck vs. Honda Civic

Suppose a dump truck collides head on with a Honda Civic. Which vehicle would undergo greater change in its motion? Why? Write your prediction and explanation in the "BEFORE" column of the table below. Click the SUBMIT button after doing this. Then substantiate your answer for the "AFTER" column with the help of the set of text and videos that follow.

dump truck

Honda Civic

BEFORE	AFTER
Answer: **Explanation:**	**Answer:** **Explanation:**

Go over the reading articles and videos in the following links where you can verify your explanation in the table and know a little more about the Law of Acceleration. Answer the questions that follow in your journal.

ACTIVITY 7: The "Law of Acceleration" Explained

https://suite.io/paul-a-heckert/j5x2dj
This article describes the Law of Acceleration.

http://www.physicsclassroom.com/class/newtlaws/Lesson-3/Newton-s-Second-Law
This is a more detailed discussion about the law.

http://www.youtube.com/watch?v=nO7XeYPi2FU

This video explains the Law of Acceleration. It further discusses the relationship among force, mass and acceleration.

http://www.youtube.com/watch?v=-KxbIIw8hlc
In this video, Professor Mac uses an experiment to explain the law.

Guide Questions:

1. What does the Law of Acceleration state?
2. With constant mass, how does net force acting on the body affect its acceleration?
3. With constant force, how does the mass of the object affect the acceleration?
4. How would your motion compare if you run with and without camping backpacks on?
5. How can we then use our knowledge about motion to our advantage?

ACTIVITY 8: Demonstration [Loaded vs. Unloaded]

Let's verify the concept which you have just learned in the text and videos by performing this simple demonstration on your own. Use the result to support your explanation in the dump truck vs. Honda Civic scenario. Write your observation in your journal notebook and explain it in the light of the Law of Acceleration.

Predict which car reaches the finish line first ---- the loaded or the unloaded?

Observe what happens.
Set-up: Use two identical cars. Attach a 100-g mass on the second car. Hit both cars with 2 identical suspended balls released from the same height. (This would serve as a uniform force used to push the cars.)

Explain your observation.

1. Which car reached the finish line first? Why?
2. How did the additional load on the second car affect its movement?
3. How can you use the result of this demonstration to explain the dump truck vs. Honda Civic case?

ACTIVITY 9: Laboratory Experiments

In the supermarket, how do you compare your efforts in pushing a loaded grocery cart and an empty one? On the road, how do you compare the movement of overloaded jeepneys and empty ones? Find out if the results of the next two experiments support your explanation. But since laboratory equipment would be necessary, you will have to perform these in school.

EXPERIMENT 1: Mass and Acceleration

OBJECTIVE: to determine how the acceleration of a moving body is affected by its mass

MATERIALS: toy cart, stopwatch, plane, string and set of weights

PROCEDURE:

1. Measure the mass of the toy cart.
2. Tie one end of the string to the toy cart and pass the other end through the pulley attached to the plane.
3. Suspend a 200-g mass at the end of the string that passes the pulley.
4. Mark a starting and end points of a 100-cm distance on the plane.
5. Determine the time it takes for the toy cart to travel the 100-cm distance.
6. Record the data in the table.
7. Repeat procedures 5-6 but add 100 g of mass on the toy cart at every cycle.
8. Plot the total mass (in grams) against acceleration (in cm/s^2) in a graph.
9. Answer the Analysis Questions and write the generalization.

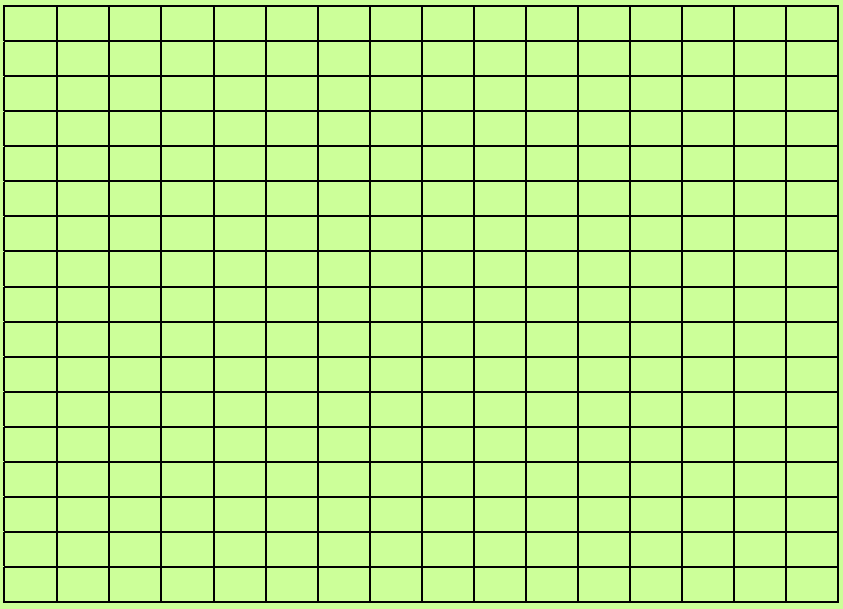
DATA AND RESULTS:

Mass of the toy cart: _____

Total Mass and the Acceleration of the Toy Cart

	Suspended Mass (g)	Added Load (g)	Total Mass* (g)	Time (s)			Average Time (s)	Acceleration (cm/s^2)
				Trial 1	Trial 2	Trial 3		

*Total Mass = mass of the toy cart + added load



3.

ANALYSIS QUESTIONS:

1. Why is there a need to know the mass of the toy cart?

_____
_____

2. Why is adding 100-g mass to the toy cart every cycle necessary for this experiment?

_____
_____

3. What is the purpose of the 200-g suspended mass in the experiment? Why is it necessary to be at 20 g at all times?

_____
_____

4. What happened to the acceleration of the toy cart if the mass is
   a. increased? _____
   b. decreased? _____

5. How would you compare the motion of an overloaded bus to a bus that is loaded to its capacity?

_____
_____
_____
_____

6. Why are there seldom chubby athletes in running competitions?

_____
_____
_____
_____

GENERALIZATION:

_____
_____
_____
_____
_____

EXPERIMENT 2: Force and Acceleration

OBJECTIVE: to determine how the acceleration of a body is affected by net force moving it

MATERIALS: toy cart, stopwatch, plane, string and set of weights

PROCEDURE:

1. Measure the mass of the toy cart.
2. Tie one end of the string to the toy cart and pass the other end through the pulley attached to the plane.
3. Suspend a 100-g mass at the end of the string that passes the pulley.
4. Mark a starting and end points of a 100-cm distance on the plane.
5. Determine the time it takes for the toy cart to travel the 100-cm distance.
6. Record the data in the table.
7. Repeat procedures 5-6 four times more but increase the suspended mass by 50 g every cycle. Refer to the table.
8. Plot the force(in dynes) against acceleration (in cm/s^2) in a graph.
9. Answer the Analysis Questions and write the generalization.

DATA AND RESULTS:

Mass of the toy cart: _____

Total Mass and the Acceleration of the Toy Cart

	Suspended Mass (g)	Weight* of the Suspended Mass (dynes)	Force pulling the Toy Cart (dynes)	Time (s)			Average Time (s)	Acceleration (cm/s^2)
				Trial 1	Trial 2	Trial 3		

*Weight (in dynes) = mass in grams x 980 cm/s^2

ANALYSIS QUESTIONS:

1. Why is there a need to know the mass of the toy cart?

_____
_____

2. Why is adding 50 g to the suspended mass every cycle necessary in this experiment?

_____
_____

3. What happened to the acceleration of the toy cart if the force is
   c. increased? _____
   d. decreased? _____

4. How would you compare the engines of the taxi cabs and the sports cars? Explain your answer.

_____
_____

GENERALIZATION:

_____
_____
_____
_____

Going back to the scenario of dump truck colliding with a Honda civic, which vehicle would more likely have a greater change in its motion? Why? Complete the table below by answering the second column. Substantiate your explanation using the reading articles, videos and experiments in the previous activities then SUBMIT *your answer.*

BEFORE	AFTER
Answer: **Explanation:**	**Answer:** **Explanation:**

After submitting your answers, click on the box below to compare and verify your explanation for the dump truck vs. Honda Civic situation.

COMPARE YOUR ANSWER:

The Honda Civic will experience greater change in its motion. Upon collision, both will actually experience equal force. But having a lesser mass, the Honda Civic will be accelerated more than the dump truck. Based on Newton's 2nd law of motion, when the net force is constant, acceleration is inversely proportional to mass.

We have just examined Newton's second law of motion (Law of Acceleration). This time, let's try to move on to the third law which is the Law of Interaction. If in the first law we looked at how moving and stationary objects behave in the absence of external force, in the second law of motion we studied how force, as well as the object's mass, can influence the movement of an object, in the third law we will focus our attention to the force of interacting bodies. Let's begin by studying the situation below.

ACTIVITY 10: Rocket Launching: Law of Interaction

Ever wondered what propels a rocket upward? Why do you think should there be such large amounts of exhaust gas in a rocket launch? Jot down your answers in the box below and click the SUBMIT button after.

I think …

Go over the reading articles and videos in the following links where you can verify your explanation in the table and know a little more about the Law of Interaction. Answer the questions that follow in your journal.

ACTIVITY 11: The "Law of Interaction" Explained

https://www.lcmrschooldistrict.com/demers/cbphysicalscience/Chp%2012-3%20Interactive%20Guide.pdf
The first three pages of this file lay down the fundamentals of Newton's 3rd law of motion.

http://www.ck12.org/physics/Newtons-Third-Law/lesson/user:Z3JpbmVyYUBzY2hlbmVjdGFkeS5rMTIubnkudXM./Newton's-Third-Law-Grade-7-Physical-Sience/r2/
This is a combination of text and video that provide comprehensive and detailed discussion of the law of interaction.

https://www.khanacademy.org/test-prep/mcat/physical-processes/newtons-laws-and-equilibrium/v/newton-s-third-law-of-motion
This is a video discussion that makes use of different situations to explain the law.

Process Questions:

1. What does the Law of Interaction state?
2. Why don't the action and reaction pair of forces cancel each other out?
3. Would a rocket still be propelled if only half as much gas is released as its exhaust?
4. In what ways have men taken advantage of the concept of the law of interaction?

Let's check whether there is really an opposite force that counters every action by performing the simple demonstration at home or in an office. Note the effect of this reaction force.

ACTIVITY 12: Demonstration 3 [Who Pushed Me?]

Predict what would happen as you push the wall while sitting on the swivel chair.

Observe what happens.

Set-up: Sit on a swivel chair with your feet off the floor. Push the wall.

Explain your observation.

1. Why did you move in the opposite direction?
2. Did the wall exert a force on you? If no, then how come you moved? If yes, how do you compare your force with that of the wall?

ACTIVITY 13: Dyadic Task ~ Action-Reaction Pair of Forces

Let's try to quantify the action-reaction pair of forces to check whether they are truly equal as explained in the videos. You may perform this with another online student or with a friend in the science laboratory.

Balancing Act

MATERIALS: 2 spring balance

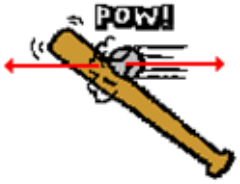
PROCEDURE:

1. Calibrate the spring balance to zero.
2. Attach the two spring balance at their hooks.
3. Pull one spring balance and have someone else pull the other spring balance. Get the reading on each balance.
4. This time, pull a little harder. How do you compare the reading of the two?
5. Does the result support Newton's 3rd Law of Motion?

ACTIVITY 14: Pairing Up

Let us then identify the action-reaction pair of forces present in every picture. Write your answer on the space provided for each number then click the **CHECK THE ANSWERS** button to check your own work.

For each picture, identify the action-reaction pairs of forces.

1. 

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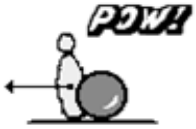
2. 

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3. 

_____
_____

4. Give 3 pairs of action-reaction forces.

a. _____
_____

b. _____
_____

c. _____
_____

We have been looking at situations where objects move in a linear path. What about the objects moving in a curved path? Do Newton's laws of motion still hold true for curvilinear or circular motion? Find out in the next set of activities.

ACTIVITY 14: It Also Goes Around

Click on the links below to read about uniform circular motion then answer the exercises that follow.

http://www.physicsclassroom.com/Class/circles/u6l2a.cfm
This discusses the how uniform circular motion is connected to Newton's laws of motion.

http://www.physicsclassroom.com/mmedia/circmot/ucm.cfm
This talks about the basic concept of uniform circular motion.

http://www.teachertube.com/video/263974
This is a video which shows situations involving uniform circular motion.

https://www.khanacademy.org/science/physics/two-dimensional-motion/centripetal-acceleration-tutoria/v/race-cars-with-constant-speed-around-curve
This is a video discussion about uniform circular motion.

Test your comprehension about uniform circular motion by answering the exercise below. Check your own answers by comparing them to the answer key which can be found after the exercises.

ACTIVITY 15: Information Check

After having read the documents and watched videos involving uniform circular motion, answer the exercise below to check your comprehension. When you're done, click the SUBMIT button then compare your own answers with the answer key found after the exercise.

UNIFORM CIRCULAR MOTION

Based on the text, answer the following exercise. Choose your answers from the word bank below.

>> TANGENT TO THE CIRCLE	>> CENTER OF THE CIRCLE
>> CENTRIPETAL FORCE	>> DIRECTION
>> SPEED	>> VELOCITY

1. If a ball on a string is swung in circles and the string suddenly breaks, the ball will move in a direction _____.
2. The acceleration of an object undergoing a uniform circular motion is in the same direction with _____.
3. A stone whirled in uniform circular motion is moving in constant _____.
4. The acceleration of a body in uniform circular motion is specifically due to its change in _____.
5. The direction of the centripetal force acting on an object in uniform circular motion is towards the _____.

Click on the next box to see the answers and compare them with your own.

UNIFORM CIRCULAR MOTION

Based on the text, answer the following exercise. Choose your answers from the word bank below.

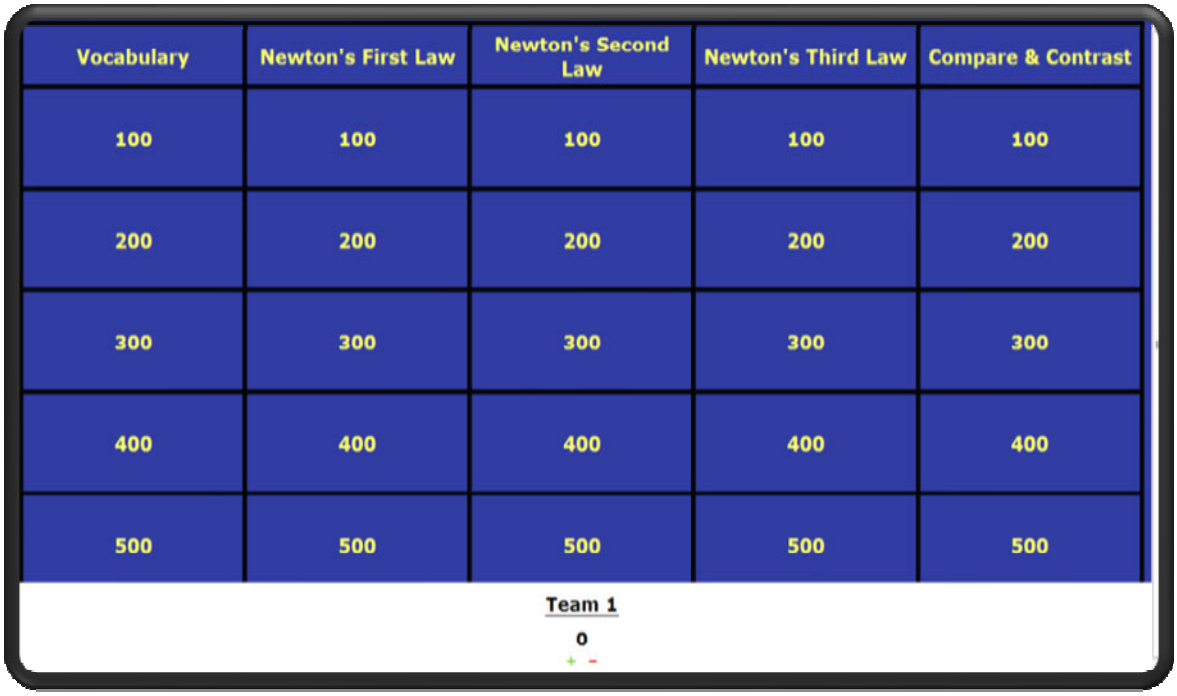
>> TANGENT TO THE CIRCLE	>> CENTER OF THE CIRCLE
>> CENTRIPETAL FORCE	>> DIRECTION
>> SPEED	>> VELOCITY

1. If a ball on a string is swung in circles and the string suddenly breaks, the ball will move in a direction **TANGENT TO THE CIRCLE**.
2. The acceleration of an object undergoing a uniform circular motion is in the same direction with **CENTRIPETAL FORCE**.
3. A stone whirled in uniform circular motion is moving in constant **SPEED**.
4. The acceleration of a body in uniform circular motion is specifically due to its change in **DIRECTION**.
5. The direction of the centripetal force acting on an object in uniform circular motion is towards the **CENTER OF THE CIRCLE**.

ACTIVITY 16: Jeopardy --- Motion Edition

How much have learned so far? Select another online learner and play this game with him/her. The highest scorer at the game is the winner. Good luck!

Follow this link: https://jeopardylabs.com/play/newtons-laws-of-motion to play the game.



Vocabulary	Newton's First Law	Newton's Second Law	Newton's Third Law	Compare & Contrast
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

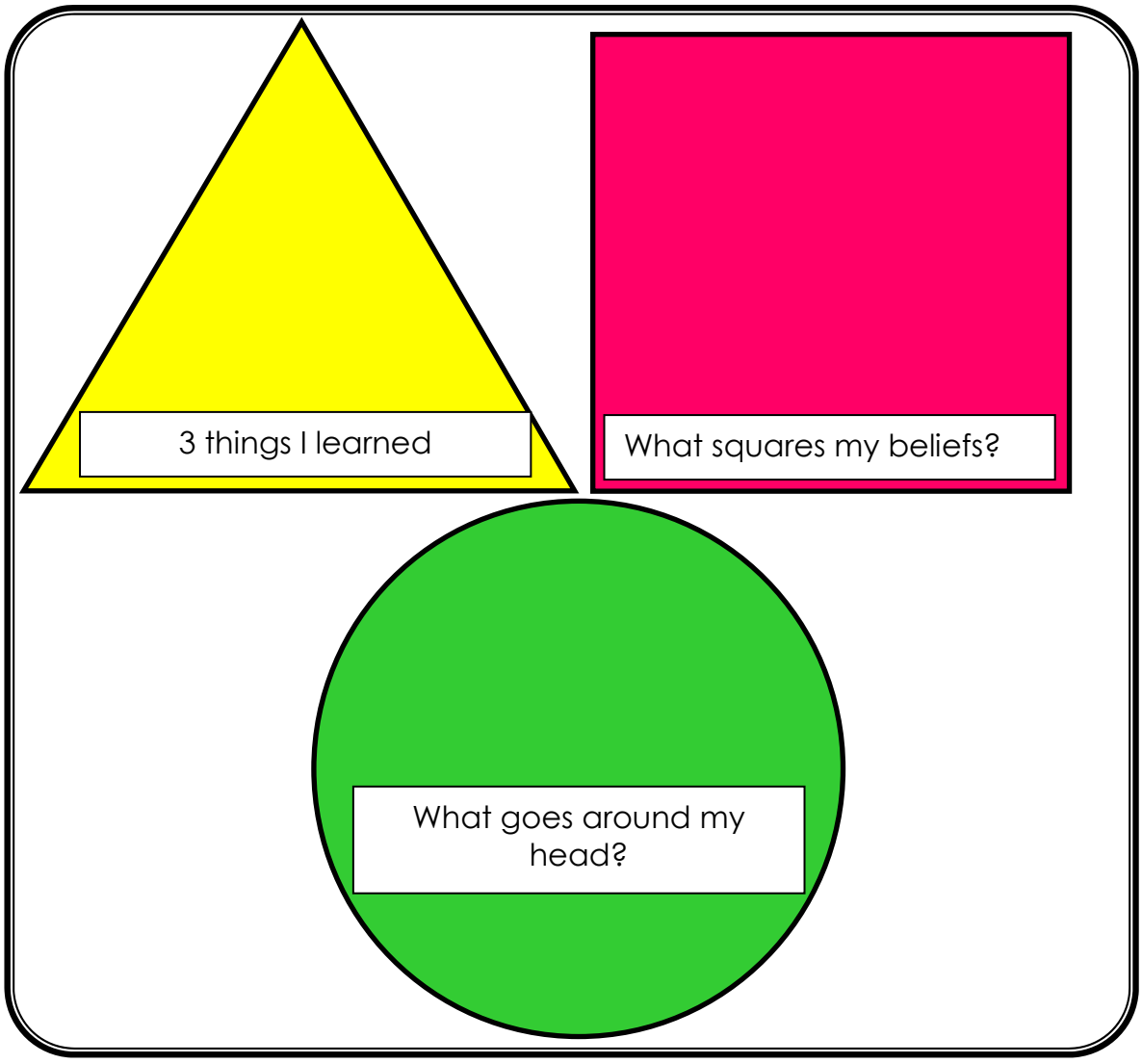
Team 1

0

+ -

ACTIVITY 17: Thought Shapes

You have gone through so many activities, read a number of articles and watched several videos. It's time to put your ideas into writing. So, let us know what's in your mind so far and write something in each thought shape.



End of FIRM UP:

In this section, the discussion focused on the concepts behind the laws of motion.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? *At this point, what can you say about how we can take advantage of our knowledge on motion?*

Now that you know the important ideas about the laws governing motion, let's go deeper by moving on to the next section.

DEEPEN

Your goal in this section is to take a closer look at how we can make use of our knowledge and understanding about Newton's laws of motion.

ACTIVITY 18: There is Strength in NUMBERS

This time, let us take your understanding to the quantitative level. Verify the concepts you have learned about the Law of Acceleration in doing some problem-solving exercises.

Follow this link for a comprehensive guide in problem solving involving Newton's 2nd Law of Motion. Go over the text first for review purposes before you try to answer the problems found in ***Check Your Understanding*** part. Solve the problems on your own, then click on the ***See Answer*** box to see the correct answer and explanation.

http://www.physicsclassroom.com/class/newtlaws/U2L3a.cfm
This website explains the Law of Acceleration and presents related problems to be solved.

Now that you've figured out how to do the sample problems, try answering this set of application problems. Keep your solution and answers in your journal.

Law of Acceleration
PROBLEM SOLVING

Problem 1

The rising concern among athletic trainers regarding concussions among football players has prompted numerous studies of the effectiveness of protective head gears. One study suggests that concussions may result from impacts rated at 740 m/s^2. If a player's head mass (with helmet) is 6.0 kg and considered to be a *free body*, then what net force would be required to produce an acceleration of 740 m/s^2?

Problem 2

Captain John Stapp of the U.S. Air Force tested the human limits of acceleration by riding on a rocket sled of his own design. His rocket sled, known as the Gee Whiz, had a mass of about 82 kg. What net force would be required to accelerate the Gee Whiz and 82-kg Stapp at 450 m/s^2 (the highest acceleration tested by Stapp)?

Problem 3

Space Shuttle Max is one of the extreme rides in Enchanted Kingdom. The first of its kind in the country, this roller coaster ride inverts its riders six times. If during one of its operations, a 53-kg boy experiences a net force of 1800 N at the bottom of its roller coaster loop, how fast would he be accelerating at this location?

Check the solutions presented below and compare it to the way that you answered the application problems.

Law of Acceleration
ANSWERS

Solution to Problem 1

Given:

a = 740 m/s^2
m = 6.0 kg

Asked:

F_{net} = ?

Formula:

$F_{net} = ma$

Solution:

F_{net} = (6.0 kg) (740 m/s^2)
F_{net} = 4440 kg.m/s^2 or 4440 N

Answer:

The net force that could produce an acceleration of 740 m/s^2 is 4440 N. Therefore, protective head gears must be able to withstand such force to avoid head concussions.

Solution to Problem 2

Given:

a = 450 m/s^2
m = 82 kg

Asked:

F_{net} = ?

Formula:

$F_{net} = ma$

Solution:

F_{net} = (82 kg) (450 m/s^2)
F_{net} = 36 900 kg.m/s^2 or 36 900 N

Answer:

The net force required to give the Gee Whiz the human acceleration limit is 36 900 N.

Solution to Problem 3

Given:

F_{net} = 1800 N
m = 82 kg

Asked:

a = ?

Formula:

$a = \frac{F_{net}}{m}$

Solution:

$a = \frac{1800\ N}{82\ kg}$ = 33.96 m/s^2

Answer:

ACTIVITY 19: Muddiest Point

At this time, write the concept or part of the lesson that is still unclear to you. Then redo the related exercises and check if this helps.

MUDDIEST POINT

Now that you are already loaded with the concepts of Newton's laws of motion, let's perform a series of games that apply the concepts that we have been studying about.

ACTIVITY 20: Minute To Win It

Are you ready for a challenge? It's time to step up our learning and get into some action by applying the concepts you have learned. Perform each challenge within a minute. Have someone take a video of yourself while doing the challenge and upload it on animoto.com.

Minute to Win It Challenge!

Whack Job

Use a broom to knock a pie tin off a glass, allowing the egg that is sitting on a toilet paper roll on top of the tin to fall into the glass.

http://www.nbc.com/minute-to-win-it/how-to/whack-job/

Shoe Fly Shoe

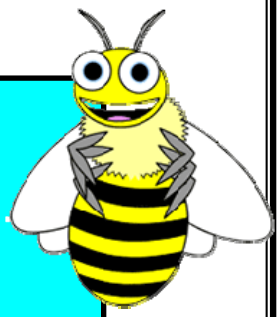
Toss shoe onto a table using only a foot.

http://www.nbc.com/minute-to-win-it/how-to/shoe-fly-shoe/

This Blows

Player must continually blow up a balloon and expel the air from it to knock cups off of a table.

http://www.nbc.com/minute-to-win-it/how-to/this-blows/



Specific Instructions for MINUTE TO WIN IT Challenge

CHALLENGE #1: Whack Job

Use a broom to knock a pie tin off a glass, allowing the egg that is sitting on a toilet paper roll on top of the tin to fall into the glass.

1. Set up tower so that it has a glass of water with a pie tin on top. On top of the pie tin is an empty toilet paper roll with an egg balanced on top.

2. When the clock starts, player steps on broom bristles and releases handle so that the handle hits the pie tin with the demonstrated motion.

3. The player may not make contact with the egg tower, and the entire egg must land inside the glass to count.

4. To complete the game, player must knock the egg off the tower and completely into the glass within the 60-second time limit.

REQUIRED ITEMS

>> glass of water
>> pie tin
>> toilet paper roll
>> raw egg
>> kitchen broom

CHALLENGE #2: Shoe Fly Shoe

Toss shoe onto a table using only a foot.

1. Set up each pair of shoes 9' from the table.

2. When the clock starts, player may insert foot into the first shoe and attempt to toss it onto the table.

3. Player may not move closer to the table or use hands at any time.

4. Credit will be given for a shoe hanging partly off the table, as long as it stays on the table for 3 seconds.

5. To complete the game, contestant must use a foot to successfully toss and land 1 shoe on the table where it must rest for 3 seconds within the 60-second time limit.

REQUIRED ITEMS

>> 12 shoes
>> 1 table

CHALLENGE #3: This Blows

Player must continually blow up a balloon and expel the air from it to knock cups off of a table.

1. Set up 15 plastic cups in a row across the table.

2. When the clock starts, player may grab the balloon and begin to blow it up.

3. Player may only knock cups off the table by using air from the balloon and must always stay on 1 side of the table.

4. If the player makes physical contact with the cup, the game is over.

5. To complete the game, the player must knock all cups off of the table using only the air from the balloon within the 60-second time limit.

REQUIRED ITEMS
>> 1 balloon
>> 15 cups
>> table

Let's take the next set of challenges to the next level! We will still make use of the concepts of Newton's laws of motion in each challenge. But instead of asking you to follow the given procedure, you will make one of your own by making sense out of the materials provided.

ACTIVITY 21: Loco-motion

In the next activity, you need to couple your learned concepts with imagination! Find out how and enjoy your experience.

INSTRUCTIONS: Come up with a game/challenge pertaining to any Newton's Laws of Motion using the given set of materials. Write the step-by-step procedure on the space provided and explain how the chosen law works in your designed challenge.

MATERIALS:	**PROCEDURE:**
2 softdrink bottles 1 Php100-bill	_____ _____ _____ _____ _____ **JUSTIFICATION:** _____ _____

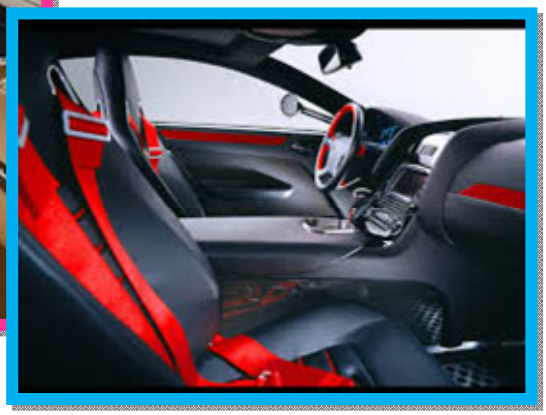
MATERIALS:	**PROCEDURE:**
rubber balloon toy car adhesive tape	_____ _____ _____ _____ _____ **JUSTIFICATION:** _____ _____

At this point, let's take a look at real situations where we can find the concept of Newton's laws of motion being applied.

ACTIVITY 22: Newton's Laws AT WORK!

Check out how Newton's Laws work in the different situations below. Once you're done, click on the ✉ button to email the answers to your teacher.

❶ *What's in a* CAR?



a. What safety features can you see in the car's interior?
b. Explain in the light of Newton's laws how each feature keeps you safe.

❷ Cease Fire

When firing a rifle, the bullet is shot at a high speed as the rifle recoils in the opposite direction.

a. How do you compare the force which they impart on each other?
b. How do you then explain the big difference in the velocities of the two? Would you care to fire a rifle whose bullet is ten times as massive as the rifle? Why or why not?

❸ Lights, Camera, Action!

a. In terms of inertia, what is the disadvantage of a lightweight camera when snapping the shutter? Why?
b. Why is a massive tripod
5. preferred by most

6. photographers?

❹ Smashed Up

a. If a Mack truck and a Honda Civic have a head-on collision, upon which vehicle is the impact force greater?
b. Which vehicle undergoes the greater change in its motion? Explain your answers.

❺ Ka-Brooom!

How is a race car different from ordinary cars?

Click this button ✉ if you're ready to send your answers on *Newton's Laws At Work* to your teacher.

ACTIVITY 22: MAKING GENERALIZATIONS

Using your answers in the previous activity, complete the table below by summarizing in what ways or situations can each Newton's law of motion be proved to be useful. Then make a generalization about the laws of motion in all situations. Write this in the fourth row of the table. Finally, answer the question in the fifth row by connecting it to your generalization.

1st Law of Motion: Law of Inertia	
2nd Law of Motion: Law of Acceleration	
3rd Law of Motion: Law of Interaction	
In all situations, I can generalize that …	
"How can we take advantage of our knowledge about motion?"	

End of DEEPEN:

What new realizations do you have about the topic? What new connections have you made for yourself? How can we take advantage of our knowledge on Newton's laws of motion?

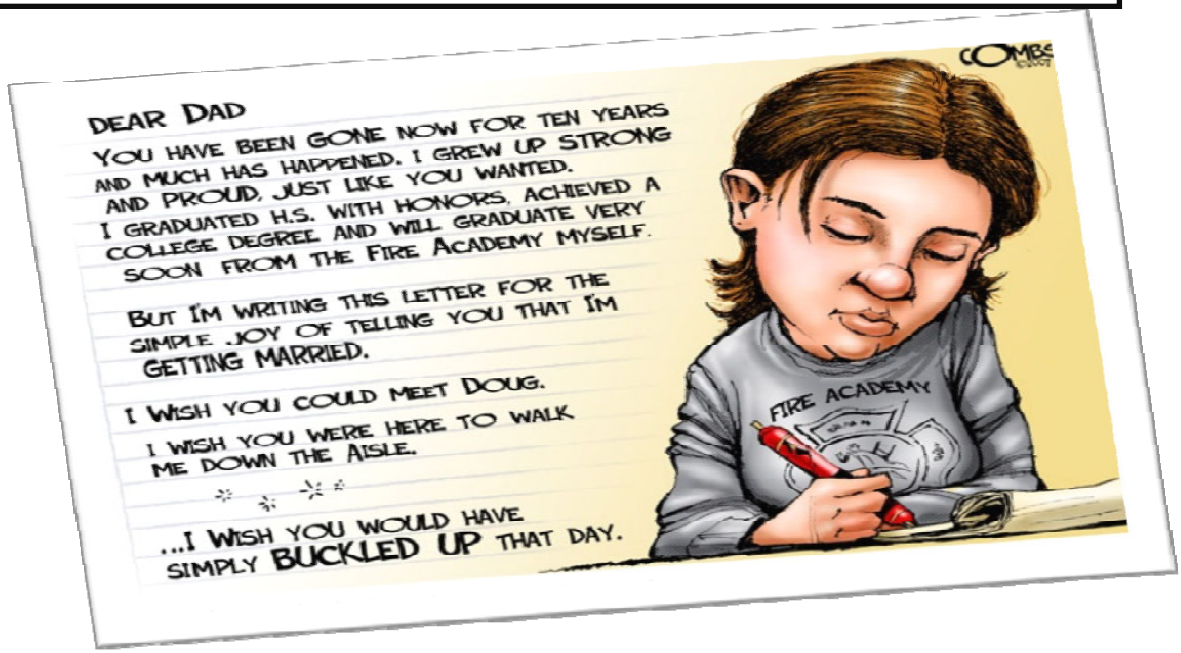
Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER :

Your goal in this section is to apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 22: Digital Journal

Read the letter below and accomplish your digital journal by answering the questions that follow. Type your answers in the tablet and click ✉ to send your journal to your teacher.



Source: https://www.google.com.ph/search?q=2007+paul+combs&tbm=isch&tbo=u&source=univ&sa=X&ei=zA6oU4m_GYz48QWbyYKoAw&ved=0CBkQsAQ&biw=1024&bih=499#facrc=_&imgdii=_&imgrc=LYfgLU7lzwBNTM%253A%3B_zGYTUUQEk8xIM%3Bhttp%253A%252F%252F1.bp.blogspot.com%252F_6HnzjP2s_IU%252

FTE94jh_Z6JI%252FAAAAAAAAAyY%252FxAL_DKBXWQM%252Fs1600%252Fcombs_February07_largest2.jpg%3Bhttp%253A%252F%252Fthekitchentable.firerescue1.com%252F2010_07_01_archive.html%3B600%3B420

1. Why do you think is the woman writing to her dad?
2. What could have happened to her dad?
3. Do you know of someone who faced the same tragedy?
4. Do you religiously follow the Seatbelt Use Act? Why or why not?
5. How can our knowledge on motion be useful to us?

Click here to submit this to your teacher.

ACTIVITY 23: Anticipation-Reaction Guide

Let's now take a second look at our statements and see whether you will answer them the same way. Draw your check mark (if you agree with the statement) or an X mark (if you don't) under the column AFTER.

BEFORE	STATEMENT	AFTER
	1. With a jerk, a piece of cloth underneath a wine glass may be removed without toppling the glass off.	
	2. You are thrown backward if the vehicle you are riding suddenly stops.	
	3. An empty grocery cart runs faster than the loaded one because it is easier to move.	
	4. The engine of a jeepney uses more energy in traveling when it is overloaded with passengers than when it is only loaded to its seating capacity.	
	5. Upon collision, a car receives a greater force of impact than the wall it crashed into.	
	6. Every time you push the wall, it also pushes you back with equal force.	

ACTIVITY 24: Performance Task

It is now time to put everything that you have learned in this module to test. Apply the appropriate learning in performing the ultimate task.

PERFORMANCE TASK

The Junior Scientists' Club of your alma mater holds their annual science camp. Commissioned as the event organizer for the said camping, you were asked to prepare an activity a la "*Amazing Race*" for the science club members. Dubbed as *Newton's Olympics*, it must comprise three relevant challenges. Details of the plan must be submitted to the club adviser for review prior to the science camp. Your output will be assessed based on the following criteria: relevance to the theme, originality, feasibility.

RUBRIC for RATING

	4 Exemplary	3 Satisfactory	2 Developing	1 Beginning
Relevance to the Theme	The task clearly requires deep understanding of the concept and application of the skills acquired throughout the module.	The task makes use of concepts and skills of Newton's laws of motion.	The task makes use of the concept of motion in general but not necessarily Newton's laws of motion.	It is a task that simply makes use of the materials but has nothing to do with the topic at all.
Originality	The challenge is uniquely and creatively conceived.	It is not copied from any of the games presented in this module.	It is patterned to certain games in the module but is given a twist in the procedure.	It is completely copied from a game in the module; only replacing the materials.
Feasibility	The task is sufficiently challenging, requires thorough understanding and dexterity but could still be achieved.	The task can be successfully done with relative ease in a reasonable period of time by one who has developed skills and has understood the concepts presented in this module.	The task is impractical and difficult in some parts.	The task is impossible to achieve even the organizer.

End of TRANSFER:

Now that you've completed the performance task, take time to recall the entire experience and write a brief reflection by responding to the series of prompts provided in the table.

PROMPT	RESPONSE
What skills did you acquire in the completion of the performance task?	
What did you find the most challenging part of the task?	
What did you learn about your own learning throughout completing this task? Specifically, how will you apply that knowledge in the future?	

Try to answer the Post-Assessment now and see for yourself how much your understanding about the laws of motion has improved.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next lesson. If your score is not at the expected level, you have to go back and take the lesson again.

1. Which of these animals has the greatest inertia?
   a. deer
   b. horse
   c. elephants
   d. mouse

2. What causes an object to accelerate?
   a. inertia
   b. net force
   c. acceleration
   d. mass

3. What relationship exists between an object's mass and the force responsible to move it?
   a. direct
   b. inverse
   c. direct square
   d. inverse square

4. How would you compare the force you exert in punching a bag to the force that your receives from the punch?
   a. greater
   b. equal
   c. lesser
   d. zero

5. Which of the following is a reaction when walking?
   a. Feet pushing the ground backwards
   b. Ground moving backwards
   c. Feet sliding backwards
   d. Ground pushing the feet forward

6. A high-speed bus and an innocent bug have a head-on collision. The force of impact splatters the poor bug over the windshield. The corresponding force that the bug exerts on the windshield is
   a. lesser.
   b. greater.
   c. the same.
   d. dependent on their mass ratio.

7. What concept may explain why it's tiring to pedal a bike when you have a back ride?
   a. action-reaction
   b. law of acceleration
   c. friction
   d. inertia

8. What will most likely happen if the Sun suddenly loses its gravitational pull on Earth? The Earth will
   a. slow down and eventually stop.
   b. wander in any direction.
   c. accelerate.
   d. move at a constant velocity.

9. Which statement is TRUE when a bus is overloaded?
   a. Its mass is decreased.
   b. Its acceleration is increased.
   c. It requires greater force to keep it moving.
   d. Its inertia is increased twice.

10. Which of the following is TRUE about a person standing on a platform?
    a. His inertia decreases.
    b. No force acts on him because he is not accelerating.
    c. The platform pushes the person with a force equal to his weight.
    d. Only force weight acts on the person.

11. Which of the following allows a satellite to revolve around the Earth?
    a. its well-designed orbit
    b. the gravity of the Sun
    c. the gravitational pull of the Earth
    d. the force used to launch it

12. What makes a person move forward as he walks?
    a. the force that the feet exert on the ground
    b. the force that the legs exert on the feet
    c. the force that the feet use to step on the ground
    d. the force that the ground exerts on the feet

13. Which concept is the reason why it is advisable to wear seat belt?
    a. acceleration
    b. inertia
    c. action-reaction
    d. centripetal force

14. Which of the following may decrease the acceleration of a jeepney?
    a. unloading passengers
    b. stepping hard on the accelerator
    c. adding loads
    d. using powerful engines

15. When moving at the same speed, which vehicle could less likely do harm to a tree when it crashes into it?
    a. bicycle*
    b. train
    c. taxi
    d. minibus

16. Which of the following will help a sprinter?
    a. weight loss
    b. running speed training
    c. mass gain
    d. none of the above

17. How will you remove a ply of tissue from a roll with only one free hand?
    a. employ sudden pull on the ply
    b. twist the tissue ply
    c. pull the tissue slowly sideways
    d. none of the above

18. In terms of motion, which may offer an advantage to an extremely obese person?
    a. setting one's self to run
    b. climbing a flight of staircases
    c. to be dislodged by others out of place by shoving
    d. to be carried in someone else's arms

19. Why does banging the bottom of a hammer's wooden handle to a hard surface help in tightening the hammer's head to its handle?
    a. Banging the handle produces an impact just enough to tighten the hammer's head.
    b. The inertia of the hammer's head allows it to move down further even as the handle stops thereby tightening itself to the handle.
    c. The wooden handle would cause the head to accelerate as it hits the surface thus making it tighten itself to the handle.
    d. As the wooden handle hits the surface, the surface would offer an equal reaction force that would move the handle and tighten itself to the head.

20. How could an astronaut in empty space get back inside the space shuttle if his rocket backpack runs out of fuel?
    a. He should swim towards the stationary space shuttle.
    b. He should throw the backpack opposite the space shuttle's direction to propel his body back to the shuttle.
    c. He should start spinning as it creates a motion just like a typhoon and continue to do so until he reaches the shuttle.
    d. It would be impossible for him to get back.

GLOSSARY OF TERMS USED IN THIS LESSON:

Acceleration - the rate of change of a body's velocity

Centripetal Force - force that pulls an object towards the center of a circular path; makes the object move in a circular motion

Inertia - the tendency of a body to resist a change in its state of motion or rest

Linear Speed - the distance moved per unit time

Mass - the measure of a body's inertia

Newton - the SI unit of force

Rotational Speed - the number of rotations or revolutions per unit time

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

http://www.youtube.com/watch?v=Xtz6laJXMMg
This video shows several road accidents.

http://www.youtube.com/watch?v=2QAVAdq5aAE
This website explains Newton's 1st Law of Motion and the difference of the inertia of varying masses.

http://www.youtube.com/watch?v=Ncn2LH9yYms
This video presents similar concept as the previous video.

http://www.youtube.com/watch?v=u6rbrFgudLg
This video shows the effect of inertia when you are riding a vehicle.

http://www.youtube.com/watch?v=xyKkyFqKbX4
This video explains the diff types of forces that make objects move.

http://www.wisc-online.com/objects/tp1202/tp1202.swf
This is an interactive presentation of the concept of the Law of Inertia.

http://www.youtube.com/watch?v=nO7XeYPi2FU
This website explains the Law of Acceleration. It further discusses the relationship among force, mass and acceleration.

http://www.youtube.com/watch?v=MUgFT1hRTE4
This website discusses Newton's 3rd Law of Motion.

http://www.cpo.com/home/portals/2/Media/post_sale_content/newtons%20third%20law.swf
This video shows that action-reaction pair of forces are equal.

http://www.youtube.com/watch?v=fKJDpPi-UN0
This video presents several examples/situations where the Law of Interaction applies.

http://science.discovery.com/games-and-interactives/newtons-laws-of-motion-interactive.htm
This website summarizes the concepts of Newton's Laws of Motion. It further allows you to vary some variables like mass, acceleration, etc. to establish and/or verify the relationships of different variables in each law.

http://www.physicsclassroom.com/Class/circles/u6l2a.cfm
This discusses the how uniform circular motion is connected to Newton's laws of motion.

https://jeopardylabs.com/play/newtons-laws-of-motion
This website allows you to play Jeopardy game about Newton's Laws of Motion.

http://www.neok12.com/quiz/LAWMOT03
This is an interactive quiz about Newton's Laws of Motion.

http://www.physicsclassroom.com/class/newtlaws/U2L3a.cfm
This website explains the Law of Acceleration and presents related problems to be solved.

http://www.physicsclassroom.com/class/newtlaws/U2L3a.cfm
This website explains the Law of Acceleration and presents related problems to be solved.

http://www.physicsclassroom.com/calcpad/newtlaws/problems.cfm
This presents problems and solutions pertaining to the Law of Acceleration.

http://www.nbc.com/minute-to-win-it/how-to/whack-job/
This is a video showing the blueprint for the Whack Job challenge in Minute to Win it.

http://www.nbc.com/minute-to-win-it/how-to/shoe-fly-shoe/
This is a video showing the blueprint for the Shoe Fly Shoe challenge in Minute to Win it.

http://www.nbc.com/minute-to-win-it/how-to/this-blows/
This is a video showing the blueprint for the This Blows challenge in Minute to Win it.

Lesson 2: The Relationship of Work, Power and Energy

Introduction and Focus Question(S):

You have heard adults say "I am so tired from working on the computer all day!" or "All the paperwork I had to do today drained my energy." Are these claims rooted on scientific reasoning? In the scientific sense, when is work really done? Does the amount of work that one can do relate to one's power and energy? How can we do a lot of work?

Find out as we journey together in this lesson and discover the relationship of work, power and energy and learn about the factors that may affect each of these important concepts.

As we progress in this lesson, always remember to address the question: "How can a lot of work be done?"

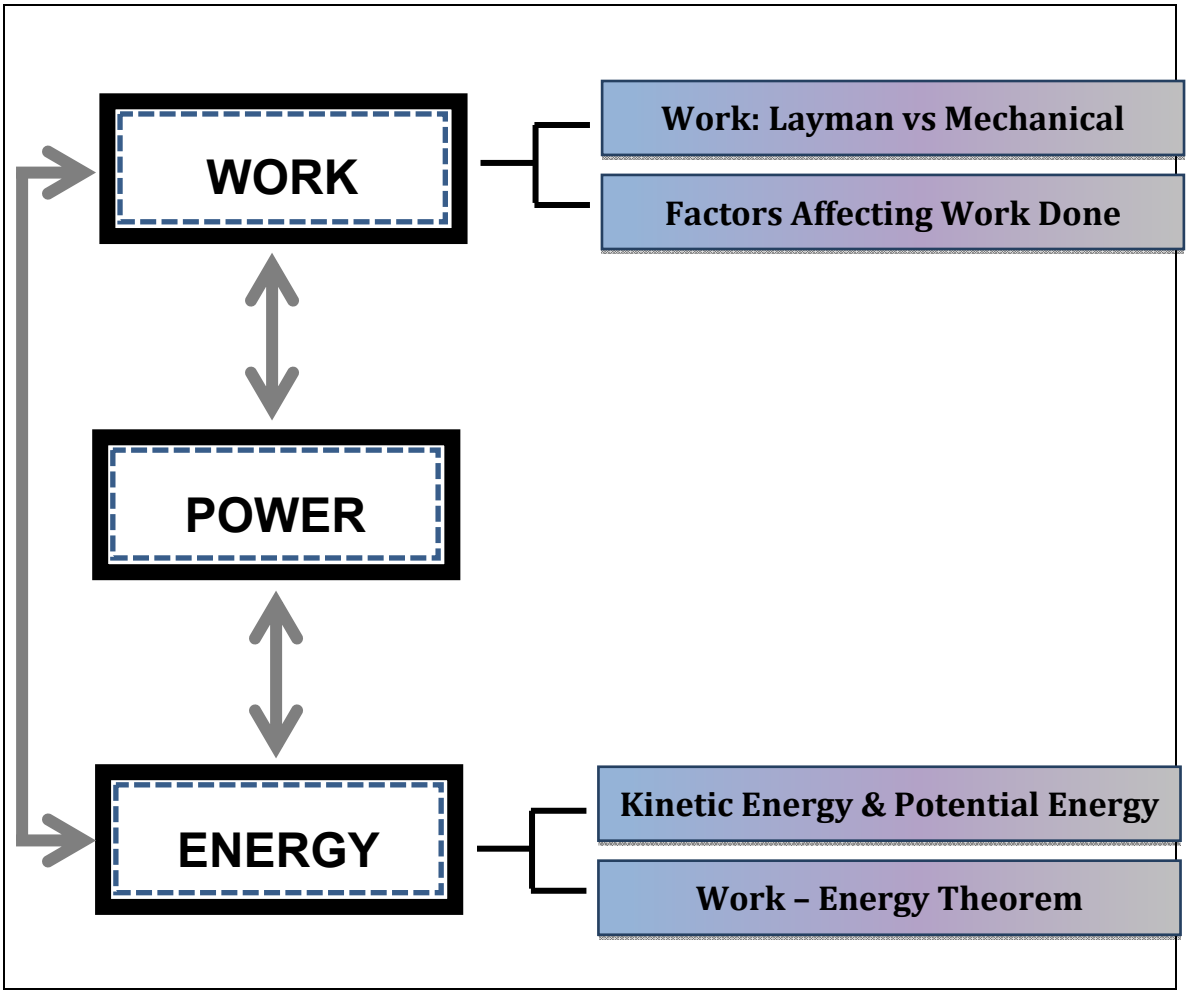
LESSON COVERAGE:
In this lesson, you will examine the following questions:

a. When is work done?
b. How does work and power relate to energy?
c. How can a lot of work be done?

In this lesson, you will learn the following:

- ▣ identify situations in which work is done and in which no work is done
- ▣ describe how work is related to power and energy
- ▣ differentiate potential and kinetic energy
- ▣ relate speed and position of object to the amount of energy possessed by a body
- ▣ apply the concepts of work, power and energy in real-life situations
- ▣ infer the amount of work done based on the energy possessed by a body

LESSON MAP:
Here is a simple map of the topics you will cover:



EXPECTED SKILLS:

To do well in this module, you need to remember and do the following:

- ▣ Perform conscientiously all the tasks as instructed in every part.
- ▣ You may collaborate with other online students or consult other references, as often as needed. Explore deeper and further as your time permits.
- ▣ Take down some notes which you find important and interesting. Writing on paper or typing on your computer helps you remember and understand things easier. Plus, these may come in handy when you need to review.
- ▣ Keep a journal of your insights as well as questions.
- ▣ Determine the learning style and environment where you learn best so as to maximize your learning.
- ▣ Schedule your time for study and relaxation.
- ▣ Lastly, enjoy what you are doing and be inspired to study well.

PRE-ASSESSMENT:

Let's find out how much you already know about this lesson. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this lesson.

1. In which of the following cases is there no work done?
   a. A weightlifter lifts a barbell.
   b. A weightlifter holds a barbell overhead.
   c. A weightlifter slowly lowers a barbell.
   d. A weightlifter drops a barbell and falls to the ground.

2. If the sign of work is negative,
   a. the force is in the same direction as the displacement.
   b. the force is perpendicular to the displacement.
   c. the component of the force that does work is in the direction opposite the displacement.
   d. the component of the force that does work is perpendicular to the displacement.

3. A painter lifts a bucket of paint, carries it 5 m horizontally, then sets it back down. Which of the following is true?
   a. The force of gravity does negative work when the painter lifts the bucket.
   b. The painter does positive work on the bucket as he carries it horizontally at a constant speed.
   c. The painter does positive work on the bucket when setting it down
   d. No net work is done on the bucket.

4. A parachutist falls at a constant speed for 200 meters. Which of the following is true?
   a. The force of gravity is the only force doing work on the parachutist.
   b. Air resistance is the only force working on the parachutist.
   c. No forces are doing work on the parachutist.
   d. No net work is done on the parachutist.

5. Friction does -400 J of net work on a moving car. How does this affect the kinetic energy of the car?
   a. The kinetic energy of the car increases by 400 J.
   b. The kinetic energy of the car decreases by 400 J.
   c. The kinetic energy does not change at all.
   d. There is insufficient data.

6. Which of the following does not affect gravitational potential energy?
   a. Object's mass
   b. Height relative to ground
   c. Free-fall acceleration
   d. Speed

7. If a big person and a small person run up the stairs at the same time, which of them does greater work?

   a. Small person
   b. Big person
   c. Both of them
   d. Insufficient data

8. An engine moves a boat through the water at a constant speed of 15 m/s. The engine must exert a force of 6.0 kN to balance the force that the water exerts against the hull. What power does the engine develop?
   a. 21 Watts
   b. 400 Watts
   c. 0.4 kilowatts
   d. 90 kilowatts

9. Isra has to get a piano onto a 2.0-m-high platform. She can use a 3.0-m-long frictionless ramp or a 4.0-m-long frictionless ramp. Which ramp should Isra use if she wants to do the least amount of work?
   a. 3.0 – m long ramp
   b. 4.0 – m long ramp
   c. either of the two ramps
   d. insufficient data

10. Brutus, a champion weightlifter, raises 240 kg of weights a distance of 2.35 m. He does work on the weights as he lifts them. Does he also do the same amount of work on the weights as he lets go of them to the ground?
   a. Yes, he does the same amount of work.
   b. No, he does not do work in letting go of the weights.
   c. Brutus does only half the work in letting the weights go.
   d. There is no way of telling in which case is greater work done.

11. A forklift raises a box 1.2 m and does 7.0 kJ of work on it. What is the mass of the box?
   a. 8.4 kg
   b. 5.83 kg
   c. 595 kg
   d. 5 833 kg

12. An elevator lifts a total mass of 1.1×10^3 kg a distance of 40.0 m in 12.5 s. How much power does the elevator generate?
    a. 13.75 kilowatts
    b. 34.5 kilowatts
    c. 88 kilowatts
    d. 550 kilowatts

13. Two people of the same mass climb the same flight of stairs. The first person climbs the stairs in 25 s; the second person does so in 35 s. Who does the greater work?
    a. the 1st person since he accomplished the task first
    b. the 2nd person since he did the work longer
    c. both did the same amount of work
    d. cannot be determined

14. A student librarian lifts a 2.2-kg book from the floor to a height of 1.25 m. He carries the book 8.0 m to the stacks and places the book on a shelf that is 0.35 m above the floor. How much energy is stored in the book in this process?
    a. 0.77 J
    b. 7.5 J
    c. 27 J
    d. 207 J

15. Two people carry identical 40-N boxes up a ramp. The ramp is 2-m long and rests on a platform that is 1-m high. One person walks up the ramp in 2 s, and the other person walks up the ramp in 4 s. What is the difference in power the two people use to carry the boxes up the ramp?
    a. 5.00 W
    b. 10.0 W
    c. 20.0 W
    d. 40.0 W

16. A 4-N soccer ball sits motionless on a field. A player's foot exerts a force of 5 N on the ball for a distance of 0.1 m, and the ball rolls a distance of 10 m. How much kinetic energy does the ball gain from the player?
    a. 0.5 J
    b. 0.9 J
    c. 9 J
    d. 50 J

17. In a belly-flop diving contest, the winner is the diver who makes the biggest splash upon hitting the water. The size of the splash depends not only on the diver's style, but also on the amount of kinetic energy that the diver has. Consider a contest in which each diver jumps from a 3.00-m platform. One diver, with a mass of 136 kg, simply steps off the platform and makes a big

splash. How can the second diver, with a lesser mass, compete with the splash of the second contestant?

a. He must leap upward from the platform before diving.
b. He must be in spread-eagle position as he dives.
c. He should kneel on the platform before he dives.
d. He should land with minimum surface area in contact with water.

18. Medieval warriors used catapults to assault castles. Some catapults worked by using a tightly wound rope to turn the catapult arm. What forms of energy are involved in catapulting a rock to the castle wall?

a. elastic potential energy and kinetic energy
b. chemical potential energy and kinetic energy
c. gravitational potential energy and kinetic energy
d. thermal energy, potential energy and kinetic energy

19. You have been hired to make a roller coaster more exciting. The owners want the speed at the bottom of the first hill doubled. How should you rebuild the first hill?

a. Make it ½ the original height.
b. Make it ½ times higher than the original hill.
c. Build it two times as high as the original.
d. Build it four times as high as the original.

20. If you were a mobile crane operator of a wrecking ball, how would you maximize the force of impact and knock a structure down easily?

a. Decrease the mass of the wrecking ball for easy maneuver.
b. Use a more massive wrecking ball.
c. Choose a weak structure to knock down.
d. Hit the side of the structure first.

EXPLORE

Have you tried wishing a certain task can be done easily --- or better yet, quickly? Have you ever wished you can pull off a task at a much lesser time? Let's find out the possibility of these as we explore of the scientific concepts behind these. Meanwhile, let's find out if we have a common understanding of what one of the important terms in this unit mean, and that is WORK. Let's begin with the activity below.

ACTIVITY NO. 1: Working or Not?

Study the pictures below. Identify which situations show that work is done by clicking on the box found before each choice. Write your explanation on the space below the choices.

☐ Work done ☐ No Work done

_____

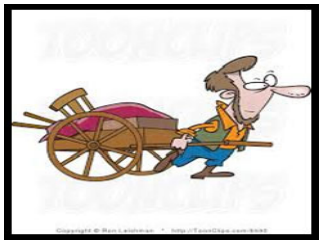
☐ Work done ☐ No Work done

_____

☐ Work done ☐ No Work done

_____

_____



☐ Work done ☐ No Work done

_____

_____

PROCESS QUESTIONS:

1. What is your basis in choosing a situation where work is done?
2. When is work really done?
3. What are the factors affecting the amount of work we do?
4. **How can a lot of work be done?**

ACTIVITY NO. 2: IRF Worksheet: Eliciting Prior Knowledge

In the previous activity, you were asked to identify the basis in determining whether work is done in a situation or not. But a more important question is "**How can a lot of work be done?**"

Summarize your thoughts and ideas about the question and write them in the Initial column of the IRF worksheet. The next two columns will be answered later on as we progress in the unit to monitor if there will be a development of your answer. When you're done with the first column, click the "SUBMIT" button below.

"How can a lot of work be done?"		
INITIAL	REVISED	FINAL

End of EXPLORE:

You gave your initial ideas on how work could be done through the IRF worksheet.
Connect with other learners and compare their initial ideas to your own. As you compare, find out if your ideas are in line with the standard. You will also learn other concepts, which will help you complete a required project found at the end. The project will require you to propose a training program that will improve the performance of athletes.

We will start by doing the activities in the next section.

FIRM-UP

Your goal in this section is to learn and understand key concepts of Work, Power and Energy, as well as the interrelationship between the three. The competencies you are to learn are found in the table below. Monitor your progress from time to time in order to make sure that our goals are clearly established.

ACTIVITY NO. 3: Establishing Goals

As we go along this unit, put a check mark before each competency as soon as you become confident about the described concept or skill.

COMPETENCIES CHECKLIST	
	▣ identify situations in which work is done and in which no work is done
	▣ describe how work is related to power and energy
	▣ differentiate potential and kinetic energy
	▣ relate speed and position of object to the amount of energy possessed by a body
	▣ infer the amount of work done based on the energy possessed by a body

ACTIVITY NO. 4: Demystifying Work

Complete the concept of *Work* as you accomplish the tasks in the series of blocks below. Answer each set of mini-task to uncover the idea each block conveys in order to build up the concept of *Work*.

Block 1: Complete each of the sentences below based on its corresponding picture.

What is needed to push a table?

What happens to the table as it is pushed?

The table moved

_____

as I pushed it

_____

What is necessary to be able to lift a load?

What happens to the load as it is lifted?

The load moved

_____

as I exerted effort on it

_____

2

WORK

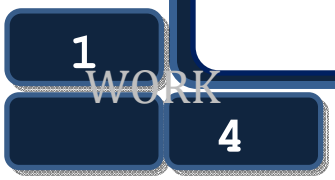
4

Block 2: Working Out

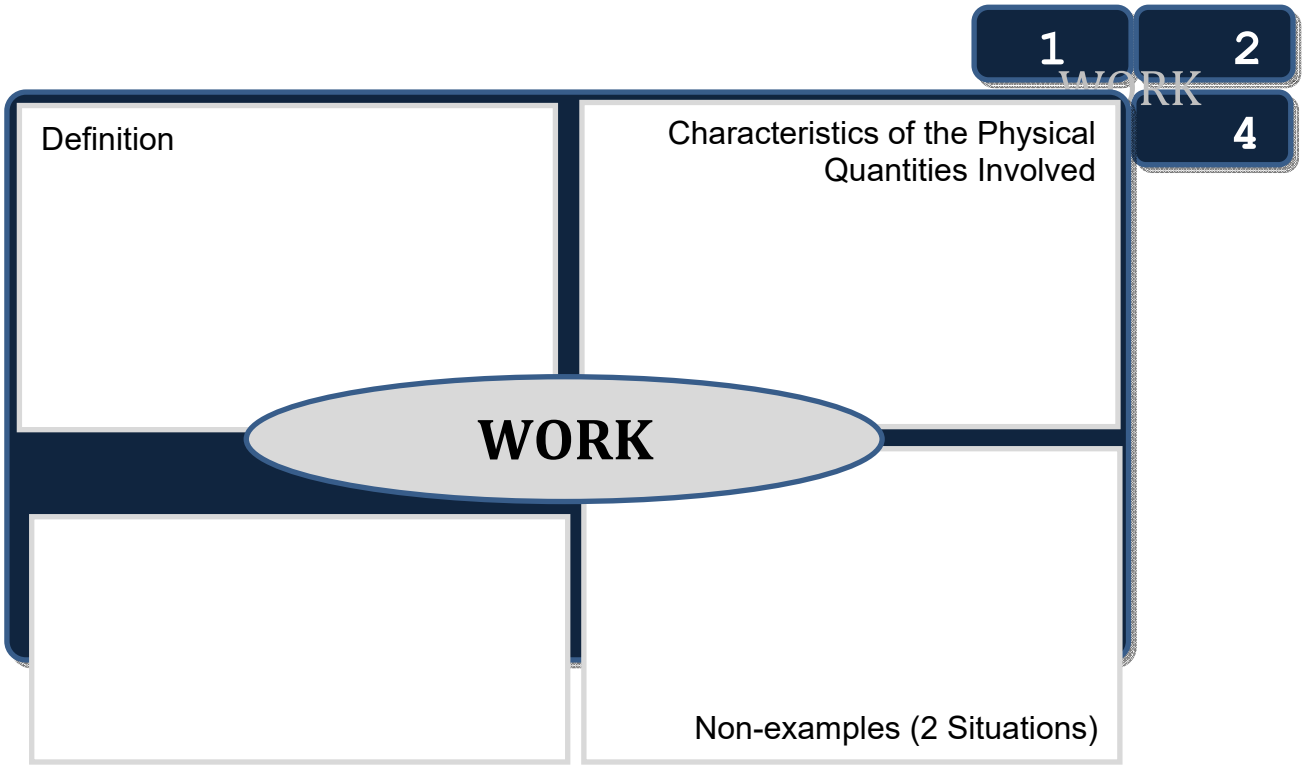
In the first activity, you were asked to identify situations that showed work. We will find out in this activity if your answers are in line with the scientific sense of the word *work*. We will also see how the activity in block #1 relates to this. Read through the webpage links listed below. Just focus on the concept of work first. One of these links may already talk about energy but that would be treated in detail at a later part. Write down important ideas or questions in your notebook or Notepad and find out if they will be strengthened or answered as we go along the unit.

http://www.physicsclassroom.com/class/energy/Lesson-1/Definition-and-Mathematics-of-Work
Definition and Mathematics of Work

https://www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/v/introduction-to-work-and-energy
Video discussion on Work



Block 3: Based on the web links given, summarize the concept of *Work* by accomplishing the **Frayer's Model** diagram.



1 2 WORK 3

Block 4: Laboratory Experiment about Work

Working Out

Objective: To determine the work done in different set-ups

Materials: 2 identical blocks of wood, wooden plane, spring balance, meterstick

Procedure:

A. 1. Set-up the wooden plane 1 meter from the ground. You may use stools to support and position it horizontally.
2. Using a string, attach one block of wood to the spring balance.
3. Holding the spring balance, slowly lift the block from the ground and place it on top of the wooden plane.
4. Get the reading of the spring balance and record it in the Table A below.
5. Do this two times more for verification of values.
6. Compute for the work done and record in Table A.
7. Repeat the same process but attach 2 blocks of wood to the spring balance.

B. 1. Follow again steps 1-6 in procedure A but this time, change the height of the wooden plane. On the first try, use ½ meter and on the second try use 2 meters. Record all data in Table B.

Table A. Effect of Force on Work Done

NO. OF BLOCKS	MASS of the WOODEN BLOCKS (kg)			FORCE EXERTED in LIFTING the BLOCKS (N)	HEIGHT of the PLANE (m)	WORK DONE on the BLOCKS (J)
	Trial 1	Trial 2	Trial 3			
One						
Two						

Table B. Effect of Distance on Work Done

NO. OF BLOCKS	MASS of the WOODEN BLOCK (kg)			FORCE EXERTED in LIFTING the BLOCK (N)	HEIGHT of the PLANE (m)	WORK DONE on the BLOCK (J)
	Trial 1	Trial 2	Trial 3			
One						
One						

continuation, Working Out

Analysis Questions:

1. How was the force exerted in lifting the wooden blocks determined?
2. What variable was changed in procedure A?
3. What effect did this change have on the work done on the blocks?
4. What variable was changed in procedure B?
5. What effect did this change have on the work done on the blocks?
6. What are then the factors that affect *work*?
7. What relationship exists between a) work and force
   b) work and distance?

PROCESS QUESTIONS:

1. Are the results of the experiment supported by the concepts of *work* you have gathered from the previous activities?
2. What may affect the amount of work we do?
3. **How can a lot of work be done?**

<u>ACTIVITY NO. 5:</u> Work: Layman Vs. Mechanical Language

This time, complete these two sentences based on the idea you have just acquired.

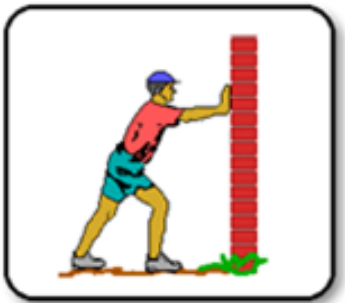
Before, I thought that WORK is
_____.
Now, I think that WORK is

PROCESS QUESTIONS:

1. Is the layman concept of work the same as its scientific counterpart?
2. When is work really done?
3. **How can we strategically increase the work that we do?**

At this point, let us revisit the first activity and determine which situations show that work is done. Compare your previous and new set of answers as well as explanations and check whether there is a change. Post this new set of answers in the Discussion Forum and find out whether other learners agree with you.

ACTIVITY NO. 6: Working Or Not --- You Judge!



☐ Work done ☐ No Work done

_____

_____

☐ Work done ☐ No Work done

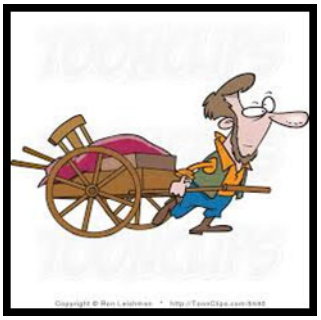
_____

_____

☐ Work done ☐ No Work done

_____

_____



☐ Work done ☐ No Work done

_____

_____

PROCESS QUESTIONS:

1. Which of your answers were already correct in the first try?
2. Were the bases of the correct answers in line with the right concept of work? Explain.
3. So when can work be done?

Armed with the ideas that you have acquired in the previous activities, let us now compare who or which has done greater work in the following situations.

ACTIVITY NO. 7: Who's Doing Greater Work?

Study each picture and situation below and answer the question that follows. Make a concise explanation for your answer. When done, click the "Submit" button.

Situation 1: Seven-year old female twins of identical mass exhausted themselves in a park slide. Kara consistently played in the 2-meter tall yellow slide while her twin, Lara, played on the blue slide. *Who has done greater work in each slide ride?*

_____
_____
_____
_____

Situation 2: Harry and Sam went on a wall climbing adventure for a weekend father-&-son bonding. *At the summit which both of them successfully reached, who has done greater work on himself – Harry or his 6-year-old son?*

_____
_____
_____
_____

PROCESS QUESTIONS:

1. How is the amount of force determined in each situation?
2. How is the amount of work affected by the force you exert on a body?
3. How is the amount of work affected by the distance moved by a body that is applied with force? Give examples.

Is “doing greater work” different from “doing work faster”. Let’s try to figure that out in the succeeding activities.

ACTIVITY NO. 8: Who’s Doing Work Faster?

Study each picture and situation below and answer the question that follows. Make a concise explanation for your answer. When done, click the “Submit” button. You may

Situation 1: In a newly renovated office, workers busied themselves in transferring materials into their new areas. Jim who painstakingly pushed a pile of boxes towards his place, envied his co-worker who effortlessly transported his boxes using a trolley. *At the end of their task, who has done greater work? Who has done his work faster? Why?*

_____
_____
_____
_____
__

Situation 2: The picture at the right shows a 105-Watt, 36-Watt and 11-Watt compact fluorescent lamps (CFL). The lamp with the greatest wattage gives off the brightest light. *Which of the 3 lamps does its work faster? Why?*

_____
_____

_____
_____

PROCESS QUESTIONS:

1. How can we do work fast?
2. Is "*doing work fast*" similar to "*doing a lot of work at a given time*"? Explain.
3. What factors may affect how fast the work is done?

Let's find out if your answers will match the result of the experiment in the next activity.

ACTIVITY NO. 9: Laboratory Experiment: Power Up!

This experiment needs to be done in a laboratory together with at least two other students. Find out if the results of the experiment support your ideas in the previous activity.

GOING UP THE STAIRS

Objective: To determine the work done and the power developed in going up the staircase

Materials: meter stick, stopwatch and bathroom scale

Procedure:

1. Determine your mass using the bathroom scale.
2. Measure the height of the staircase using a meterstick.
3. Let each member go up the staircase. Determine the time of travel.
4. Record the data collected in Table A.

Data and Results:

Work Done and Power Developed by the Members of the Group

Weight = mass in kilogram x 9.8 m/s^2

Work = weight x height of the stairs

Power = work / time of flight

Names of the Members	Mass of the Member (kg)	Weight of the Member (newton)	Height of the Staircase (m)	Time of Flight (s)	Work (Joules)	Power (watts)

Questions:

1. What must a person possess to be able to climb staircases?
2. What form of energy is demonstrated in climbing staircases?

1.

3. From what form of energy does the answer in #2 come from?
4. How is the work done in climbing staircases determined?
5. Who was able to perform the greatest work among your group mates? Explain.
6. What relationship exists between a) work and force b) work and distance c) work and time?

2.

7. Who is the most powerful in the group?
8. What physical quantities will determine the power demonstrated?
9. What relationship exists between a) power and work b) power and time?
10. In view of energy, why is running on the same flight of staircases more tiring than just walking through them?

Verify if the results of your activity agree with the established concepts by browsing different resources.

ACTIVITY NO. 10: I've Got The Power (Webpage Reading)

http://www.physicsclassroom.com/class/energy/Lesson-1/Power
Definition and Mathematics of Power

http://www.onlinemathlearning.com/physics-work.html
Power

PROCESS QUESTIONS:

1. What new concepts or principles were introduced in the links?

2. How can the value of power be determined?
3. How does this formula support the principles about power? What are some examples where this formula is useful?
4. Are the data in your experiment supported by the ideas conveyed in the resource materials? Justify your answer.

Check your comprehension by doing the following problem-exercises about power.

ACTIVITY NO. 11: Power Up

Analyze each situation and apply the concepts and information you have acquired in the previous activities to solve the problems.

PROBLEM-SOLVING:

1. You do a pull-up, lifting yourself by 0.5 m in 2 seconds. If your weight is 600 N, how much work did you do, and what was your power output during lifting?
2. How much energy does a 75-W light bulb consume while running for 30 minutes?
3. How long must a 100-W light bulb run in order to consume a million joules of electrical energy?
4. Find the power output of a 60-kg dash-runner who accelerates from 0 to 4 m/s in 0.5 seconds?

PROCESS QUESTIONS:

1. Did you solve the problems with relative ease?
2. In what aspect do you need help most?
3. What must you do to address this need?
4. What can we say about a person who can finish a task at a shorter period of time?
5. What is really meant when we classify an appliance as “low-powered”?
6. How may this new information help you in accomplishing a lot of work?

Summarize the important ideas in the lesson so far in the next activity.

ACTIVITY NO. 12: Completing Ideas
Complete the sentences to sum up the ideas in the lesson.

▣ Power is

_____.

▣ It can be determined by

_____.

▣ Greater power either means that work is done in _____ time or that

_____ work is done in a certain period of time.

▣ Its value is expressed in unit _____ which may be broken down

into units _____ per _____.

What does it take to do a lot of work? Is the elders' prompting of *"Kumain ka na at nang magkaroon ka ng lakas para magtrabaho"* founded on a scientific principle? Find out as we investigate the relationship of work to energy. Let's begin with the basic concepts of an important form of energy – the mechanical energy.

ACTIVITY NO. 13: Mechanical Energy

Click on the links below to acquire the basic information about mechanical energy. If necessary, go over the materials more than once in order to grasp the concepts. You may also want to check related links to strengthen or verify the ideas acquired from these sources.

http://www.physicsclassroom.com/class/energy/Lesson-1/Mechanical-Energy
Introduction to the concept of Mechanical Energy

http://education-portal.com/academy/lesson/what-are-the-types-of-energy.html
Details on the Types of Mechanical Energy

http://www.physics-chemistry-interactive-flash-animation.com/mechanics_forces_gravitation_energy_interactive/energy_potential_kinetic_mechanical.htm
Flash animation showing the total mechanical energy of a roller coaster rider

PROCESS QUESTIONS:

1. What new ideas about energy did you get from these references?
2. What old ideas about energy did you have that were strengthened in what you have read and watched?
3. Does the amount of energy that a body possesses affect the work that it can do? Explain.

ACTIVITY NO. 14: Organizing Facts

Organize the information gathered from the previous references. Construct your own graphic organizer that will show the classification or types of mechanical energy as well as the characteristics of each. Upload your output for the teacher and other students to see.

For your reference, you may follow this link to check on some samples of graphic organizers: http://www.enchantedlearning.com/graphicorganizers/

PROCESS QUESTIONS:

1. What are the types of mechanical energy? Compare and contrast the two.
2. How does one's energy compare to the amount of work he can do?
3. What happens to a body's energy as he performs work? Why?
4. What can you then say about a person or an object that possesses great potential energy?
5. How can a person or an object gain energy?
6. What does this realization tell you about being able to do a lot of work?

Assess your own comprehension as you work on the following exercises.

ACTIVITY NO. 15: Exercises About Mechanical Energy

Let's put your learning to test. Do the following exercises that involve conceptual and problem-solving items. You may also click on this link to look at a sample problem before heading on to the task.

http://m.everythingscience.co.za/grade-12/05-work-energy-and-power/05-work-energy-and-power-03.cnxmlplus
Sample problem which can be used as a guide in answering the exercises

1. Name the type of energy possessed by each of the following: a raised book, a stretched spring water at the top of the falls, speeding train, gasoline

2. Would the gravitational potential energy of an apple be changed if it is removed from the tree and placed in the fruit basket on the table? Why?

3. You slam on your automobile brakes, sliding a certain distance with locked brakes. How much farther would you slide if you had been moving twice as fast? What implication does this have on your safety?

4. In a hydroelectric dam, the gravitational energy of the water is converted into electrical energy as the water falls. Consider just one cubic meter (1000 kg) of water that falls a distance of 500 ft. Assuming that the energy conversion is 100% efficient, how much electrical energy can be obtained as it falls? Please express your answer both in joules and in kilowatt-hours.

PROCESS QUESTIONS:

1. How did you find the exercises?
2. How confident are in your answers? What made you (can help you) become confident about your skills?
3. What can be done in order to maximize the work that one can do?

To sum up the important concepts you have acquired in the entire section, click on the link below and assess yourself if you are still on the right track.

ACTIVITY NO. 16: In A Nutshell
http://www.wou.edu/las/physci/GS361/EnergyBasics/EnergyBasics.htm
Summary of Work, Power & Energy

PROCESS QUESTIONS:

1. How is important is it to learn about the concept of work, power and energy?
2. Would the knowledge and skills you have developed in all the activities suffice for a deep understanding about work, power and energy?
3. Would these be enough to prepare you in accomplishing your project at the end of the unit?
4. How would these new learning benefit you?

Let's now find out how much of your initial ideas have changed throughout this section. Accomplish the second part of IRF worksheet.

ACTIVITY NO. 17: IRF: Revising Ideas

Answer the second column of this worksheet and compare it with how you answered the question previously.

"How can you do a lot of work?"		
INITIAL	REVISED	FINAL

End of FIRM UP:

In this section, the discussion was about the relationship of work, power and energy. You looked into the important concepts of each quantity in order to build a clear connection among the three.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? Update also your Competencies Checklist at the beginning of this section. How much of it have you already accomplished? Can you do all competencies with relative confidence?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

At this point it is expected that you already have a good grasp of the concepts of work, power and energy and how they affect one another.

Your goal in this section is to take a closer look at some aspects of the topic by analyzing different situations where these concepts are applied.

ACTIVITY NO. 18: Pull Back, Aim, Shoot

Want to be the next Katniss Everdeen? Learn the basics and the Physics behind archery by clicking on the link below. As you watch the video, don't lose sight of our target: how to maximize the work that one can do on the arrow! Prepare to make a summary of what you will learn in this video.

https://www.youtube.com/watch?v=h5iuKmSBVlk
Instinctive Archery_Basic Shooting Technique

PROCESS QUESTIONS:

1. How is an arrow released in archery?
2. On which object is work being done?
3. Why must the bow be drawn back as far as possible?
4. What physical quantity is manipulated in drawing the bow far back?
5. What form of energy is stored as one draws the bow?
6. How is the bow's energy affected by how far it is drawn?
7. What happens to this energy as the arrow is released?
8. How does this affect the movement of the arrow?
9. In archery, how can one maximize the work that he can do on the arrow?

Now as a "learned" beginner, advise another aspirant archer on how he/she can shoot arrows farther. You can do this by summarizing your ideas about archery based on your answers to the process questions. Use the worksheet below to guide you in organizing your ideas.

Give a catchy title for your advice

[*You may insert a picture to illustrate what the advice is all about.*]

1st Paragraph: Give your specific advice to the beginners who would like to try archery for far ranges.

2nd Paragraph: Explain conceptually how this advice works then justify your explanation by dragging in the concepts and relationship of energy to work.

[This could make for a reliable advice!]

With the help of this activity especially the worksheet, let's analyze another situation and put your skills to test.

ACTIVITY NO. 19: Golf Swing Made Simple

Let's take a look at another sport, golf. Watch the video for a short tutorial in doing golf swings. Check out how the swings vary with the distance of the holes.

https://www.youtube.com/watch?v=sXtekwuT8R0
Tips on Making Golf Swings

Still using the guide in the previous activity in identifying key notes in giving information, spread the word through www.voki.com. Create your own avatar and have it talk with your voice to guide beginner golfers.
PROCESS QUESTIONS:

1. How is a golf swing done?
2. On which object is "work" being done?
3. What determines the height from where the golf club is swung?
4. What is the relationship between the distance of the hole and the height of swing? Explain.
5. What form of energy is stored as a golfer raises the club?
6. How is the club's energy affected by how high it is raised?
7. What happens to this energy as the club strikes the tee?
8. How does this affect the movement of the golf tee?
9. In golf, how can one maximize the work that he can do on the golf tee?

ACTIVITY NO. 20: Hard At Work!

Assess your own understanding by working on the different application situations of the unit. At the end, craft a generalization statement that would embody the general idea underlying in all three situations.

Demolition Method: Crane & Ball

One of the oldest and most commonly used methods for building demolition, the ball and crane use a wrecking ball weighing up to 13,500 pounds to demolish concrete and masonry structures. During the process, the ball is either dropped onto or swung into the structure that is to be demolished. The ball and crane, however, is unsuitable for all demolition applications. Some limitations:

- Additional work removing rebar in concrete structures is needed.
- Only highly skilled and experienced crane operators should be used on ball and crane demolition
- Smoothness in controlling the swing of the ball is CRITICAL since missing the target may tip or overload the crane.
- The size of the building that can be demolished with this method is limited by crane size and working room, including proximity to power lines.
- This form of demolition creates a great deal of dust, vibrations and noise.

Analysis Questions:

1. How does a wrecking ball work?
2. Is this the most effective way of demolishing buildings?
3. How does the mass of the wrecking ball affect its energy? Explain.
4. How then does the mass of the wrecking ball affect its purpose? Explain.
5. Does the vertical displacement of a wrecking ball affect its energy? If so, in what way?
6. Does the level of elevation of the wrecking ball affect its purpose? How?

7. Would the energy possessed by a wrecking ball affect the work that it needs to do in demolishing structures? Explain.
8. How then can a wrecking ball be made a little more effective with every swing?

Driving 'em down!

A hammer is a tool that delivers a blow (a sudden impact) to an object. The most common uses for hammers are to drive nails, fit parts, forge metal, and break apart objects. Hammers vary in shape, size, and structure, depending on their purposes.

Analysis Questions:

1. How high must a hammer be swung before it is made to strike a nail?
2. How does the height to where the hammer is brought affect its ability to drive a nail down?
3. How will the energy of the hammer be affected by this height?
4. What effect does your answer in #3 have on the work that the hammer does in driving the nail into a surface?
5. Should the hammer always be swung from a higher elevation? Explain.
6. How can a carpenter maximize his effort in hammering nails with down?

The Power of Water

Hydroelectric power plants employ hydraulic power, the force or energy of moving water, to produce electricity. This makes it one of the cleanest sources of electrical power and also the cheapest to operate.

Large hydroelectric power plants work by harnessing the potential energy of water in a dam and using it to drive a water turbine and generator. Water from the dam is transmitted by the penstock, an enclosed pipe that delivers and controls water flow to the turbine. The resultant forces cause the turbine shaft to turn as it runs through the blades. The generator produces the electricity by using the rotating force from the turbine shaft.

Small hydroelectric plants operate on the same principle mentioned above, except that they do not make use of dams. Instead, they make use of run-off from water bodies such as rivers, streams, and oceans.

First Gen, in its commitment to produce clean and renewable energy, operates the **132-MW Pantabangan-Masiway** and **1.6-MW Agusan hydroelectric power plants**. The Pantabangan-Masiway Hydroelectric Plant makes use of a cascade arrangement to better utilize the hydraulic potential of the resource and control the water flow. It does this by passing the water through two (2) 50-MW plants upstream, and then further, to a smaller 12-MW plant downstream using the same water resource. The Pantabangan reservoir can hold up to 1,753 million cubic meters of water which is used both for irrigation and power production purposes.

http://www.firstgen.com.ph/PowerIndustry.php?id=57

Analysis Questions:

1. Trace the energy transformation process in a hydroelectric power plant.

2. What is the difference between large and small hydroelectric power plants in terms of power sources?

3. What is the advantage of damming water up?

4. Compare the electrical energy produced in 1- hour operation of the Pantabangan-Masiway and Agusan .

Pantabangan-Masiway	Agusan

Therefore,

_____
__

5. Why would a large amount of water that turns the turbine help in producing greater electrical output?

6. What does the quantity of electrical output say about the work done by the power plant?

7. What does the quantity of electrical output say about the energy of the water source?

8. How can the amount of work done in a hydroelectric power plant be maximized?

Based on the 3 articles, explain what is the best way to maximize the amount of work a body can do. Explain and justify your point.

Let's take your understanding a little further in the next activity.

ACTIVITY NO. 21: Machines to the Rescue

The concept of work and energy is greatly taken advantage of in the area of construction. Where manual labor is a high form of demand, engineers make good use of machines to reduce man's effort. In this activity, help the social media community become aware of the use of pile drivers in driving pre-cast poles into the ground. Use the following links to gain helpful information about this construction machine.

https://www.youtube.com/watch?v=H7mwqHn3G1Y
How Pile Drivers Work

https://www.youtube.com/watch?v=9zhFsS_ocuQ
Diesel Pile Driver

Share your insights to a greater number of readers by creating an electronic poster with videos about golf on http://edu.glogster.com/?ref=com. If you do not have an account yet, sign up first and then create your file.

ACTIVITY NO. 22: IRF: Finalizing Ideas

Strengthen your ideas as you complete the IRF worksheet. Fill out the Final Column as you answer the question: "How can you do a lot of work?"

"How can a lot of work be done?"		
INITIAL	REVISED	FINAL

End of DEEPEN:

In this section, we learned more about the relationship of work, power and energy through their applications in various situations.
What new realizations do you have about the topic? What helped you arrive at these realizations? What new connections have you made for yourself?
Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY NO. 23: Final Check-up

You have almost completed the module and you will soon be asked to apply your understanding in a real-world context. But before you embark on such a challenge, conduct a final check on what you have accomplished and achieved in this module.

[SELF-RATING] Level of Confidence (1-5)	COMPETENCIES CHECKLIST	What helped you achieve this?
	▣ identify situations in which work is done and in which no work is done	
	▣ describe how work is related to power and energy	
	▣ differentiate potential and kinetic energy	
	▣ relate speed and position of object to the amount of energy possessed by a body	
	▣ infer the amount of work done based on the energy possessed by a body	

In summary, what have you learned from this module?

If you have rated yourself between 4-5 in each competency, then congratulations! You may proceed to the next task.

ACTIVITY NO. 24: Performance Task

TASK

A newly launched online site, PraktikalDito.com, contains varied materials on how tasks and processes can be done smartly to maximize one's time and energy. Aiming to attract more downloads from a wider scope of online users, the website's editor encourages anyone who can make clear & comprehensive, logical and practical tips in any aspect to submit their entries. As a freelance blogger, you are giving yourself a week's time in order to contribute your own version of #SmarterWays, a collection of smarter ways of carrying out tasks in different fields of interest.

Use the rubric to guide in making your output as well as in evaluating it after.

RUBRIC for Scoring

	Excellent (4)	Satisfactory (3)	Developing (2)	Beginning (1)
Impact / Compre-Hensive-ness	The importance & relevance of the identified issue &/or recommenda-tions are estab-lished and communicated in an *engaging and meaningful way*. Ideas are presented	The importance & relevance of the identified issue &/or recommenda-tions are established and *commu-nicated clearly. I*deas are presented in a manner that can be followed	The importance and relevance of the identified issue &/or recommendatio ns are not clearly established and communi-cated in the output. Information and ideas are presented in an	The impor-tance and relevance of the concepts are not communi-cated in the output. Information and ideas are poorly sequenced. The audience has difficulty

	clearly and comprehensibly.	with no difficulty.	order that the audience can follow with minimum difficulty.	following the thread of thought.
Logic	The ideas presented are insightful and are supported by correct scientific concepts. The entire output is a reflection of a deep under-standing of the learned concepts.	The ideas are supported by correct scientific facts. Details exhibit a clear under-standing of the concepts involved.	The ideas presented are either not quite relevant or bear weak scientific justifications.	The ideas do not relate to the concepts and do not contain supporting justifications.
Practical ity	The recommen-dations are well-thought out, highly feasible and are cost-effective.	The recom-mendations are sound and doable.	The recom-mendations are already commonly done.	The recom-mendations do not really point to conser-vation of energy & resources.

End of TRANSFER:

In this section, your task was to create a blog about smarter ways to do and maximize work.

How did you find the performance task? How did the task help you see the real world use of the topic?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next lesson. If your score is not at the expected level, you have to go back and take the lesson again.

1. In which of the following cases is work done?
   a. lying still on the bed
   b. holding a pail of water
   c. tossing a ball
   d. standing in a queue

2. If the sign of work is positive,
   a. the force is in the same direction as the displacement
   b. the force is perpendicular to the displacement
   c. the component of the force that does work is in the direction opposite the displacement
   d. the component of the force that does work is perpendicular to the displacement

3. A child picks up a teddy bear from the floor. The child then carries this toy with constant speed to the other side of the room, and drops it down. At which part was the child doing work on the toy?
   a. when he picked it up
   b. as he carried it across the room
   c. the point when he dropped it
   d. the entire time it was with him

4. A 7.0-kg bowling ball is moving on a bowling lane with a velocity of 5.0 m/s. What is the kinetic energy of the ball at that instant?

   a. 12 J
   b. 35 J
   c. 87.5 J
   d. 612.5 J

5. Which of the following affects an object's kinetic energy?
   a. Object's mass
   b. Height relative to ground
   c. Free-fall acceleration
   d. Power

6. Ramon and his 5-year-old son run up the stairs at the same time. Between the two, who performs greater work?

   a. Ramon
   b. The son

c. Both of them
d. Insufficient data

7. Two cars have the same mass, but one is moving three times as fast as the other is. How much more work is needed to stop the faster car?
   a. the same amount
   b. twice as much
   c. three times as much
   d. nine times as much

8. In the annual Empire State Building race, contestants run up 1,576 steps to a height of 320 m. In 2014, Australian Suzy Walsham won the women's competition in a record-breaking 11 minutes 57 seconds. Suzy Walsham weighs about 50 kg. How much work did Walsham do in reaching the top of the building? What was her average power output?
   a. 16 000 J; 22 Watts
   b. 78 800 J; 110 Watts
   c. 156 800 J; 219 Watts
   d. 772 240 J; 1077 Watts

9. As it orbits Earth, the 11,000-kg Hubble Space Telescope travels at a speed of 7,900 m/s and is 560,000 m above Earth's surface. At this state, what is its kinetic energy?
   a. 8.69×10^{7} J
   b. 3.43×10^{11} J
   c. 4.87×10^{13} J
   d. 3.78×10^{15} J

10. Two students are poised to dive off equal equal-height diving towers into a swimming pool below. Student B is twice as massive as Student A. Which of the following is true?
    a. Student B will reach the water sooner than student A.
    b. Both students have the same gravitational PE.
    c. Both students will have the same KE just before hitting the water.
    d. Student B did twice as much work in climbing the tower.

11. Best friends Jim and John transfer 5 blocks of concrete to a high table one at a time. Jim accomplished the task in 55 seconds while John finished it 20 seconds later. Who does the greater work?
    a. Jim since he accomplished the task first
    b. John since he did the work at a longer time
    c. both did the same amount of work
    d. cannot be determined

12. As shown in the Figure, a 26.0-kg child slides down a playground slide that is 2.5 m high. At the bottom of the slide, she is moving at 3.0 m/s. How much energy was lost as she slid down the slide?
    a. 117 J
    b. 195 J
    c. 520 J
    d. 637 J

13. Identical cars A and B are being driven up the same steep hill. If the power output of A is larger than that of B, what must be happening?
    a. Car B is moving slower than car A.
    b. Car B is consuming more fuel than Car A.
    c. Car B needs to travel farther to get to the destination.
    d. Car B arrives at the destination earlier than Car A.

14. When more people ride upward in an elevator,
    a. the elevator requires greater power.
    b. it takes longer time move from one floor to the next.
    c. the elevator has to move faster.
    d. energy expended is considerable reduced.

15. A particular hydraulic pile driver uses a ram with a mass of 1040 kg. If the maximum pile energy is 11,780 J, how high must the ram be raised to take advantage of its capability?
    a. 0.09 m
    b. 0.87 m
    c. 1.16 m
    d. 11.33 m

16. An archer puts a 0.30-kg arrow to the bowstring. An average force of 200 N is required to pull the string back in order to provide the arrow with a velocity of 40 m/s, enough to hit its target. Assuming that all the energy goes into the arrow, how far should the string be drawn back?
    a. 0.70 m
    b. 0.95 m
    c. 1.0 m
    d. 1.2 m

17. A 12.0-m-long conveyor belt angled at 33^{o} with the ground is used to transport bundles of newspapers from the mail room up to the cargo bay to be loaded onto delivery trucks. Each newspaper has a mass of 1.0 kg, and there are 25 newspapers per bundle. Determine the power that the conveyor develops if it delivers 15 bundles per minute.

    a. 400 W
    b. 2.5 kW

c. 4.5 kW
d. 24 kW

18. Medieval warriors used catapults to assault castles. Some catapults worked by using a tightly wound rope to turn the catapult arm. Why should the rope be tightly wound?
a. in order to secure the catapult

b. so that it can store up enough elastic potential energy

c. because it's a way of increasing the inclination of the throw

d. because doing such develops greater power

19. Two cars are lifted to the same elevation in a service station. If one car is twice as heavy as the other, which of these sentences is true?
a. The heavier car has lesser potential energy.
b. The heavier car will land to the ground first if they are both accidentally released from such elevation.
c. The heavier car will cause more impact thus create more damage if they both fall.
d. The heavier car requires lesser power in being raised to its level.

20. As a learned coach of javelin throw, what technique would you advise your athlete to enhance his performance?
a. Throw the javelin when your arm is up as high as possible.
b. Upon throwing, position your arm at shoulder level instead of from the back or front.
c. Stop running and relax your muscles before throwing the javelin.
d. Start the throw when your arm is at the same level and is at right angle with your neck.

GLOSSARY OF TERMS USED IN THIS LESSON:

Work - something which is done by a body when it successfully makes an object move with the force it has exerted on that object

Power - refers to how fast or slow a body performs work

Energy - possessed by a body to make it do work

Force - something that is applied to a body to make it change its state of motion

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

Physical Science, 10th Edition. Tillery, B. USA: McGraw Hill, 2014.

Conceptual Physics, 7th Edition. Hewitt, P. USA: Harper Collins, 1993.

http://www.physicsclassroom.com/mmedia/energy/au.cfm
It gives a comprehensive discussion on the relationship of work, power and energy.

http://images.schoolinsites.com/SiSFiles/Schools/GA/BleckleyCounty/BleckleyCoHigh/Uploads/DocumentsCategories/Documents/secquiz_1_2_3_4_5_6.pdf
A pool of assessments pertaining to Work, Power and Energy

http://www.fortthomas.kyschools.us/userfiles/269/Classes/27332/practice%20questions%20for%20work%20and%20energy%20unit%20test.pdf
A pool of assessments pertaining to Work, Power and Energy

http://hendrix2.uoregon.edu/~dlivelyb/phys101/lab3.pdf
Laboratory experiment about work

http://www.proprofs.com/quiz-school/story.php?title=chapter-test-work-energy-power
Test questions about power

http://www.superchargedscience.com/affiliate/Common-Misc.pdf
Common misconceptions in Science including the topics Work and Energy

IMAGES

Man pushing the brick wall
https://www.google.com.ph/search?q=pushing+brick+wall&biw=1024&bih=499&tbm=isch&tbo=u&source=univ&sa=X&ei=BkExVKuSM4bn8AXBkYGICg&ved=0CBoQsAQ#facrc=_&imgdii=_

&imgrc=bElaEqXmkQwDsM%253A%3BwxdxbJ9M0WH9VM%3Bhttp%253A%252F%252Fw3.shorecrest.org%252F~Lisa_Peck%252FPhysics%252Fsyllabus%252Fmechanics%252Fnewtonlaws%252FNewton_webpage%252F2009%252Femily%252FGRD90013.gif%3Bhttp%253A%252F%252Fw3.shorecrest.org%252F~Lisa_Peck%252FPhysics%252Fsyllabus%252Fmechanics%252Fnewtonlaws%252FNewton_webpage%252F2009%252Femily%252FScience.htm%3B237%3B215

Girl reading a book

https://www.google.com.ph/search?q=pushing+brick+wall&biw=1024&bih=499&tbm=isch&tbo=u&source=univ&sa=X&ei=BkExVKuSM4bn8AXBkYGICg&ved=0CBoQsAQ#tbm=isch&q=woman+studying+cartoon&facrc=_&imgdii=_&imgrc=zps2J6Bee8kiKM%253A%3BJz7fm-76fuNpvM%3Bhttp%253A%252F%252Fwww.clipartheaven.com%252Fclipart%252Feducation_%2526_schools%252Fcartoons%252Fgirl_studying.gif%3Bhttp%253A%252F%252Ffunny-pictures.picphotos.net%252Fpattern-art-push-pin-stock-vector-illustration-of-picture%252Fimages.clipartof.com*small*1047227-Royalty-Free-RF-Clip-Art-Illustration-Of-A-Cartoon-Black-And-White-Outline-Design-Of-A-Man-Rushing-To-Push-A-Panic-Button.jpg%252F%3B490%3B228

LESSON 3: SOUND, LIGHT, AND HEAT

INTRODUCTION AND FOCUS QUESTION(S):

When you tap a solid object like your shoes, your chair, your pen, etc. you would hear a distinct sound. Why is this so? When you talk, you can feel something vibrating inside of you. Have you ever wondered how we are able to produce sound? On the other hand, when we look at something, we see different colors as well as identify the objects shape. When we look at the sky in the morning it is blue, when we look at it during sunset it is red. Why is this so? You've used your senses of hearing and of sight, how about if you use your sense of touch? Why can you feel that something is hot? Or that something is cold? Several of these questions arise from the use of our senses. Remarkable isn't it?

The sound that you hear, the light that makes you see the different colors of nature, and the heat that you feel are effects of the movement of particles and that of energy. We are able to perceive these because of the movement of something, either matter or energy.

In this lesson, you will find out about the interplay of motion of particles and energy that produces sound, light, and heat. You will learn a lot of wonderful things about the natural world that you live in. How musical sound is produced, why skies are blue, why rainbows are colorful, why things expand, and a lot more are taken up in this lesson.

.

Remember to search for the answers to the question: Why are there earthquakes?

LESSON COVERAGE:

In this lesson, you will examine:

Sound, Light and Heat

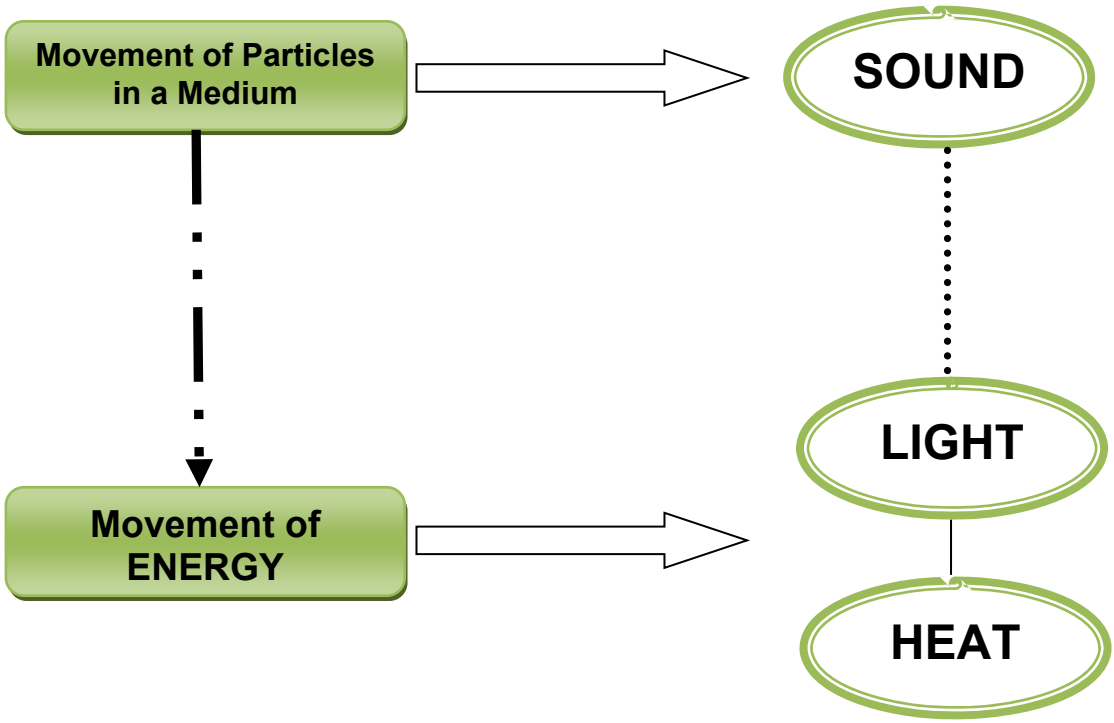
A. Vibrations and Waves
B. Nature of Sound
C. Reflection and Refraction
D. Forced Vibrations and Resonance
E. Musical sound
F. The Electromagnet Spectrum
G. Light
H. Reflection, Refraction, and Diffraction
I. Color
J. Colors in Nature
K. Heat and Temperature

L. Methods of Heat Transfer
M. Heat Calculations and Calorimetry
N. Thermal expansion

In this lesson, you will learn the following:

The learner: • Discusses phenomena such as blue sky, rainbow, and red sunset using the concept of wavelength and frequency of visible light.

LESSON MAP:
Here is a simple map of the above lesson you will cover:



EXPECTED SKILLS:
To do well in this lesson, you need to remember and do the following:

1. Do the exploratory activities carefully. Always write down your observations during the activities using Evernote. If you have some questions in mind during the performance of the activity, write them down and remember to go back to the questions as you progress in each lesson.
2. Read the contents of this module carefully. When in doubt, read again and try to understand the directions clearly.
3. When asked to view a documentary video, write the guide questions in advanced and then while watching the video, listen carefully and write down notes. If you do

not understand the video on the first viewing, you can always view the video again and pause in between significant lines or dialogues in the video.
4. This module provides you with a list of internet sites which you could browse through for clarification. Visit the sites and read thoroughly the contents of the site.
5. When doing the performance tasks, bear in mind that these tasks are applications to what you've gone through in this module. When asked to make a brochure or any campaign material, always bear in mind the intended audience.
6. Keep an open-mind like any other follower of science. When in doubt, consult other reliable sources of information and counter check.
7. Do the Web test for several times and don't forget to click on the correct answer for your reference.

In this lesson, you shall:

1. infer how the movement of particles of an object affects the speed of sound through it,
2. investigates the effect of temperature to speed of sound through fair testing,
3. demonstrate the existence of the color components of visible light using a prism or diffraction grating,
4. explain the hierarchy of colors in relation to energy,
5. explain that red is the least bent and violet the most bent according to their wavelengths or frequencies, and
6. differentiate between heat and temperature at the molecular level.

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this lesson.

1. Which of the following set shows a CORRECT arrangement of colors according to increasing energy?
   A. Red, Green, Orange, Violet
   B. Orange, Green, Blue, Violet
   C. Yellow, Orange, Red, Violet
   D. Indigo, Blue, Green, Yellow

2. Why do we see red sunsets?
   A. Sunlight travels through a bigger part of the atmosphere with particles that are big enough to scatter red light but not all the other components of visible light.
   B. Sunlight travels through a smaller part of the atmosphere with particles that are small enough to scatter all other wavelengths of light except red.
   C. Sunlight travels through the atmosphere with particles that scatter all the wavelengths of light leaving behind red with the biggest wavelength.
   D. Sunlight travels through a polluted atmosphere in the afternoon that absorbs the bigger wavelength of light which is red.

3. The average kinetic energy of the molecules of an object is measured by _____.
   A. calorie
   B. heat
   C. specific heat
   D. temperature

4. On some days, air nearest the ground is colder than air that is higher up. On some of these days, sound waves _____.
   A. travel without refraction
   B. are refracted everywhere
   C. tend to be refracted upward
   D. tend to be refracted downward

5. A friend of yours would like to investigate on the effect of temperature on the speed of sound. He intends to use a closed room with an air-conditioning unit and a sound sensor that is placed inside the room. The sensor is placed in one end of the room while a tuning fork that will serve as the source is placed on the opposite end. Which of the following is a problem with his set-up?
   A. The air-conditioning unit will not be able to cool the air to the desired temperature.
   B. A closed room will produced too many reverberations that will be detected by the sensor and will cause an inaccurate reading.

C. The sound sensor will not be able to detect the vibration of the tuning fork because it is so close to the source.
D. The distance between the source and the sensor is too close that the sensor must be very quick enough to detect the speed of sound.

6. In which of these media does sound travel the fastest?
   A. Ice
   B. Steam
   C. Water
   D. Water vapor

7. If the moon blew up, why would we not hear it?
   A. The moon is far away such that sound coming from it would be dissipated before it reaches us.
   B. The explosion would not be too loud for us to hear, since the moon is much smaller than the earth.
   C. Immediately after the Earth's atmosphere is empty space so that there is no medium for the sound to travel.
   D. Sound produced by the moon's explosion will be directed away from the earth; thus, we will not be able to hear it.

8. While playing with his ball point pen with a grooved transparent body, Rick saw a rainbow as he placed the pen's transparent body in front of his eye as he was viewing the fluorescent lamp inside their classroom. He kept on doing this to verify what he saw. Which of the following explains what Rick saw?

   A. The grooved transparent body of the pen acted like an absorbent cotton taking in all the light sources inside the classroom thus allowing him to see a rainbow.
   B. All other colors of light were present inside the classroom. These were captured by the pen thus allowing him to see a rainbow.
   C. The grooved transparent body of the pen served as a diffraction grating separating all the colors of white light passing through it. This allowed him to see a rainbow from the other side.
   D. Several sources of differently colored neon lights were inside the classroom and all of it were reflected onto the fluorescent lamp which Rick looked at.

9. A five centavo coin is heated to a glow. Then it is placed hanging right on top of the surface of acetone in a beaker. While hanging, the coin keeps glowing. Why is this so?
   A. Heat coming from the acetone is transferred to the coin causing it to glow.
   B. The thermal energy of the acetone is transferred to the beaker then to the coin.
   C. The five centavo coin is just so hot that it will continue to glow until it gets cold.

D. As it evaporates, acetone fumes hit the hot coin. The heat coming from the coin vaporizes the acetone molecules in the fumes, thus letting us see a glow.

10. Why would it be futile to attempt to detect sounds from other planets, even given the very best in audio detectors?
    A. The planets are very far away from the earth; thus, we would not be able to hear it given the distances among them.
    B. In between planets is empty space or vacuum, where there is no media for sound to travel; thus, we will not hear anything.
    C. These audio detectors must be placed near the source. We don't have a spacecraft that can go to each of these planets.
    D. There are no sounds in these planets as they are without life compared to the earth.

11. A person standing waist-deep in a swimming pool appears to have short legs because of light _____.
    A. absorption
    B. diffraction
    C. reflection
    D. refraction

12. A green light is shining on a green plant in a red pot. There are no other lights in the room. What color will the green plant and the red plant appear? The plant will be _____ and the pot will be _____.
    A. green , red
    B. green , green
    C. green , black
    D. both will be a darker color

13. A volume of helium gas has a temperature of 0 ^{0}C. The same gas twice as hot has a temperature of _____.
    A. 0 ^{0}C
    B. 2 ^{0}C
    C. 100 ^{0}C
    D. 273 ^{0}C

14. To say that something is twice as hot as another suggests that the hotter thing has _____.
    A. twice the thermal energy
    B. twice the absolute temperature
    C. both
    D. none of the above

15. Theaters have spot lights that are covered with red, blue, and green cellophane plastic. Why is this so?
    A. The only available colors of cellophane plastic are red, blue and green.
    B. Red, blue, and green are additive colors so a combination of these will highlight an actor's presentation.
    C. Red, blue, and green are bright colors that will put emphasis on an actor's presentation.
    D. The colors can be easily obtained from the store and the bulbs can be replaced if busted.

16. An acoustical engineer, in designing a theatre, will have to deal with _____.
    A. beats
    B. forced vibrations
    C. modulation
    D. wave interference

17. With the advent of technology, most cellular phones are now able to capture photos and store it in the device. What does the statement "You are against the light" mean?
    A. The person is standing in between a light source and the photographer. The light source is facing the photographer.
    B. The light source is between the person and the photographer facing the latter's direction.
    C. The light source is on the side of the person and is illuminating only half of the person.
    D. The light source is at the back of the photographer directed towards the person.

18. Aside from ceilings, modern houses now have insulating materials made-up of Styrofoam sandwiched between two sheets of aluminum. What purpose does this insulating material serve?
    A. The insulating material keeps the temperature inside the house low and prevents it from rising up.
    B. The insulating material keeps rats and other insects away from the ceiling because it becomes hot once exposed to the heat of the sun.
    C. On a hot day, it prevents heat transfer from the roof to the interior part of the house. On a cold day, it prevents heat lost.
    D. The material adds aesthetic qualities to the ceiling so that it doesn't look dull and lifeless.

19. In cold regions of the earth, most people would wear jackets that are either stuffed with wool or have large packets of air. Why is this so?
    A. Wool and air packets keep a person warm because the two are already warm.

B. Wool and air packets prevent heat lost by the body keeping the body temperature constant.
C. Wool and stuffed air have small particles that continuously jostle producing enough heat to warm the body.
D. The particles in wool and stuffed air are good conductors of heat thus keeping the body warm.

20. On a very cold and snowy night, a concrete house feels much colder than a house made of solid wood. Why is this so?
    a. Concrete loses thermal energy faster than wood, so it would feel colder than the wood.
    b. Solid wood has a lot of molecules that jostle; thus, it is warmer than concrete.
    c. Concrete molecules tend to stop more rapidly than the molecules of the wood; thus, it becomes colder.
    d. Solid wood gains heat more readily than concrete; thus, it becomes warmer on a very cold and snowy day.

EXPLORE

Let's begin this lesson by gathering your ideas about sound, light, and heat.

ACTIVITY NO. 1: Impossible!

Click on this website https://www.youtube.com/watch?v=TyovO2I4dPU (video showing a child breaking a wine glass using his voice) and watch what the child does. You may also do this at home but please wear safety goggles and gloves when doing this.

PROCESS QUESTIONS:

7.

1. What happened to the piece of drinking straw placed inside the wine glass?
2. Why was the straw placed inside the wine glass?
3. Could this experiment be true? Why or why not?
4. How did that child produce that sound?
5. Can we predict the behavior of sound? How?

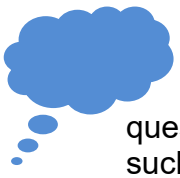
Now you have an idea of what sound can do. Before proceeding to an in-depth study of sound, light, and heat, answer the next activity containing statements about the concepts that you are about to learn.

ACTIVITY NO. 2: Eliciting Prior Knowledge through ARG Chart

The box below contains statements about sound, light, and heat. On the first column, write True if you think the statement is true and False if you think otherwise. Do not answer the third column yet. You will answer the third column when you finish this module. Remember to take note of the items in Evernote and from time-to-time check on these. Click the icon "SUBMIT" so that your teacher will know your initial ideas.

True or False	STATEMENTS	Were you correct?
	1. Sound is a transverse wave.	

	2. Vibrations of materials do not create sound.	
	3. Sound can travel in a vacuum or in space.	
	4. Sound travels faster in cold winds.	
	5. Sound travels faster in wind than in solid materials like steel.	
	6. White light is really just white.	
	7. Red, which is the first color in the visible spectrum, has the highest frequency.	
	8. Violet has the lowest energy because it has the lowest frequency.	
	9. Light does not have anything to do with the color that we see on objects.	
	10. Blue skies result from the scattering of the lowest frequency of light in the spectrum.	
	11. Heat and temperature are one and the same.	
	12. Heat is something that an object contains.	
	13. When an object is heated, the motion of the molecules of that object slows down.	
	14. Convection, as a method of heat transfer, does not involve the movement of air molecules.	
	15. The amount of energy needed to raise the temperature of an object by one degree Celsius is determined by its specific heat capacity.	



As you proceed to the rest of the activities, always have these questions in your mind. How do sound, light, and heat change? Why do such changes happen? Can these changes be predicted?

End of EXPLORE:

You have just seen one of the effects of sound and you have answered questions about sound, light, and heat. As go along this module, remember to think small. Think as though you are molecule. What action(s) would you be doing if you were in air? When something bumps you, what is the initial reaction of your

body? What would your reaction be if you were heated? If you absorbed energy, how would your body react? Your understanding of how sound, light, and heat behaves will allow you to explain certain phenomena in your natural world.

Furthermore, you will be able to give an in-depth discussion of how these phenomena such as blue skies and red sunsets happen. With this knowledge comes your ability to enhance audiovisual presentations in school and in the community.

Your understanding of sound, light, and heat will be increased as you study the lessons and perform the activities in the FIRM UP phase. Remember to take-down notes all the time using Evernote or your notebook.

FIRM-UP

You have shared your ideas about sound, light, and heat. Now it's time for you to know more about these concepts. Remember to take down notes using Evernote or your ordinary notebook.

ACTIVITY NO. 3.1: Vibrations and Waves

Before you begin to explore the nature of sound, light and heat, let's take a look at the fundamental characteristic of sound and light – both of these are waves. Click this website http://www.brightstorm.com/science/physics/vibration-and-waves - video discussions on vibrations and waves by Dr. Jonathan Osbourne. In the website, watch the videos of the following by clicking the appropriate link.

1. Wave characteristics
2. Frequency – period
3. Amplitude
4. Wavelength
5. Wave speed
6. Wave phase
7. Standing waves
8. Transverse waves
9. Longitudinal waves

Choose ten (10) important words from the videos that you've watched and then complete the graphic organizer below.

Name:_____ Class Period:_____ Date:_____

10 Most Important Words

	Word or Term	My Ideas about this Word or Term
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

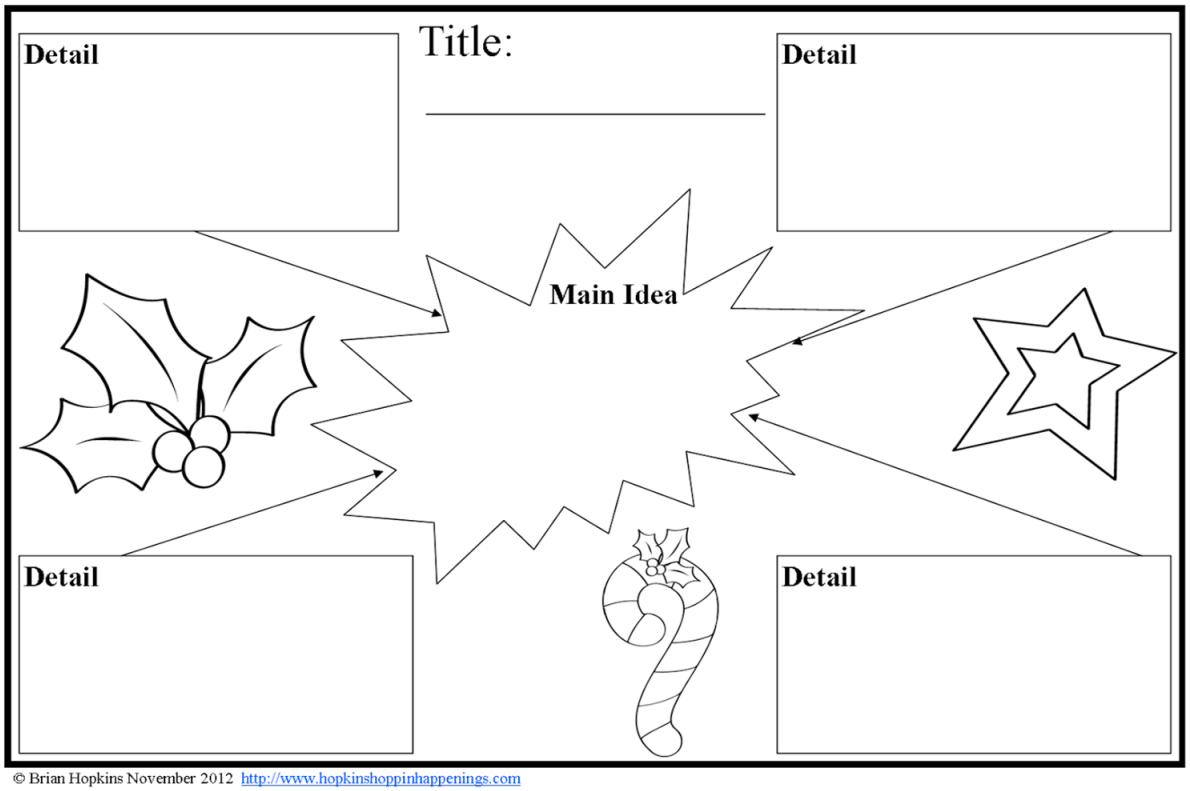
http://www.dailyteachingtools.com/language-arts-graphic-organizers.html

PROCESS QUESTIONS:

1. What is a wave?
2. What is the difference between a transverse wave and a longitudinal wave?
3. How do you calculate the frequency of a given wave? How about the amplitude?
4. How do you calculate the speed of a wave?
5. When do you know if two waves are in-phase or out-of-phase?
6. How do waves behave?

Do you understand all the terms used in the video? If it is not clear yet, you may go back to the same website and watch the videos again. After watching the videos, complete the graphic organizer below with Vibrations and Waves as the main idea.

Name: _____ Date: _____



ACTIVITY NO. 3.2: Calculating Wave Characteristics

In the previous activity, you learned that the frequency of a wave is the number of wave cycles that are completed per unit of time. On the other hand, period is the time it takes for a complete wave cycle to be done. How are frequency and period related to wave speed? Click on this website http://www.physicsclassroom.com/class/waves (webpage discussion on waves and its properties) and then read Lesson 2 about the Properties of a Wave. After reading the webpage, answer the questions that follow.

Remember to write your neat, clean, and complete solutions in your notebook. Once you are done answering, click SUBMIT.

QUESTIONS	ANSWERS
1. A longitudinal sound wave has a speed of 340 m/s in air. If this wave produces a tone with a frequency of 1000 Hz, what is the wavelength?	
2. A transverse wave has a wavelength of 0.50 m and a frequency of 20 Hz. What is the wave speed?	
3. A student reading his physics book on a lake dock notices that the distance between two incoming wave crests is about 2.4 m and he then measures the time of arrival between wave crests to be 1.6 seconds. What is the approximate speed of the waves?	
4. Light waves travel in a vacuum at a speed of 300,000 km/s. The frequency of visible light is about 5 x 10^{14} Hz. What is the approximate wavelength of the light?	
5. A certain laser emits light of wavelength 6.33 x 10^{-7} m. What is the frequency of this light in a vacuum?	

How did you fare in the previous activity? If you are still uncertain about your solutions to the problems, click on this website http://www.physicsclassroom.com/calcpad/waves/problems (contains problem sets on wave basics including audio guided solutions) and answer the problems. Once you are done with the problems in this website, you may listen to the audio guided solutions that are found in the same page.

PROCESS QUESTIONS:

1. What are the different properties of a wave?
2. How were you able to calculate frequency, period, and wave speed?
3. How does a wave behave?
4. Why do these changes happen?
5. Can we predict these changes? Why or why not?
6. Whenever a public storm signal is raised, the Philippine Coast Guard will never allow boats or ships to sail even if these boats have outriggers (see picture below). Why is this so? (What happens at sea during storms?)

8. 

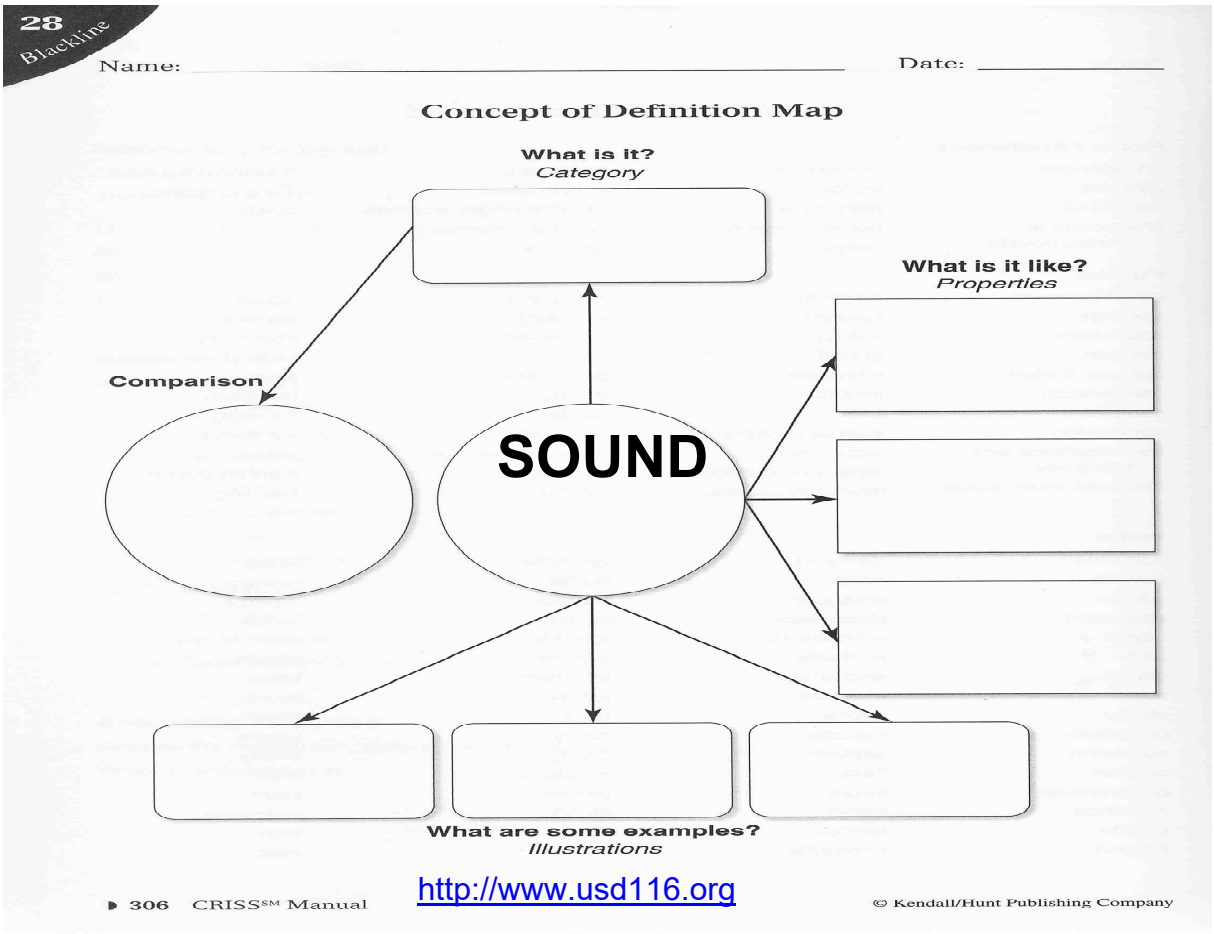
7. Policemen who go to the firing range for practice shooting will always wear a headset before attempting to fire their guns. What's the purpose of the headset? How is it related to waves?

ACTIVITY NO. 4: Nature of Sound

Part I - Concepts

Now that you know about the characteristics waves, let's us now proceed to a very common wave that we encounter daily – sound. What is sound? What kind of a wave is sound? Click on these websites and watch the videos. After watching the videos, complete the graphic organizers that follow.

1. https://www.youtube.com/watch?v=kt1pTcfstC8 – Bill Nye's video on sound properties
2. http://www.youtube.com/watch?v=HVGE854x1yQ – video showing how sound is produced and how it is propagated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Name: _____ Date: _____

Concept of Definition Map

What is it?
Category

What is it like?
Properties

Comparison

SOUND

What are some examples?
Illustrations

306 CRISS℠ Manual

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http://www.usd116.org

TASK

Now you have an idea of how sound works. Click this website https://phet.colorado.edu/en/simulation/sound (simulation of sound), and download the Sound simulation or you can run it in html. Once you've downloaded the simulation, you will see these tabs.

Click the "Listen to a Single Source" tab first.

PROCESS QUESTIONS:

1. What is the effect of changing the frequency of the tone generated?
2. What is the effect of changing the amplitude of the tone generated?
3. Using the slide bar as a rough ruler, and with the frequency set to 100 Hz, how low in amplitude (%) can you still hear the tone?
4. Using the slide bar as a rough ruler, and with the frequency set to 1000 Hz, how low in amplitude (%) can you still hear the tone?

This time, click the “Measure” tab of the simulator. You will see a ruler and a timer in the simulator. Notice that the ruler is a scale of 5 meters and the timer can record time up to ten thousandths of a second. Set the frequency to 10 Hz and predict the time it will take for a wave to reach 5 meters. Complete the prediction table below then observe what happens in the simulator.

Amplitude based from slide Bar	Prediction	Observation
25 %		
50 %		
75 %		
100 %		

With the data that you have, how far do you think will sound reach in one second? Why?

_____
_____
_____

We will continue with the sound simulator in the next part of this activity. In the meantime, proceed to the next part of this activity.

PROCESS QUESTIONS:

1. What is sound?
2. What kind of a wave is sound?
3. Why do we hear echoes?
4. How do we hear sound?
5. What’s the relationship between wave frequency and pitch?
6. How is sound propagated?

7. Can we predict the behavior of sound?

Part II – Properties of Sound

In the previous part of this activity, you were introduced to the conceptual understanding of what sound is. Now, let's go into a little bit of math involving sound. Click this website http://www.physicsclassroom.com/calcpad/sound (shows an overview of the problem sets about sound and the different properties that are associated with sound) and read about the following topics:

1. The Speed of Sound,
2. Sound Intensity,
3. The Decibel Scale,
4. Speed of waves in strings, ropes, wires and cables, and
5. Frequency-Wavelength-Speed relationship.

PROCESS QUESTIONS:

1. In the previous part of this activity, you were able to make a rough estimate of how far sound can travel in a second. How close is your estimate compared to the speed of sound given in the webpage that you've just read?
2. How does the frequency of sound affect your perception of it?
3. Consider this, dolphins as well as bats are able to communicate using sound. But why can we not hear it?
4. We are often reminded not to make the volume of sound louder when we are using a headset in listening to music. Why is this so?

Let's continue playing with the sound simulator. Do you know what interference means? Click on the "Two Source Interference" tab of the simulator and we will try to discover what interference means. You will see two sources of sound in the display and a head which will represent you. You move this head to a position and this will allow you to listen to the sound of the sources at that position.

PROCESS QUESTIONS:

1. What pattern did you see as the two sources produced sound? Please draw the pattern that you see in your notebook.
2. When the sound coming from the two sources meet, did you notice the very dark spots? How about the very light ones? What could be happening in these spots?

3. Try moving the head into these spots and listen carefully. What have you heard?
4. In which spot will you hear sound? In which spot do you not hear a sound?
5. What then is interference?
6. How many sources of sound do you need in order to have interference?
7. Many jackhammer operators would wear noise cancelling devices before working with a jackhammer. Can you describe what these devices actually do?

We still have two more tabs in the simulator. Click the “Interference by Reflection” tab of the simulator. On its right, you will see the same controls for the amplitude and frequency. You will also see slide bars for adjusting the wall angle and position with respect to the source. You are given the choice as well if you want a continuous wave or just a pulse. Tick continuous for this part and observe what happens to the wave as you go through each of the process questions that follow.

PROCESS QUESTIONS:

1. What happens to the wave as it hits the wall?
2. Do you still see dark spots and light spots? What happens in these regions again?
3. Now try this in your room, go to a corner and shout. What happens to the sound you produced?
4. Likewise, do the same for a flat wall in your room. How loud is the sound you hear?
5. If you move away from the flat wall, how loud will the reflected sound be? Why?

On to the last tab in the simulator, click “Listen with Varying Air Pressure” tab and notice what happens to sound when you begin to extract or pump out air from the box containing the source of sound. Remember what you know about atmospheric pressure? We feel the pressure coming from the atmosphere because there are tiny molecules of air that push us down. That is why there is pressure.

PROCESS QUESTIONS:

1. Before you start, let’s begin with a few questions on what you see in the simulator. It says 1 atm of pressure in the gauge, what does this mean?

2. If we pump out air in the box, what does it have to do with the pressure reading?
3. So if the pressure lowers in the box, it also means that?
4. Observe what happens before you begin to pump out air from the box. Do you hear a sound?
5. Now begin pumping out air from the box. What happens to the sound that you've heard previously?
6. What happens when all the air has been evacuated from the box i.e. is zero pressure?
7. What does this tell us about sound?
8. Suppose a big planet such as Jupiter exploded. Do you think we will hear it? Why or why not?

After reading about the topics listed above and playing with the sound simulator, click this website http://www.physicsclassroom.com/calcpad/sound/problems.cfm (problem set about sound and its properties) and do the word problems first. After doing it on your own, listen to the audio guided solutions of the problems that you answered.

PROCESS QUESTIONS:

1. What are the factors that affect the speed of sound in air?
2. What factors affect the speed of sound in any material?
3. How do you calculate the intensity of sound?
4. What is the decibel scale?
5. What information does the decibel give us?
6. How do you calculate the speed of sound waves in strings, ropes, wires, and cables?
7. How are frequency, wavelength and speed of sound related?
8. What do all these tell us about sound?
9. Can we predict its behavior? How?

ACTIVITY NO. 5: **What's That Sound Experiment?**

TASK

Now you know what sound is! Let's do a little experiment about sound using a slinky. Click this website http://hendrix2.uoregon.edu/~dlivelyb/phys101/lab8_s07.pdf (pdf file containing experiments about sound) and do experiment no. 1 only. While doing the experiment, ask someone to take a video of you doing the experiment then

upload this video to Youtube and share this to your teacher and friends. Let your friends comment on the experiment that you did.

PROCESS  QUESTIONS:

1. What role did the slinky do in the experiment?
2. Is energy transferred when sound is propagated? How?
3. How is the frequency and wavelength of a sound related to energy?
4. Can we predict this behavior of sound?

ACTIVITY NO. 6: Check Mic Test 1-2-3

Now it's time to do a little bit of mind exercise about sound. Read, analyze, and answer the questions below thoroughly. Click this website www.vicphysics.org/documents/teachers/unit3/sound/SoundTest1.doc (test on sound) and answer numbers 1 – 18 only.

Before you proceed to the next activity, do a quick check of the concepts you learned by ticking the appropriate column of this check-bric

SOUND CHECK 1-2-3	Yes	No	Not Quite!
1. I can explain how sound is produced.			
2. I can draw an illustration of how sound is propagated.			
3. I can demonstrate how sound behaves and explain its behavior.			
4. I can now choose a good spot in a theater or concert venue where I can hear the sound well.			
5. I can relate ocean waves with sound waves.			
6. I can now explain why two plastic cups, connected with a thin string whose ends are attached at the bottom of each, can be used as a phone.			
7. I can already position two or more speakers such that sound is smoothly propagated through these.			
8. I can now do sound proofing at home.			

In order for you not to forget what you learned, go to www.blabberize.com and upload a picture of a radio. Make the radio talk about sound, its properties and propagation, and why it is important. Then share it to your friends.

Congratulations! You have just learned about the properties of sound and how it is propagated. In the next activity, you will encounter another type of wave that allows us to see things in our natural world. This type of wave is similar to sound in some aspects. But, it is different from sound in other aspects because it can travel even without a medium plus it is much faster than sound. What is this wave? Read on.

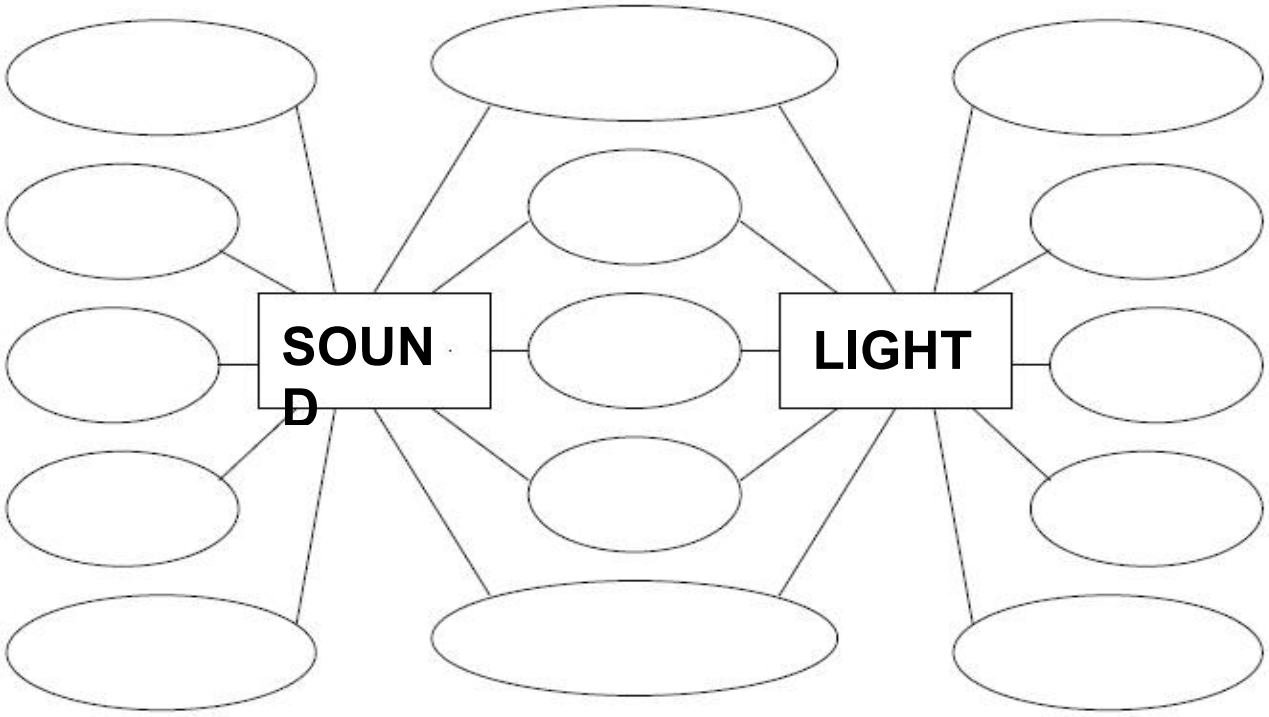
ACTIVITY NO. 7: Let there be Light!

Why are we able to see things? Seeing things involve a particular kind of wave that is called light. Click on these websites to know more about it and then complete the graphic organizer below.

1. https://www.youtube.com/watch?v=gtgBHsSzCPE – Bill Nye the science guy video on light and color
2. http://www.physicsclassroom.com/class/light/Lesson-1/Wavelike-Behaviors-of-Light - shows a discussion on the properties of light as it behaves as a wave
3. http://www.ivyroses.com/HumanBody/Eye/What-is-Light.php - gives a discussion about the nature of light, white light, and its propagation
4. http://physics.tutorvista.com/light.html - enumerates the different properties of light

Name: _____ Date: _____ Class: _____

Compare and Contrast Chart with Bubble Map



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PROCESS QUESTIONS:

1. How are light and sound the same?
2. How are they different?
3. Why do you see lightning first before you hear thunder on a rainy day?
4. What is light?
5. How many ways does light behave?
6. Is white light just white? If not, how many colors is it made of?
7. The arrangement of the component colors of white light is based from what property of light?
8. What are the different properties of light?
9. How does each property help us to see things?
10. Can we predict the behavior of light?

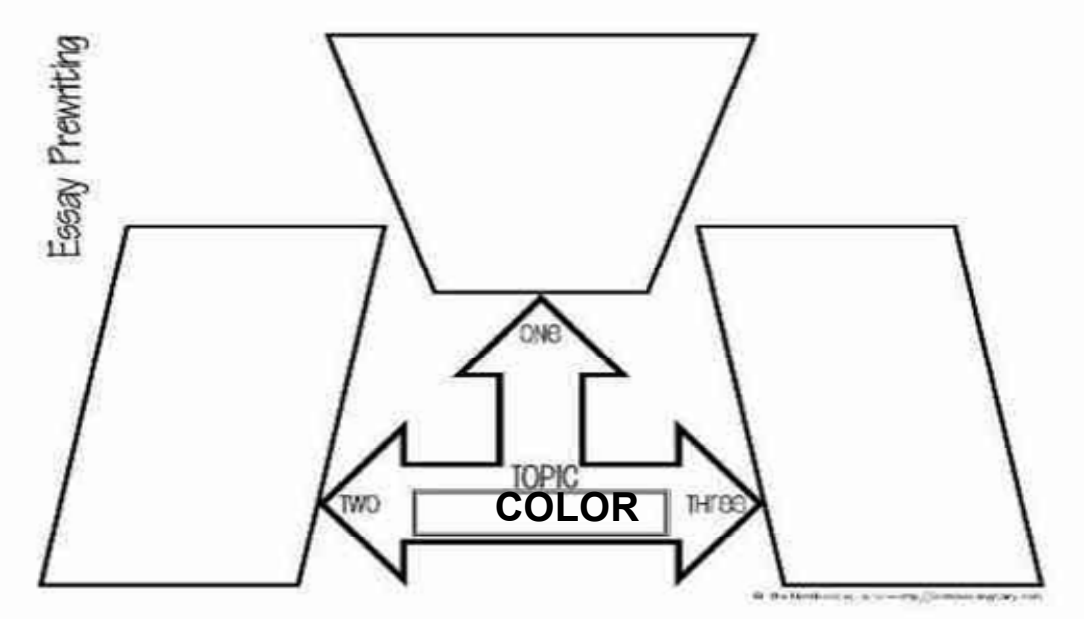
ACTIVITY NO. 8: Colors Everywhere

In the previous activity, you learned about the behavior of light. White light that hits objects is just a portion of what is called the electromagnetic spectrum. Moreover, this white light is made-up of different colors of light with varying wavelengths and frequencies from red to violet. In this activity, you will learn how these components make your natural world colorful. Click on these websites:

1. http://physics.info/color/ - Physics hypertextbook containing information about color and how we see color, and

2. http://www.physicsclassroom.com/class/light/Lesson-2/The-Electromagnetic-and-Visible-Spectra -this website is the start of lesson 2 which is about light and color.

For the second website listed above, READ and CLICK the complete lesson 2 to have a complete idea of how we perceive color. You should also do the practice items that are found in each part of the lesson. Then complete the graphic organizer below.



http://notebookingfairy.com/2012/04/graphic-organizers-prewriting/

After reading the webpages, click this website https://www.youtube.com/watch?v=Yu5u_6giZ-I (Paul Hewitt's video on Colors) then answer the following questions.

PROCESS QUESTIONS:

1. Why do we see a rainbow immediately after a rain?
2. What wavelength of light is absorbed by a ripe banana? What wavelength does it transmit?
3. We always see water to have no color at all. But why do we see blue tropical seawaters?
4. When a car is parked out in the sun, drivers will always place an aluminum covered reflector in their dashboard. Why is this so?

ACTIVITY NO. 9: A Colorful Experiment

TASK

It's now time to do a little bit of experiment about light. In this activity, you will need a friend to do the experiments. You will also be handling a sharp cutter blade so, EXERCISE CAUTION IN HANDLING THE BLADE.

Experiment no. 1: Color Addition and Subtraction

For this experiment, you will have to click this website https://phet.colorado.edu/en/simulation/color-vision (contains a downloadable simulation of the color humans perceive when photons of light are varied) and download the simulation in your computer. After you download this simulation, you will be asked to choose whether you will use a single light or three lights (red, green, and blue). Choose the three lights and you will see on screen a person with a dialogue box. Each time you adjust the color tabs of the light, the color that is perceived by the person will be shown in the dialogue box. Now do the following:

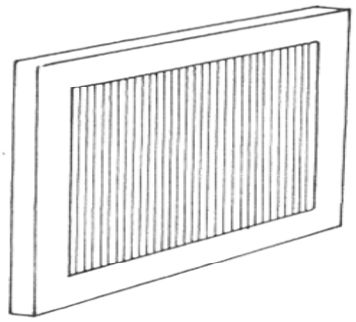
1. Move the tabs to 100% and observe what happens. What color does the person see?
2. Move the red tab to zero (0) while the blue and the green tabs remain at 100% and observe the color that the person sees. What does he see?

3. Now, raise the red tab to 100% and move the green tab to zero (0) while the blue tab remains at 100%. What color does the person see?
4. This time, raise the green tab to 100% while the red tab stays at 100% and move the blue tab to zero (0). What color does the person see?
5. Do the first four steps of this virtual experiment confirm everything that you've read so far? If so, write down your generalization in your notebook.
6. Now, you can play with the color vision simulator. Remember to take note of whatever color you get while mixing the tabs.

Experiment no. 2: Light Diffraction

CAUTION: Please handle the cutter blade carefully.
Materials: cutter blade, ruler, 5-cm square illustration board, small flashlight, and a dark room.
Procedures:

1. Draw a 1-cm border from each side of the 5-cm square board on the white side of it.
2. In the smaller square, draw lines that are 2 mm apart. Using a cutter blade, make slits on these lines. Your board should look like the figure below.



http://eaae-astronomy.org/WG3-SS/WorkShops/Spectroscopy.html

3. Now, in a dark room, switch on the flashlight and put it on the white side of the board and observe the light that comes out of the dark side of the board. Record all your observations.
4. Let your friend do the same thing and see if you both have the same observations.
5. Observe a window blind in a room. Notice how it looks like? Why is the size of each part equal and the spacing equal?
6. Grab hold of a Panda ™ ball point pen. Take a look at the grooves that you use for holding it. Now, observe a fluorescent lamp through the grooves. What do you see? Is this something similar to what you observed earlier with the illustration board? What effect did the grooves have on the light that enters through it?

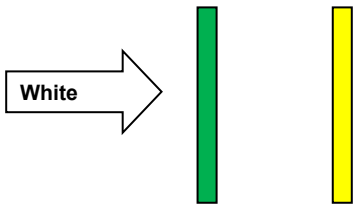
PROCESS QUESTIONS:

a. What color did you observe coming out of the dark side of the board?
b. What instrument did you just make out of the illustration board?
c. What do the slits do to the white light that passes through it?
d. The color that you see coming out of the dark board is an evidence of what behavior of light?
e. Why does this behavior happen?
f. Can we predict this?

ACTIVITY NO. 10: Light and Color Problems

In the previous activities, you learned about how we see and why see things. In the process of seeing, light is always involved. Light has to be reflected by the object and into our eyes so that we can see it. The color of the object that we see depends on its color and the color of light that illuminates it. Let's put all the concepts you learned in practice and try to answer the questions that follow. Click "Submit" when you are done.

QUESTIONS	ANSWERS
1. It is sometimes said that black is the absence of all color or that a black object absorbs all incident light. If so, why do we see black objects?	
2. Several beverages, such as root beer, when poured into a glass develops a "head" of foam. Why is the foam generally white or light, while the liquid is dark?	
3. Why does a white piece of paper appear white in white light, red in red light, blue in blue light, and so on for every color?	
4. Your friend reasons that magenta and yellow paint mixed together will produce red because magenta is a combination of red and blue, and yellow is a combination of red and green – and that the color in	

common is red. Do you agree or disagree, and why?	
5. Fill in the last statement. (All colors are combined by the addition of light.) Red + green + blue = white Red + green = yellow = white – blue Red + blue = magenta = white – green Green + blue = cyan = white - _____	
6. White light is incident on a material with green pigment and passes through it. After it passes through the green-colored material, the transmitted light is incident on a material that has yellow pigment (see figure below). What color of light emerges from the yellow-colored material? 	
7. When white light is shone on red ink dried on a glass plate, the color that is transmitted is red. But the color that is reflected is not red. What is it? Explain.	

Before you end this part, fill-up the check-bric below. Should you have some questions regarding the items in it, don't be afraid to send a message to your teacher or pose the question in the discussion group.

MOVING AT THE SPEED OF LIGHT	Yes	No	Not Quite!
1. I can explain how light is produced.			
2. I can draw an illustration of how light is propagated in different media.			

3. I can demonstrate how prisms and diffraction gratings are used.			
4. I can explain the hierarchy of colors in the visible spectrum.			
5. I can explain how we see things in our natural world.			
6. I can explain how light behaves in transparent, translucent, and opaque materials.			
7. I can already position spotlights in a venue that will enhance the aesthetic effects of stage performers.			
8. I can now choose the type of light that will be cool for my own room and for our house.			

Congratulations! You've learned another type of wave that is light. Before proceeding to the next activity, observe what happens when you do the following:

1. If you have a good singing voice, continuously sing at least 5 of your favorite songs. What do you feel after the 5th song? Why does your throat dry up when you continuously sing?
2. If you don't have a good singing voice, continuously tap with a beat one of your textbooks for at least 30 minutes. After 30 minutes of tapping, how does the book feel? How about your hand?
3. Now, go near a fluorescent lamp or any other light source in your house. How does it feel? What sensation did your body feel when you went near the light source?

In all the mini-activities that you were asked to do, what caused the drying of your throat, the warmth of the textbook and your hand, and the warm sensation that your body felt while staying near a light source? Do you see the energy? In these mini-activities, heat was produced. How do we distinguish between heat and temperature? Proceed to the next activities to find out and learn more.

ACTIVITY NO. 11: Hot or Cold (Experiment)

TASK

Before you proceed to the next topic in this module, let's do a quick experiment. You will need three (3) dippers, 250 ml ice water, 250 ml warm water (about 50 ^{0}C), 250 ml tap water (4 ^{0}C), and a keen sense of scientific observation.

Procedures:

1. Place the three dippers side-by-side and put the ice water on the left dipper, the tap water in the middle dipper, and the warm water on the right.
2. Simultaneously put your right hand in the warm water, and your left hand in the ice water. Do you feel the difference in temperature?
3. Count to 10 and then put both of your hands in the tap water. Do you feel any difference in temperature?
4. Now switch hands and do the same procedure in step 3.

PROCESS QUESTIONS:

1. What did you feel when you dipped your hands in the ice water and in the warm water?
2. Is there any difference when you dipped both hands in the tap water?
3. What does this tell you about heat and temperature?

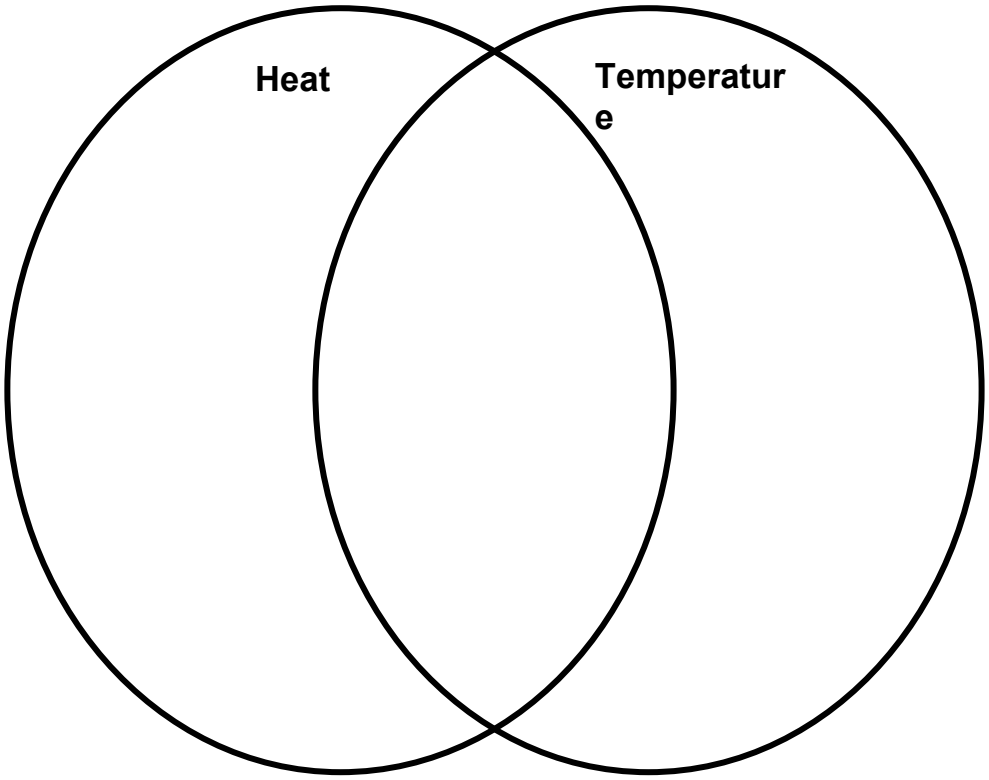
In this activity, you found out that heat is not just a physiological feeling and that it is difficult to determine which is hot or cold just by feeling it. If this is the case, then how do we distinguish between heat and temperature? In order for you to answer this question, proceed to the next activity.

ACTIVITY NO. 12: Heat and Temperature

In the previous activity, you had a short experiment on the difference between heat and temperature. This time let's look at the exact difference between heat and temperature. Click on the websites below and complete the graphic organizers that follow.

1. https://www.youtube.com/watch?v=pdtUnNEH22c – Prof. Julius Miller's video on the ideas of heat and temperature showing the distinction between the two terms
2. https://www.youtube.com/watch?v=Y4RCeTuAu_k&index=34&list=PLYYsOmj5qI6XQi0ShPhBX9afy_J0r5DXK - Paul Hewitt video on Heat and Temperature
3. http://hop.concord.org/h1/phys/h1p.html - discussion and illustration of the difference between heat and temperature

4. http://science.howstuffworks.com/dictionary/physics-terms/heat-info3.htm - discussion on heat and the different temperature measures



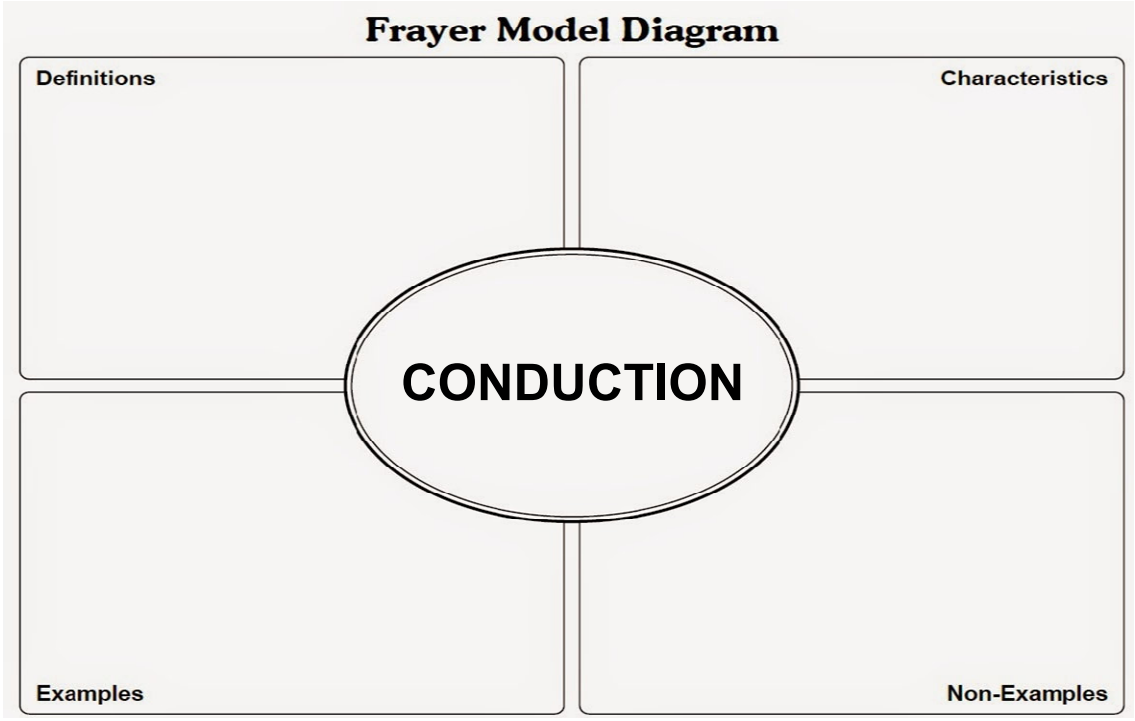
PROCESS QUESTIONS:

1. What is heat?
2. What type of molecular motion is associated with heat?
3. Can an object contain heat?
4. What is the difference between heat and temperature?
5. If something has a high temperature, does it follow that it also has high heat? Why or why not?
6. How does heat change the behavior of a particle?
7. Why does this change happen?
8. Can we predict this change? Why or why not?

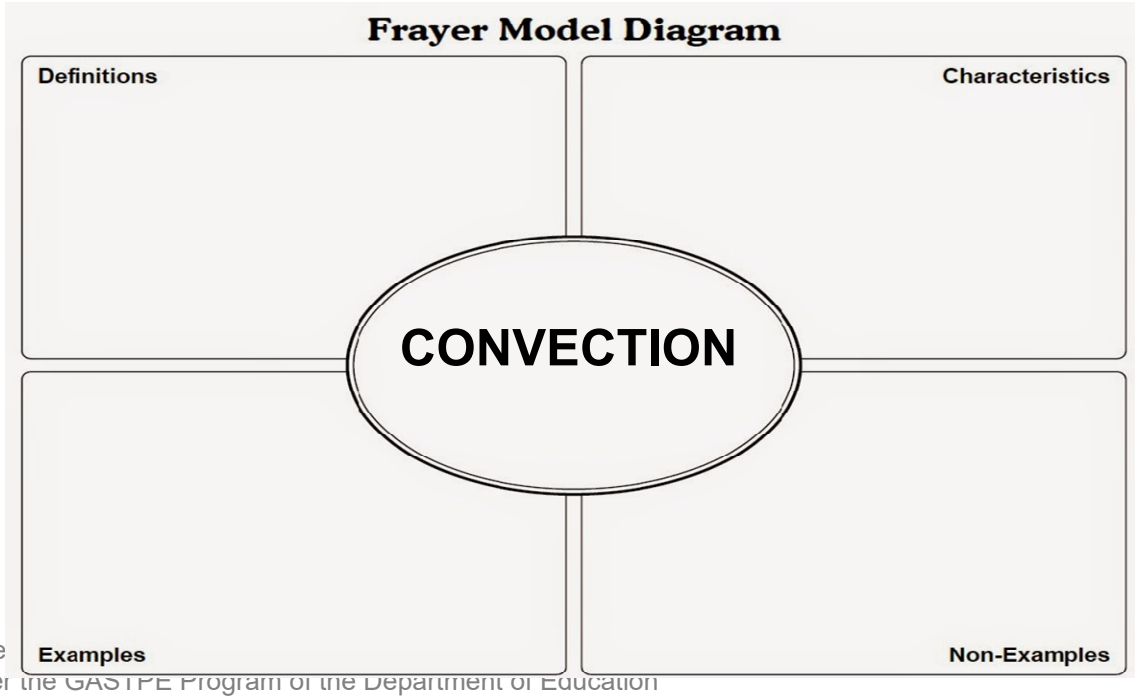
ACTIVITY NO. 13: Heat Transfer and Thermal Expansion

In the previous activity, you were introduced to the concept of heat and temperature. These two terms must be very clear to you now before you proceed

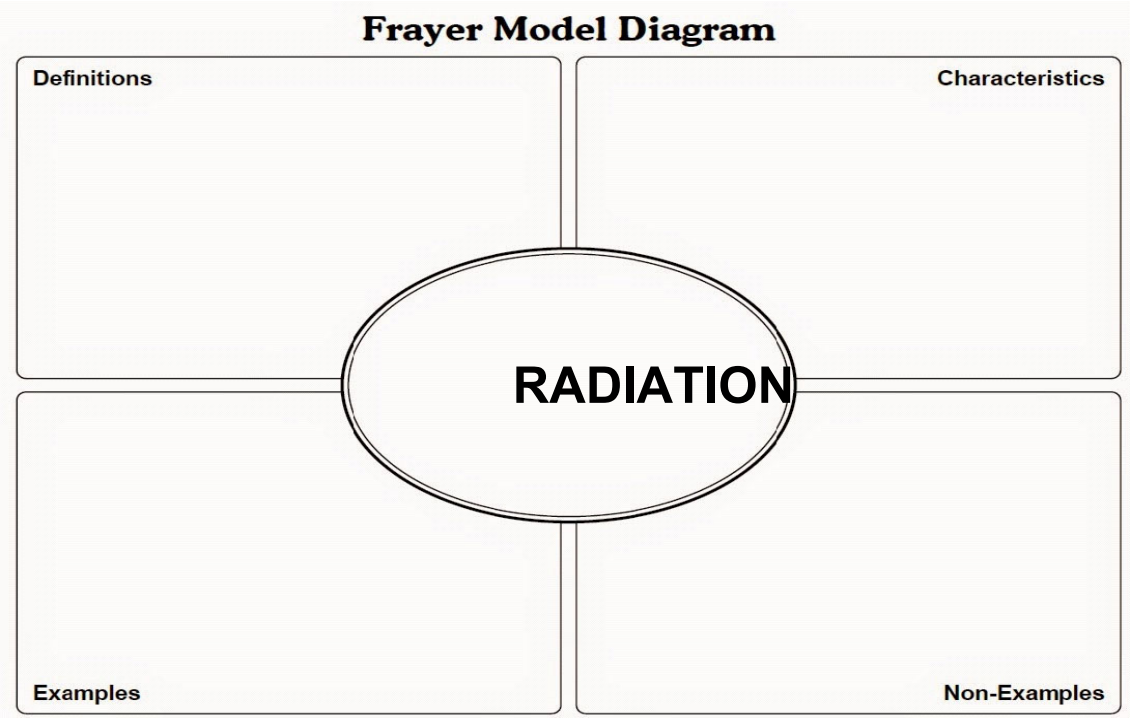
with this module. Heat, as defined in the previous activity, is energy in transit. This means that when two objects have differences in temperature, heat will flow. Click on this website https://www.youtube.com/watch?v=fBeJPpeeYJQ (Bill Nye video on heat) and complete the Frayer model graphic organizer for each method of heat transfer.



http://readingisswagg.blogspot.com/2014/08/digging-into-frayer-model-for-word.html



http://readingisswagg.blogspot.com/2014/08/digging-into-frayer-model-for-word.html



http://readingisswagg.blogspot.com/2014/08/digging-into-frayer-model-for-word.html

Now that you know the different methods of heat transfer, complete the following table below.

GADGET	Method of Heat Transfer	HOW DOES THIS WORK?
		
		
		

PROCESS QUESTIONS:

1. What condition will allow heat to transfer?
2. Why are there different methods of heat transfer?
3. What difference does each method have?

4. Will heat perpetually transfer from an area with high temperature to an area with low temperature? Why or why not?
5. Why does heat behave this way?
6. Can we predict this behavior? Why or why not?

Now you know the ways in which heat transfers. We should remember however, as pointed out in the previous activity, that heat affects the movement of particles in objects. This movement causes expansion in the objects that are heated. Click on this website https://www.youtube.com/watch?v=fZaAqRS6uOM (Prof. Julius Miller's video on the thermal expansion of solids) and watch how solids expand.

PROCESS QUESTIONS:

1. At the molecular level, what happens when heat is applied?
2. When these molecules move, what happens to the object?
3. Do molecules of gaseous substances behave in the same manner as molecules in solid when heat is applied? Why or why not?

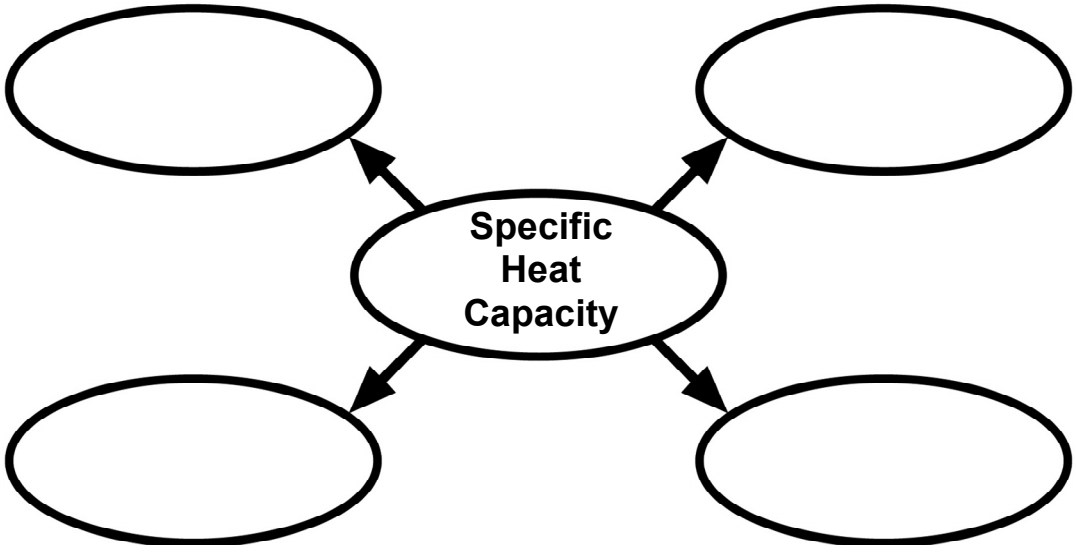
In the previous part of this activity you learned that solids expand when heated. The heat applied to the solid goes into exciting the molecules thus these molecules would move into regions were they are less concentrated. This would push molecules in the outer boundaries of the material to move towards empty space. In relation to this concept answer the following questions below.

QUESTIONS	ANSWERS
1. If you happen to pass by a bridge, you will see that it is not entire solid. Meaning, there are gaps in between segments of the bridge. Metal plates are often fitted into these like teeth. Why is this so?	
2. Whenever you change the temperature setting of an air conditioning unit, you will always	

hear a clicking sound. What could this be? Why?	
3. A friend of yours said that you should have the area of a parcel of land measured during the night if you want to buy it. Do you agree with him? Why or why not?	
4. Would you believe a friend of yours if he said that the bottle used for a 1.5-liter soda comes from a small pellet that is smaller than your thumb? Why or why not?	
5. Most glass food plates are not microwavable. They crack when they are microwaved. Why do glass food plates crack when heated?	

The next questions that need to be answered are these: (a) Does the addition or subtraction of heat always result in a change of temperature?, (b) With the application of heat, is the change of temperature the same for all substances?, and (c) If the change of temperature is not the same, what determines this? To answer all these, click these websites and complete the graphic organize that follows thereafter.

a. http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/spht.html - gives a discussion of specific heat capacity and has a heat calculator
b. http://www.iun.edu/~cpanhd/C101webnotes/matter-and-energy/specificheat.html - gives a discussion of specific heat capacity with a table of specific heats and sample word problems
c. http://www.kentshillphysics.net/thermodynamics/latent-heat-phase-change/ - a discussion of phase change and latent heats



http://www.superteacherworksheets.com/splashtop-whiteboard-flipchart-graphics.html

PROCESS QUESTIONS:

1. So what does the added or subtracted heat do to an objects temperature?
2. Will the change in temperature be the same for all substances assuming that the same amount of heat is added or subtracted? Why or why not?
3. What does the specific heat capacity of a substance tell you?

4. If you look at the specific heat capacity table presented in the websites you've just read, why do you think is water used as a coolant in automobile radiators?
5. Can we use the information on specific heat capacities to predict how much energy is needed by a substance to raise its temperature?

ACTIVITY NO. 14: Heat Calculations

In the previous activity you learned that the amount of heat lost or gained by a substance that does not undergo a change of phase is given by the equation $\boldsymbol{Q = mc\Delta T}$

where ***Q*** is the amount of heat lost or gained written in Joules (J), ***m*** is the mass of the substance in kilograms, ***c*** is the specific heat capacity of the substance in $\frac{J}{kg \cdot C^{\circ}}$ and **ΔT** is the change in temperature $\Delta T = T_{final} - T_{initial}$

.

Hence the amount of heat lost or gained by a substance can be written as $\boldsymbol{Q = mc(T_{final} - T_{initial})}$.

The equation of heat tells us that the amount lost or gained is directly proportional to the specific heat capacity of the substance. The previous activity also showed that when two objects are in contact with each other and are perfectly insulated with no heat lost or gained from the environment, then the heat flows from the object with high temperature to the object with low temperature.

Now, it's time to practice calculating heat lost or gained. Should you encounter any difficulty solving the problems listed in the table below, you may click these websites:

a. http://blowers.chee.arizona.edu/cooking/heat/ex11.html - shows an example of calculating heat with two objects involved,
b. http://www.physicsclassroom.com/class/thermalP/Lesson-2/Measuring-the-Quantity-of-Heat - gives a discussion on how heat is measured and shows examples of calculating heat, and
c. http://mypages.iit.edu/~smart/stonmar1/lessonC.htm - shows four examples of heat calculations.

QUESTIONS	***Solutions and Answers***
1) How much heat does 25 g of aluminum give off as it cools from 100 ^{0}C to 20 ^{0}C? For aluminum, c = 880 J/kg*C^0.	
2) A certain amount of heat is added to a mass of aluminum (c=0.21 cal/g*C^0), and its temperature is raised to 57 ^{0}C. Suppose that the same amount of heat is added to the same mass of copper (c=0.093 cal/g*C^0). How much does the temperature of the copper rise?	
3) Two identical metal plates (mass = m, specific heat = c) have different temperatures; one is at 20 ^{0}C, and the other is at 90 ^{0}C. They are placed in good thermal contact. What is their final temperature?	
4) A thermos bottle contains 250 g of coffee at 90 0C. To this is added 20 g of milk at 5 0C. After equilibrium is established, what is the temperature of the liquid? Assume no heat loss to the thermos bottle?	
5) A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.	

Before proceeding to the next section of this module, complete the check-bric below on heat. Remember to send a message to your teacher or post a question in the discussion group should you have any questions or clarifications regarding the concepts discussed in this section.

THE HEAT IS ON!	Yes	No	Not Quite!
1. I can explain how heat is produced.			
2. I can distinguish clearly between heat and temperature.			
3. I can determine where heat will flow given the differences in temperature of two or more substances.			
4. I can explain how a solid will behave when heat is applied to it.			
5. I can calculate the heat required to increase the temperature of a given object.			
6. I can explain why bridges have expansion joints.			
7. I can explain why home ceilings have foam insulators.			
8. I can now improve the ventilation or flow of air in my room and at home.			
9.			

End of FIRM UP:

In this section, you ventured into the molecular world in order to understand sound, light, and heat. You also learned that both sound and light are waves although they differ in the materials that they can travel on. For sound to travel, a medium must be present in order to transfer the vibrations from one particle to other. Light, on the other hand, can travel even without a medium. This explains why we can see stars that are distant from the earth. With the vibrations and movements of particles comes the production of heat. Heat, as you have learned, has something to do with the kinetic energy or movement of molecules that is why it is referred to as the energy in motion. All objects have internal energy but an object cannot contain heat. How do sound, light, and heat change? Why do such changes happen? Can these changes be predicted?

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? How can your understanding of the behavior of sound, light, and heat be of good use to you? Can we benefit from the changes that they make?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

In this section, you will venture into what your senses can perceive as part of the changes that sound, light, and heat make. Remember, all the activities here are effects of what happens deep within the molecular realm that you studied in the previous part of this module.

ACTIVITY NO. 15: Resonance and Forced Vibrations

In the previous part of this module, you learned that everything that is tapped or struck will produce sound as long as it is vibrating. What happens when something continuously vibrates? Let's look back at the video you watched in the first part of this module and look at another video showing the effects of vibration. Click on the websites below.

a. https://www.youtube.com/watch?v=TyovO2I4dPU - video showing a child breaking a wine glass using his voice
b. https://www.youtube.com/watch?v=3mclp9QmCGs – video showing the collapse of the Tacoma Bridge in the USA

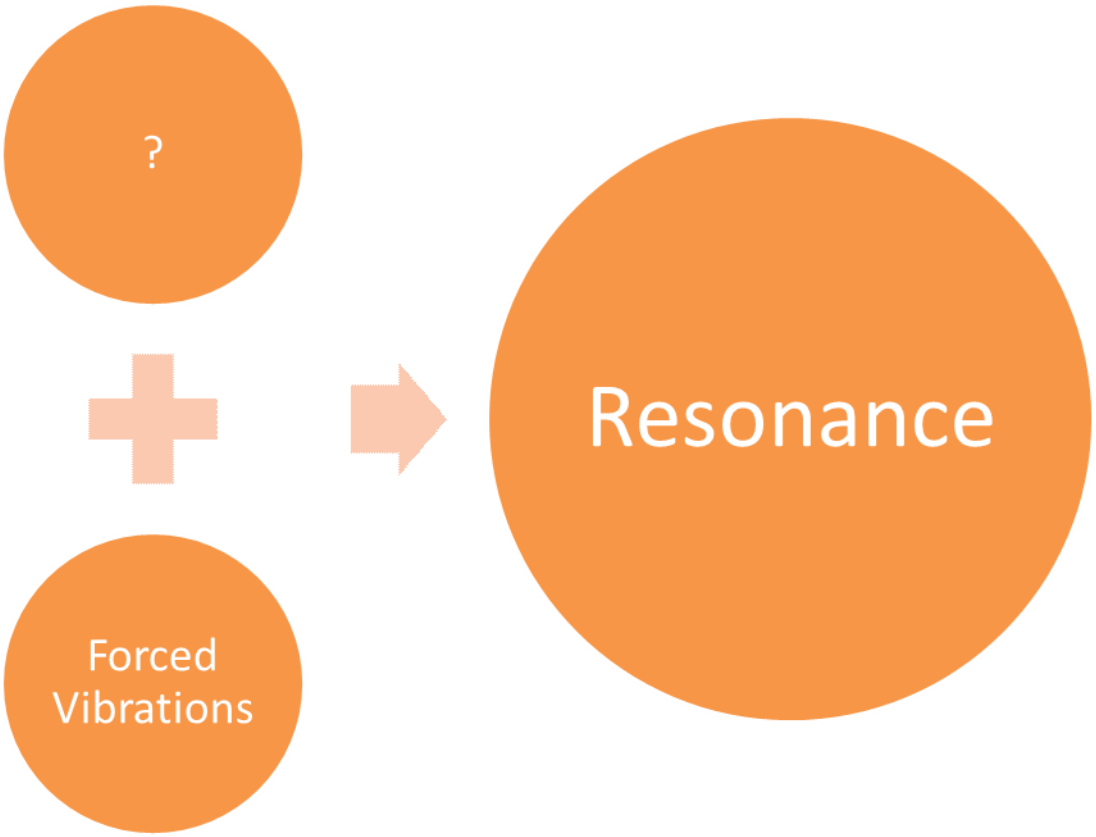
PROCESS QUESTIONS:

1. Why do you think the glass broke in the first video you watched?
2. Is it really possible to break the glass just by using your voice? Why or why not?
3. How about the second video clip, why did the bridge collapse?
4. How are these two videos related to each other?

Remember in the previous part of this module, when a molecule vibrates and hits another molecule the other molecules will be forced into vibration also. Right?

Now, do you think the child in the first video has started vibrating the molecules of the glass? Click on these websites and complete the graphic organizer that follows.

c. https://www.youtube.com/watch?v=C-Bn70PpbrM – demonstrations in Physics – resonance and forced vibrations
d. https://www.youtube.com/watch?v=bJj4Wjjf0WI – video from BBC showing a glass goblet being shattered because of sound
e. http://www.physicsclassroom.com/class/sound/Lesson-4/Forced-Vibration - discussion on forced vibrations and resonance



PROCESS QUESTIONS:

1. What does it mean when an object resonates?
2. What is the difference between resonance and forced vibration?
3. How will you explain the collapse of the Tacoma Bridge using the two concepts?
4. How about the breaking of the glass?
5. Why does sound behave like this?
6. Can we predict this behavior? Why or why not?

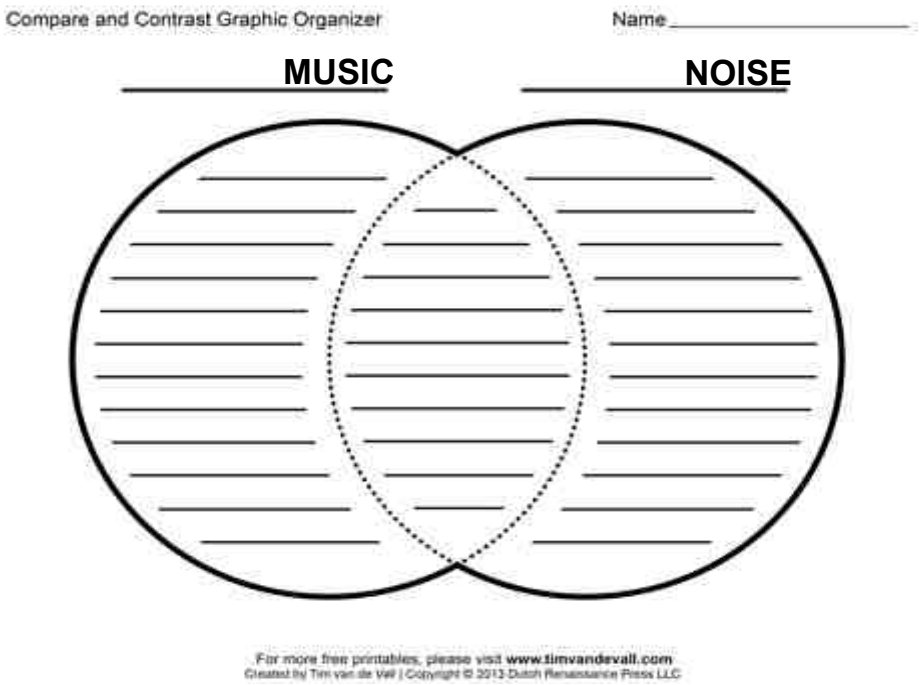
ACTIVITY NO. 16: Musical Sounds and Acoustics

When you pluck the strings of a guitar, you are forcing it to vibrate. When you start tapping the beat box, you are vibrating it. In all of these actions where we allow materials such as strings or wood to vibrate, we are trying to create a sound that is pleasing for our ears to hear – music. Click on the websites listed below and know more about how we produce music. Then complete the graphic organizer that follows.

a. http://www.infoplease.com/dk/science/encyclopedia/musical-sound.html - discussion on how some instruments produce music (for this website, also click its "FIND OUT MORE" section)
b. http://method-behind-the-music.com/mechanics/physics/ - gives a discussion about how music is produced and distinguishes between fundamental and harmonics
c. http://www.physicsclassroom.com/class/sound/Lesson-4/Fundamental-Frequency-and-Harmonics - discussion on fundamental frequency and harmonics with sample calculation of frequency; contains a timbre calculator (you may try this calculator and hear the sound that you produce by entering four different frequencies)

PROCESS QUESTIONS:

1. How is music produced?
2. What is the difference between music and noise?
3. What is the difference between a fundamental frequency and harmonics?
4. Why do different strings produce different sounds?
5. What happens when different sounds interfere with each other?
6. Why will two sounds overlap or otherwise cancel each other out?
7. Using the concept of interference, how do we reduce noise entering a house?
8. Can we prevent this? How?



The last question in the previous part of this activity might have left you wondering if interference can be prevented or not. Fortunately, there is a science that deals particularly with the interactions of sound, and how these interactions can be used to our advantage. That is, the science of acoustics. This science will help you design and construct the plenary hall of the convention center. Click on the websites below, know more about acoustics, and complete the graphic organizer that follows.

a. http://www.infoplease.com/dk/science/encyclopedia/acoustics.html - gives a discussion of acoustics and different elements that are considered in this science
b. https://www.youtube.com/watch?v=fHBPvMDFyO8 – video from Tutorvista.com showing the different elements that should be considered in building acoustics or when building an audio-visual room
c. http://www.norsonic.com/en/applications/building_acoustics/ - gives a discussion of the different elements of room and building acoustics as well as suggestions for soundproofing
d. https://www.youtube.com/watch?v=JPYt10zrclQ – video showing how sound behaves in a room and how sound can be controlled within the room

PROCESS QUESTIONS:

1. What is acoustics?
2. How is room acoustics different from building acoustics?

3. What are the different elements that must be considered when building an audio-visual room / auditorium? Describe each.
4. What happens to sound when it hit an absorbent material?
5. Why should certain behaviors of sound be controlled in an audio-visual room / auditorium?

TASK

Now, try to do a little bit of a qualitative experiment with your friends at home using the concepts that you have learned in this activity. You will need a 12-inch open-top box made of wood, packaging tape, pieces of rag (the cheap ones you can buy in the store), egg trays, Styrofoam boards, and a cellular phone. Here are the procedures:

1. Put the cellphone on the floor and cover it with the box. Make sure that the phone is not in silent mode but is in full volume.
2. Stay on the side of the box and ask your friends to stay on the other sides. Now call the number of the phone that is inside the box using another phone. Listen to the sound that you hear.
3. Now, using the packaging tape, tape the pieces of rag on the inside walls of the box so that the inside walls are covered all throughout. Do procedure numbers 1 and 2.
4. Remove the rags from the inside wall and replace these with egg trays. Make sure that all areas of the inside wall are covered with egg trays. Do procedure numbers 1 and 2.
5. Remove the egg trays from the inside wall and replace these with cut Styrofoam boards. Make sure that all areas are covered with the same thickness of Styrofoam board. Do procedure numbers 1 and 2.

PROCESS QUESTIONS:

a. On a scale of 1 to 10 with 10 being the loudest, how loud was the sound you heard with just the uncovered inside walls of the box?
b. Which inside-wall cover reduced the ringing sound of the cellphone?
c. How will this experiment help you in the design and construction of your proposal?

ACTIVITY NO. 17: Blue Skies, Red Sunsets, and White Clouds

You already know what light is and what it is made of. But most of all, you have observed several phenomena that have something to do with light. Blue skies, red sunsets, white clouds, rainbows after a rain, and a lot more! All of these must have left you hanging with a question: why do these happen? To answer your queries, click on the websites below and complete the table thereafter.

a. https://www.youtube.com/watch?v=SRh75B5iotI – Prof. Walter Lewin's lecture on Physics (start at the 27- minute mark)
b. https://www.youtube.com/watch?v=uRmdZVvzMzQ&list=PLYYsOmj5qI6XQi0ShPhBX9afy_J0r5DXK&index=43 – Paul Hewitt short lecture on rainbows
c. https://www.youtube.com/watch?v=8vUzS9b_0IE – Paul Hewitt's video on why the sky is blue and why sunsets are red
d. http://hyperphysics.phy-astr.gsu.edu/hbase/atmos/rbowpri.html - discussion on primary and secondary rainbows
e. https://www.youtube.com/watch?v=Asyzw3gMfb0 – video showing a thorough discussion of the different colors that can be seen in the sky as well as addition of colors and Rayleigh scattering

PHENOMENON	Explanation
Blue Skies	
Red Sunsets	
Primary Rainbow	

Secondary Rainbow	
Twinkling of Stars	

PROCESS QUESTIONS:

1. What properties of light are common in all of the phenomena?
2. What do these phenomena tell us about how light behaves?
3. Can we replicate these phenomena on a smaller scale? How?

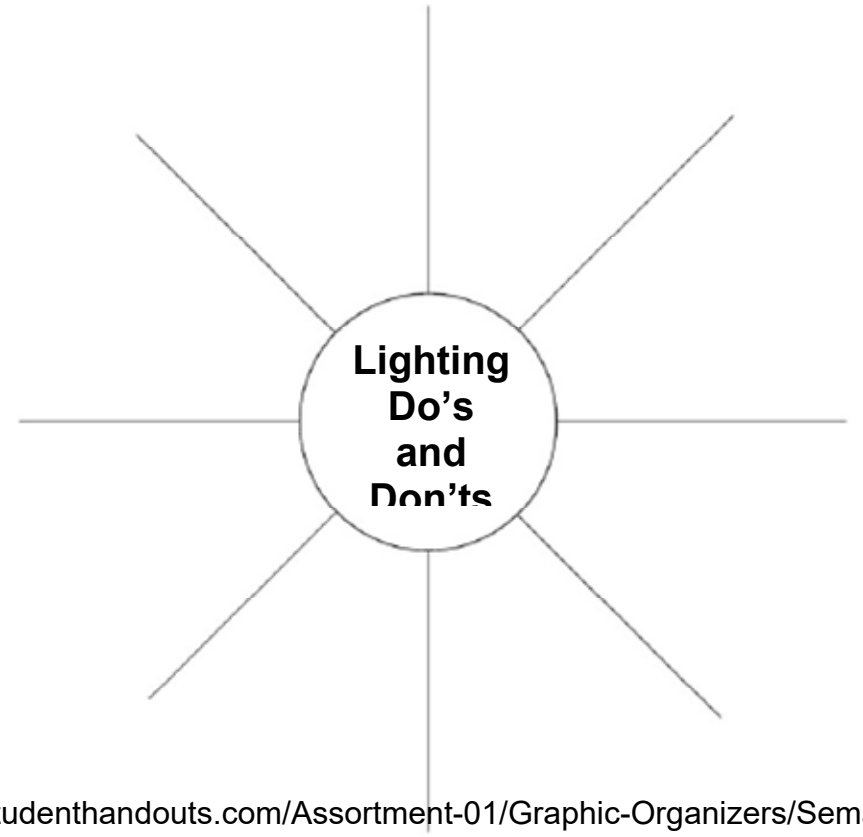
ACTIVITY NO. 18: Lighting Effects

In the Firm-up part of this module, you were introduced to the different properties of light. In this activity, we will look at how these properties are used in lighting audio-visual rooms or auditoriums. Click on the websites below and complete the graphic organizer that follows.

a. http://robertdavisinc.com/lighting.htm - webpage discussion on the different types of lighting in an auditorium
b. http://www.slideshare.net/vinay12n4/auditorium-lighting - slideshow presentation of the different elements to consider when lighting an auditorium
c. ftp://ftp.leviton.com/LevitonFTP-Public/LES/Library/ApplicationNotes/Application_Guide_-_Theater_400-900_Seats.pdf - contains a listing of equipment and their use in lighting an auditorium

Name: _____ Date: _____ Class Period: ____

Semantic Map



http://www.studenthandouts.com/Assortment-01/Graphic-Organizers/Semantic-Map-Picture.bmp

PROCESS QUESTIONS:

1. What are the factors that should be considered in lighting an audio-visual room or an auditorium?
2. Why should the lighting system be put at the proper place?
3. How does the positioning of the lights affect visual effects?
4. What are the possible equipments that you can use in your proposed plenary hall?

TASK

Now you know how auditoriums are lighted. Try to do a quick experiment on lighting. You will need adult supervision in the construction and handling of the light bulbs in sockets. For this you will need: 3 white incandescent light bulbs attached to a rubber socket with wire plugs for switching on (light bulbs should be of different wattage),

aluminum foil, plastic cellophanes (red, green, blue), white cartolina, a stapler, a step ladder, and a dark room.

Procedures:

1. Using the cartolina, make three right circular cones with different radii and cut the tip so that the wire of the socket can pass through.
2. Cover the inside portion of the cones with aluminum foil. You can do this by stapling the foil.
3. Now place one of the bulbs inside one of the cones and switch it on.
4. Switch-off the lights in the room and using a step ladder, hold the cone and observe what happens to the lighted area of the floor as you go up the ladder.
5. Using the same bulb, use the other two cones and repeat procedure number 4.
6. Repeat procedure numbers 3 – 5 for the other bulbs.
7. Repeat procedure numbers 3 – 6 but this time cover the circular base of the cone with plastic cellophane. Do this for the other colors.

PROCESS QUESTIONS:

a. Which cone lighted the biggest area on the floor?
b. What happened to this lighted area as you went up the ladder?
c. Which bulb illuminated the most floor area?
d. What was the role of the plastic cellophane?
e. Why do you only need red, green, and blue cellophanes?
f. Is it possible to have other shapes aside from cones? Why or why not?

ACTIVITY NO. 19: Putting it all Together (Revisiting the ARG)

Remember the table that you answered in the first part of this module? Look at the table once again and check the statements that you answered correctly. If your answer to a statement is incorrect, write the correct answer with explanation in the third column.

True or False	STATEMENTS	Were you correct?
	1. Sound is a transverse wave.	
	2. Vibrations of materials do not create sound.	
	3. Sound can travel in a vacuum or in space.	
	4. Sound travels faster in cold winds.	
	5. Sound travels faster in wind than in solid materials like steel.	
	6. White light is really just white.	

	7. Red, which is the first color in the visible spectrum, has the highest frequency.	
	8. Violet has the lowest energy because it has the lowest frequency.	
	9. Light does not have anything to do with the color that we see on objects.	
	10. Blue skies result from the scattering of the lowest frequency of light in the spectrum.	
	11. Heat and temperature are one and the same.	
	12. Heat is something that an object contains.	
	13. When an object is heated, the motion of the molecules of that object slows down.	
	14. Convection, as a method of heat transfer, does not involve the movement of air molecules.	

	15. The amount of energy needed to raise the temperature of an object by one degree Celsius is determined by its specific heat capacity.	

You've just finished learning about sound, light, and heat. To put more color into what you've just learned, go to www.toondoo.com and create a comic strip entitled "The Adventures of Light and Sound". You will have to register first before you can start creating your comic strip. You can start light's adventure with the heating of a Tungsten filament in a bulb. Go ahead create and share this to your friends and family.

End of DEEPEN:

In this section you went deeper into the application of sound, light, and heat in everyday phenomena. What new realizations do you have about the topic? What new connections have you made for yourself?

In your notebook, write a brief reflection on your experience about the nature of sound, light and heat. How do sound, light, and heat change? Why do such changes happen? Can these changes be predicted? How?

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is to apply your learning to real life situations. You will make a proposed design and construct a model of an audio-visual room / auditorium that will be constructed by your school. This design should contain provisions for the control of sound, lights, and heat through proper ventilation. But before you can do the task, remember what you have learned about how sound, light and heat behave.

ACTIVITY NO.20: My Music Studio: Sound, light, and Heat Proofing A Room

In this activity, you are going to transform your room into a music studio. Your house is located in a densely populated community. Sound-proofing the studio is needed so that the music or noise coming from the inside would not be heard outside and disturb your neighbors. You will also arrange the lights of that room in order for it to be conducive. And lastly, you will have to make sure that the room is properly insulated so that the air-conditioning units will work properly. You will need the assistance of your best friend here. Are you ready?

TASK

With a video cam or a cellphone camera, go to your room or to any other room in your house and describe how you are going to do the tasks mentioned earlier. You may use the table below as your guide.

1) I can make my room sound proof by …
2) This room will have a brighter look if I will add these …
3) The air-conditioning unit will work better if … (or This room will be well ventilated if…)

Once you are done filming, upload your video in Youtube and ask some of your friends or teachers to watch it and post a comment.

ACTIVITY NO.21: Sound, light, and Heat Proofing A Classroom

In the previous activity, you had to improve your own room. This time, you are going to improve sound quality, lighting, and ventilation of a classroom. The difference this time is that you will have to consider the positioning of the chairs for students' better viewing. You will also have to make sure that no noise enters or goes out of the room so that other classes as well as the class in this room will not be disturbed. Here's a picture of that classroom.

http://www.brandonhall.com/blogs/wp-content/uploads/2013/09/classroom-1.jpg

TASK

You can go to www.edublogs.org, post this picture and write a blog about the improvements that you will make. Share this to your friends and teachers and ask them to comment about the improvements you've made.

ACTIVITY NO.22: PERFORMANCE TASK:

TASK

The Cebu International Convention Center (CICC), a multimillion peso project, was built in April 2006 when the Cebu province hosted the 12th ASEAN Summit and the 2nd East Asia Summit in 2007. But when the 7.2-magnitude earthquake hit Cebu, the internal structure of the convention center was damaged. Now, the province of Cebu is asking concerned citizens and individuals for proposals in the renovation of the convention center. Before the damage, the convention center had a large plenary hall that can accommodate up to 500 people. This plenary hall served as venues for important

events such as conventions, seminars, summits, and theatrical plays. Your group has been invited to design and construct a model of a new plenary hall.

Your design should have provisions for lighting, sound, and ventilation. It is expected that the design incorporates features that will maximize sound coming from whatever activity that will be held in the venue.

Your design and model will be evaluated based on the following criteria: application of scientific concepts and principles, sustainability, space utilization, and aesthetic value.

Rubrics for the Performance Task:

CRITERIA	Outstanding 4	Satisfactory 3	Developing 2	Beginning 1	RATING
APPLICATION OF SCIENTIFIC CONCEPTS AND PRINCIPLES	The design and model uses the right type of lights and position them strategically. Provisions for the smooth propagation of sound to all parts of the plenary hall are present. Walls of the room are well insulated for optimum air-conditioning.	The design and model uses the right type of lights that are correctly positioned. Provisions for the proper propagation of sound to all parts are present. Walls of the room are insulated for functional air-conditioning.	Some lights are not well-selected. Some lights are incorrectly positioned. Sound is inaudible in some parts of the plenary hall. Wall insulation is present but insufficient.	The design and model does not use the right type of lights and these are all incorrectly positioned. There are several “deaf” areas in the plenary hall. Air-conditioning units will have to work harder due to poor insulation.	
SUSTAINABILITY	The plenary hall is easy to maintain involving minimal cost. It can be used for several years.	The plenary hall requires regular maintenance with considerable cost. It can be used for several years.	The plenary hall has a slightly expensive maintenance cost and can only be used for a few years.	The plenary hall has a high maintenance cost and cannot be used long enough.	
SPACE UTILIZATION	Seating arrangement is thoughtfully designed to accommodate more than the previous capacity of	Seating arrangement is designed to accommodate the previous capacity of the hall. No	Seating arrangement can only accommodate the previous capacity of the hall.	Seating arrangement is poorly planned and can only accommodate a few people. Most	

	the hall. There are no seats blocked by columns. View from any area in the audience is pleasing.	seats are blocked by columns. View from any area in the audience is pleasing.	Some seats are blocked by columns.	of the seats are blocked by columns.	
AESTHETIC VALUE	The color used in the painting of the walls is soothing and calming for any event that will be held in this structure. The seats allow maximum comfort for participants in any event.	The color used in the painting of the walls is appropriate for several events that will be held in this structure. The seats are comfortable to sit upon for any event.	Only some events can be held in the plenary hall because of the wall color. The seats can be uncomfortable for long-hour events.	The color used for the walls is appropriate only for a few events. The seats are uncomfortable and cause physical strain.	
				OVERALL RATING	

Before you go to the post-assessment, write a *REFLECTION* in your synthesis journal about your experiences in the entire lessons. You may choose to answer one, or all of these guide questions:

1. What have you learned about the entire lesson? Is it challenging to see the world you live in?
2. What would our life be without sound, light and heat?
3. What other tasks would you like to work on in the future that could be beneficial to humans and the environment?

End of TRANSFER:

In this section, you designed and created a model of an AVR / Auditorium that will be built by your school using the concepts you learned about sound, light, and heat. Your design incorporated all aspects related to the behavior of the three concepts.

How did you find the performance task? How did the task help you see the interactions among these natural phenomena?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT:

Let's find out how much you have learned from this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Congratulations! You have finished this module.

1. Which of the following is the correct arrangement of a secondary rainbow?
   A. Red, Orange, Yellow, Green, Blue, Violet
   B. Yellow, Orange, Red, Green, Violet, Blue
   C. Violet, Blue, Green, Yellow, Orange, Red
   D. Green, Blue, Red, Yellow, Orange, Violet

2. Why do we see blue skies?
   A. The particles in the atmosphere during the day are bigger than a tenth of a micron thus scattering the bigger wavelength of blue light.
   B. The particles in the atmosphere during the day are big enough to absorb all the blue light thus we see the sky as blue.
   C. The particles in the atmosphere are smaller than a tenth of a micron thus it scatters blue light predominantly in the atmosphere.
   D. The particles in the atmosphere are enormously big that allows it to reflect the blue light which has a bigger wavelength than violet.

3. A huge block of ice has more thermal energy than a very hot cup of coffee because _____.
   A. the cup of coffee has a higher temperature compared to the block of ice
   B. the block of ice has more molecules jostling against each other
   C. the temperature of the coffee causes its molecules to jostle more
   D. the cup of coffee melts all of the block of ice

4. Cebu experienced scattered rain showers as the people celebrated the New Year 2015. They say that the firecrackers they lit, which were of the same kind as last year's, could not be heard from a distance as compared to when they celebrated the New Year 2014. A look at the weather reports on that day of 2014 showed that Cebu was experiencing a very hot day. What could be the reason why the sound cannot be heard from afar?
   A. The distance of the firecrackers from the observers were just so far that the energy of the sound has already dissipated upon reaching their ear.
   B. The firecrackers may have gotten wet before it exploded. The moisture slowed down the reaction happening inside the firecrackers.
   C. There were a lot of heavy water molecules in the air, which slowed down the vibrations for the transmission of sound.
   D. The sound emanating from the explosion of the firecrackers were transmitted in an upward direction.

5. The speed of a sound wave in air depends on _____.
   A. its frequency
   B. its wavelength
   C. air temperature

D. all of the above

6. Why will sound travel faster in solids than in liquids?
   A. Solids have particles that are bigger than those in liquids so when one of these particles are set into vibration the other particles will also vibrate immediately.
   B. Solids have loose particles that are easily set into vibration once it is tapped or applied with sound.
   C. The particles of solids are near each other so when it is tapped, the vibration is easily transferred from one particle to the other.
   D. The particles of solids are very far from each other so when it is tapped, the vibration pushes the nearby air molecules in between particles.

7. While at a concert, a wind blows directly from the orchestra toward you. The speed of sound you hear is _____.
   A. decreased
   B. increased
   C. both decreased and increased in some parts
   D. neither decreased nor increased

8. Your friend was playing with the water hose when he noticed colors dispersed by the water. Which of these could he have seen?
   A. a single color
   B. low frequency color
   C. high frequency color
   D. all colors of the rainbow

9. As you stir a hot cup of coffee with a metal spoon, you notice that the spoon becomes warm. When you leave the coffee for some time and come back, you noticed that the spoon became warmer. Why is this so?
   A. Heat has flown from the spoon to the coffee.
   B. Heat has flown from the hot cup of coffee to the spoon.
   C. The hot molecules of the spoon have transferred to the coffee to keep it warm.
   D. The hot molecules of the coffee have transferred to the spoon thus making it warm.

10. A friend of yours is doing an experiment about sound. He has with him an electric bell and a bell jar connected to a vacuum pump. At the start of the experiment, the bell is rung and then slowly the bell jar is pumped out of air. After some time of pumping out air, your friend noticed that he could no longer hear the bell but he can still see it operating. Why is this so?
    A. The bell jar was airtight that no sound could pass through it that no one from the outside could hear it.
    B. The evacuation of air from the jar has stopped the machine from functioning thus you can no longer hear the sound.
    C. When air from the bell jar was pumped out, the air molecules needed for vibration is gone. Thus, sound can no longer be transmitted.
    D. The bell did not produce enough sound to pass through the jar. Only the sound of the vacuum pump can be heard once the air was pumped out.

11. What is the advantage of having matte (nonglossy) pages in a book rather than pages with a glossier surface?
    A. The printed material in glossy surfaces will be erased through time whereas in a nonglossy paper, the prints will be permanent.
    B. Rough pages provide diffuse reflection which can be viewed from any angle. If the page were smooth, it could only be viewed well at certain angles.
    C. Glossy surfaces reflect more light which makes it hard to read as compared to nonglossy surfaces which do not reflect any.
    D. Both materials would do equally well because it just depends on the reader of the book.

12. The yellow clothes of a stage performer appear black when illuminated by light that is _____.
    A. blue
    B. cyan
    C. magenta
    D. all of the above

13. Adding the same amount of heat to two different objects does not necessarily produce the same increase in temperature. Why not?
    A. Different objects have different thermal properties due to the differences in the way energy is stored internally in the substances. That leads to differences in their specific heat capacities.
    B. The addition of heat meant that fast-moving molecules were also added to these objects. But some of the molecules in the objects reject these so the effect on temperature is different.
    C. They should have the same effect because the addition of heat always results in a change in temperature. Or a change in temperature is the same as a change in heat.
    D. Temperature and heat are one and the same. When we heat something, its temperature rises as well. When heat is removed, its temperature lowers.

14. An iron thumbtack and a big iron bolt are removed from a hot oven. Both are red-hot and have the same temperature. When dropped into identical containers of water of equal temperature, which one raises the water temperature more?
    A. the bolt
    B. the thumbtack
    C. both will raise the temperature at the same level
    D. neither of the two

15. After you measure the dimensions of a plot of land with a steel tape on a hot day, you return and re-measure the same plot on a cold day. On which day do you determine the larger area for the land?
    A. during the cold day
    B. during the hot day
    C. the land will have the same area
    D. incomplete data to say something about area

16. After you have driven a car for some distance, why does the air pressure in the tires increase?
    A. Air coming from the outside enters into the tires thus adding-up to the number of molecules of air inside the tires. More molecules mean more pressure on the tires.
    B. The circular motion of the tires causes the air molecules to be spun around. As they spin around, these molecules bump into the exterior of the tires creating more pressure.
    C. The tires heat up, which heats the air within. The molecules in the heated air move faster, which increases air pressure in the tires.
    D. In order for the car to remain on the ground, the air molecules inside the tires push it towards the outer portion of the rim. This increases the pressure readings in the tire.

17. In Olympic competition, a microphone detects the sound of the starter's gun and sends it electrically to speakers at every runner's starting block. Why?
    A. The electronic starting gun does not rely on the speed of sound through air, which favors closer runners, but gets the starting signal to all runners simultaneously.
    B. Some of the runners will not be able to hear it properly because of the noise coming from the stands. Hence, it must be done using the speakers.
    C. The sound coming from the starting gun is blocked by people watching the event thus the need to have it electronically sent to the speakers.
    D. The sound of the starting gun is not too loud so some of the runners cannot hear it properly. It is therefore sent electrically to the speakers at each starting block.

18. Why is it a sensible procedure for soldiers to break step when marching over a bridge?
    A. A bridge is narrow so not all of them will fit to pass altogether.
    B. Some soldiers will really break step in order to catch up with the other group.
    C. They need to break step so that they will not set the bridge into forced vibration or resonance.
    D. They need to break step so that they can pass through the bridge quickly and not delay all other passers-by.

19. A ripe yellow banana will appear black when illuminated with _____ light.
    A. black
    B. blue
    C. green
    D. red

20. How could you use the spotlights in a play to change the performers' clothes suddenly from yellow to black? You illuminate him with the _____ colored spotlights.
    A. green and yellow
    B. blue and yellow
    C. blue and green
    D. black and white

GLOSSARY OF TERMS USED IN THIS LESSON:

Amplitude – for a wave or vibration, the maximum displacement on either side of the equilibrium position

Conduction – in heat, energy transfer from particle to particle with certain materials, or from one material to another when the two are in direct contact

Constructive Interference – combination of waves so that two or more waves overlap to produce a resulting wave of increased amplitude

Convection – means of heat transfer by movement of the heated substance itself, such as by currents in a fluid

Crest – one of the places in a wave where the wave is highest or the disturbance is greatest in the opposite direction from a trough

Destructive Interference – combination of waves so that crest parts of one wave overlap trough parts of another, resulting in a wave of decreased amplitude

Diffraction – bending of light that passes around an obstacle or through a narrow slit, causing the light to spread and to produce light and dark fringes

Diffraction grating – series of closely spaced parallel slits or grooves that are used to separate colors of light by interference

Diffuse reflection – reflection of waves in many directions from a rough surface

Dispersion – separation of light into colors arranged according to their frequency

Echo – reflection of sound

Electromagnetic spectrum – range of frequencies over which electromagnetic radiation can be propagated

Frequency – for a vibrating body or medium, the number of vibrations per unit of time; for a wave, the number of crests that pass a particular point per unit time

Heat – the energy that flows from one object to another by virtue of a difference in temperature

Heat of Fusion – amount of energy that must be added to a kilogram of a solid (already at its melting point) to melt it

Heat of Vaporization – amount of energy that must be added to a kilogram of a liquid (already at its boiling point) to vaporize it

Interference – result of superposing different waves, often of the same wavelength

Light – visible part of the electromagnetic spectrum

Longitudinal wave – wave in which the individual particles of a medium vibrate back and forth in the direction in which the wave travels

Monochromatic Light – light made of only one color and therefore waves of only one wavelength and frequency

Natural Frequency – frequency at which an elastic object naturally tends to vibrate if it is disturbed and the disturbing force is removed

Node – any part of a standing wave that remains stationary; a region of minimal or zero energy

Partial tone – one of the many tones that make up one musical sound; each partial tone (or partial) has only one frequency

Period – the time required to complete a single cycle; for vibrations or waves, the time required for one complete cycle

Photon – light manifesting as a particle; as a corpuscle of light

Prism – triangular solid of a transparent material such as glass that separates incident light by refraction into its component colors

Radiation – energy transmitted by electromagnetic waves

Reflection – return of light rays from a surface in such a way that the angle at which a given ray is returned is equal to the angle at which it strikes the surface

Refraction – bending of an oblique ray of light when it passes from one transparent medium to another

Resonance – phenomenon that occurs when the frequency of forced vibrations on an object matches the object's natural frequency, producing a dramatic increase in amplitude

Reverberation – persistence of a sound, as in an echo, due to multiple reflections

Sound – longitudinal wave phenomenon that consists of successive compressions and rarefactions of the medium through which the wave travels

Specific heat capacity – quantity of heat required to raise the temperature of a unit mass of a substance by 1 degree Celsius; often simply called specific heat

Temperature – measure of the average translational kinetic energy per molecule of a substance, measured in degrees Celsius or Fahrenheit or in kelvins

Transverse wave – wave with vibration at right angles to the direction the wave is traveling

Trough – the lowest part of a wave
Vibration – oscillation; a repeating to-and-fro motion about an equilibrium position – a “wiggle in time”

Visible light – part of the electromagnetic spectrum that the human eye can see

Wave – a “wiggle in space and time”; a disturbance that repeats regularly in space and time and that is transmitted progressively from one place to the next with no net transport of matter

Wave speed – speed with which the waves pass a particular point

Wavelength – distance between successive crests, troughs, or identical parts of a wave

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

1) https://www.youtube.com/watch?v=TyovO2I4dPU - video showing a child breaking a wine glass using his voice

2) http://www.brightstorm.com/science/physics/vibration-and-waves - video discussions on vibrations and waves by Dr. Jonathan Osbourne

3) http://www.physicsclassroom.com/class/waves - webpage discussion on waves and its properties

4) http://www.physicsclassroom.com/calcpad/waves/problems - contains problem sets on wave basics including audio guided solutions

5) https://www.youtube.com/watch?v=kt1pTcfstC8 – Bill Nye's video on sound properties

6) http://www.youtube.com/watch?v=HVGE854x1yQ – video showing how sound is produced and how it is propagated

7) http://www.physicsclassroom.com/calcpad/sound - shows an overview of the problem sets about sound and the different properties that are associated with sound)

8) http://www.physicsclassroom.com/calcpad/sound/problems.cfm - problem set about sound and its properties)

9) http://hendrix2.uoregon.edu/~dlivelyb/phys101/lab8_s07.pdf - pdf file containing experiments about sound)

10) www.vic**physics**.org/**doc**uments/teachers/unit3/**sound**/**SoundTest**1.**doc** - test on sound

11) https://www.youtube.com/watch?v=gtgBHsSzCPE – Bill Nye the science guy video on light and color

12) http://www.physicsclassroom.com/class/light/Lesson-1/Wavelike-Behaviors-of-Light - shows a discussion on the properties of light as it behaves as a wave

13) http://www.ivyroses.com/HumanBody/Eye/What-is-Light.php - gives a discussion about the nature of light, white light, and its propagation

14) http://physics.tutorvista.com/light.html - enumerates the different properties of light

15) http://physics.info/color/ - Physics hypertextbook containing information about color an how we see color

16) http://www.physicsclassroom.com/class/light/Lesson-2/The-Electromagnetic-and-Visible-Spectra -this website is the start of lesson 2 which is about light and color

17) https://phet.colorado.edu/en/simulation/color-vision - contains a downloadable simulation of the color humans perceive when photons of light are varied

18) https://www.youtube.com/watch?v=pdtUnNEH22c – Prof. Julius Miller's video on the ideas of heat and temperature showing the distinction between the two terms

19) https://www.youtube.com/watch?v=Y4RCeTuAu_k&index=34&list=PLYYsOmj5qI6XQi0ShPhBX9afy_J0r5DXK - Paul Hewitt video on Heat and Temperature

20) http://hop.concord.org/h1/phys/h1p.html - discussion and illustration of the difference between heat and temperature

21) http://science.howstuffworks.com/dictionary/physics-terms/heat-info3.htm - discussion on heat and the different temperature measures

22) https://www.youtube.com/watch?v=fBeJPpeeYJQ - Bill Nye video on heat

23) https://www.youtube.com/watch?v=fZaAqRS6uOM - Prof. Julius Miller's video on the thermal expansion of solids

24) http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/spht.html - gives a discussion of specific heat capacity and has a heat calculator

25) http://www.iun.edu/~cpanhd/C101webnotes/matter-and-energy/specificheat.html - gives a discussion of specific heat capacity with a table of specific heats and sample word problems

26) http://www.kentshillphysics.net/thermodynamics/latent-heat-phase-change/ - a discussion of phase change and latent heats

27) http://blowers.chee.arizona.edu/cooking/heat/ex11.html - shows an example of calculating heat with two objects involved,

28) http://www.physicsclassroom.com/class/thermalP/Lesson-2/Measuring-the-Quantity-of-Heat - gives a discussion on how heat is measured and shows examples of calculating heat, and

29) http://mypages.iit.edu/~smart/stonmar1/lessonC.htm - shows four examples of heat calculations.

30) https://www.youtube.com/watch?v=TyovO2I4dPU - video showing a child breaking a wine glass using his voice

31) https://www.youtube.com/watch?v=3mclp9QmCGs – video showing the collapse of the Tacoma Bridge in the USA

32) https://www.youtube.com/watch?v=C-Bn70PpbrM – demonstrations in Physics – resonance and forced vibrations

33) https://www.youtube.com/watch?v=bJj4Wjjf0WI – video from BBC showing a glass goblet being shattered because of sound

34) http://www.physicsclassroom.com/class/sound/Lesson-4/Forced-Vibration - discussion on forced vibrations and resonance

35) http://www.infoplease.com/dk/science/encyclopedia/musical-sound.html - discussion on how some instruments produce music (for this website, also click its “FIND OUT MORE” section)

36) http://method-behind-the-music.com/mechanics/physics/ - gives a discussion about how music is produced and distinguishes between fundamental and harmonics

37) http://www.physicsclassroom.com/class/sound/Lesson-4/Fundamental-Frequency-and-Harmonics - discussion on fundamental frequency and harmonics with sample calculation of frequency; contains a timbre calculator (you may try this calculator and hear the sound that you produce by entering four different frequencies)

38) http://www.infoplease.com/dk/science/encyclopedia/acoustics.html - gives a discussion of acoustics and different elements that are considered in this science

39) https://www.youtube.com/watch?v=fHBPvMDFyO8 – video from Tutorvista.com showing the different elements that should be considered in building acoustics or when building an audio-visual room

40) http://www.norsonic.com/en/applications/building_acoustics/ - gives a discussion of the different elements of room and building acoustics as well as suggestions for soundproofing

41) https://www.youtube.com/watch?v=JPYt10zrclQ – video showing how sound behaves in a room and how sound can be controlled within the room

42) https://www.youtube.com/watch?v=SRh75B5iotI – Prof. Walter Lewin's lecture on Physics (start at the 27- minute mark)

43) https://www.youtube.com/watch?v=uRmdZVvzMzQ&list=PLYYsOmj5qI6XQi0ShPhBX9afy_J0r5DXK&index=43 – Paul Hewitt short lecture on rainbows

44) https://www.youtube.com/watch?v=8vUzS9b_0IE – Paul Hewitt's video on why the sky is blue and why sunsets are red

45) http://hyperphysics.phy-astr.gsu.edu/hbase/atmos/rbowpri.html - discussion on primary and secondary rainbows

46) https://www.youtube.com/watch?v=Asyzw3gMfb0 – video showing a thorough discussion of the different colors that can be seen in the sky as well as addition of colors and Rayleigh scattering

47) http://robertdavisinc.com/lighting.htm - webpage discussion on the different types of lighting in an auditorium

48) http://www.slideshare.net/vinay12n4/auditorium-lighting - slideshow presentation of the different elements to consider when lighting an auditorium

49) ftp://ftp.leviton.com/LevitonFTP-Public/LES/Library/ApplicationNotes/Application_Guide_-_Theater_400-900_Seats.pdf - contains a listing of equipment and their use in lighting an auditorium

Lesson 4: The Safe Connection

INTRODUCTION AND FOCUS QUESTION(S):

Charges are present in any object as atoms are present in them. Positive and negative charges exist in atoms as protons and electrons, respectively.

When the number of these charges happen to be different, then the object is said to be charged. One type of electrical charge is electron. These electrons can be transferred from one object to another by several ways. When these electrons are on the run, they transfer energy. The energy supplied to the electrons will determine how fast they should run and how much energy they should carry.

In this module, you will find out how these movements of tiny electrons make great impacts in our day to day living. A very good example for this is the use of electronic gadgets and devices.

Remember to search for the answers to the following question(s):

How do electrons flow? How do electrons pass energy? When do electrons start to flow?
Can the transfer of energy be controlled?
What is the best way to save energy?

LESSONS AND COVERAGE:

In this lesson, you will examine this question when you take the following topics:

Lesson 4.1 – The Electric Current

Lesson 4.2 – The Electric Circuit

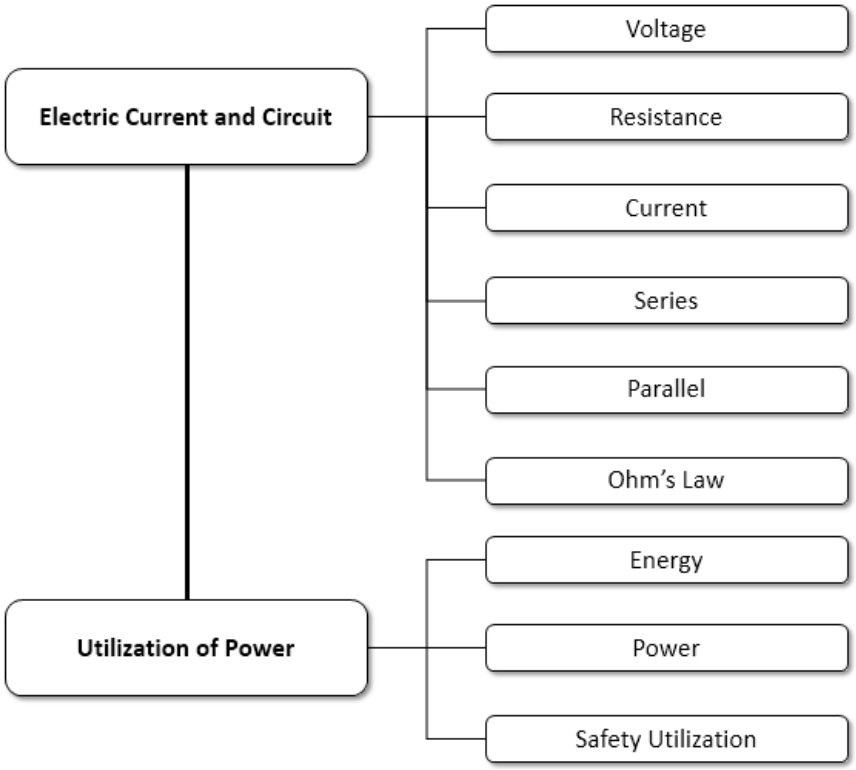
Lesson 4.3 – Safety in Electrical Connections

In this lesson, you will learn the following:

Lesson 4.1	• infer the relationship between current and charge; power and energy; current-voltage-resistance (K) • differentiate electrical power and electrical energy (K)
Lesson 4.2	• explain the advantages and disadvantages of series and parallel connections in homes (P)

	• quantify current, voltage, resistance, power or energy using appropriate formula (P)
Lesson 4.3	• explain the functions of circuit breakers, fuses, earthing, double insulation, and other safety devices in the home (P)

MODULE MAP:
Here is a simple map of the above topics you will cover:



EXPECTED SKILLS:
To do well in this lesson, you need to remember and do the following:

- read articles and take note of some important points;
- manipulate online interactively to investigate certain relationships;
- sketch schematic diagrams of safety and energy-saving circuits;
- quantify voltage, current or resistance based on their relationship in Ohm's Law;
- establish relationship between energy and power, energy and resistance;
- use web 2.0 tools in communicating ideas; and
- propose creative and effective way to educate community about safety electrical connections.

PRE-ASSESSMENT:

Let's find out how much you already know about this lesson. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this lesson.

1. Which of the given below should be done to give an electrically neutral object a positive charge?

   A. Add protons to it
   B. Add electrons to it
   C. Remove protons from it
   D. Remove electrons from it

2. A negatively charged rod is held near a neutral pith ball. What happens to the ball and rod before and after touching each other?
   A. Both will repel
   B. Both will attract
   C. Will repel then attract
   D. Will attract then repel

3. Which of the following ***BEST*** describes the electron flow in a circuit?

A. The direction of electron movement

B. The total charge of the electrons
C. The rate of electron movement
D. The number of electrons

4. Which of the following ***BEST*** describes the electron flow in a circuit?

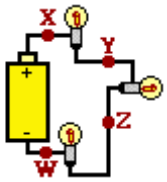
A. The direction of electron movement

B. The total charge of the electrons
C. The rate of electron movement
D. The number of electrons

4. Resistance of a wire is r. The wire is stretched to double its length, then its resistance in ohms is_____

A. r / 2
B. 4 r
C. 2 r
D. r / 4

5. The electric circuit shown below consists of a battery and three identical light bulbs. Which of the following statements is TRUE concerning this circuit?



A. The current through point X will be greater than that through point Z.
B. The current through point Z will be greater than that through point Y.
C. The current will be the same through points X, Y and Z.
D. The current through point X will be greater than that through point Y.

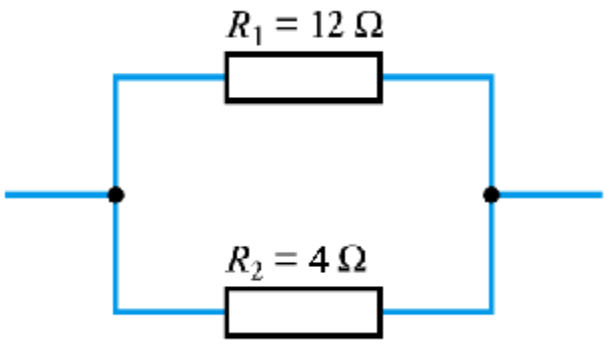
6. An electric current of 6A is the same as:
A. 6 Coulomb/second
B. 6 Joule/second
C. 6 watts/second
D. 6 Newton/second

A. 6 Coulomb/second
1A is equivalent to 1 Coulomb/second

7. The resistance of an electric bulb drawing 1.2 A current at 6.0 V is _____.

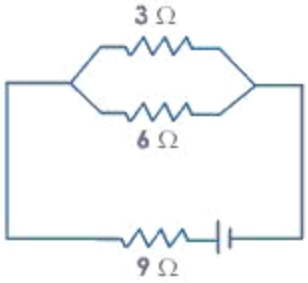
A. 0.5 W
B. 5 W
C. 0.2 W
D. 2 W

8. Calculate the effective resistance of the following combination.



A. 3Ω
B. 6 Ω
C. 10 Ω
D. 16 Ω

9. Given the figure below, identify which of the given statements is correct?



. A. 6 W , 3 W and 9 W are in series

B. 9 W and 6 W are in parallel and the combination is in series with 3 W

. C. 3 W , 6 W and W are in parallel

D. 3 W , 6 W are in parallel and 9 W is in series

10. Calculate the effective resistance of the following combination.

A. 5
B. 35
C. 42
D. 49

11. In a parallel circuit containing set of bulbs, if one of the bulbs blew up, what happens to the effectiveness of the resistance?

A. Remains same
B. Increase
C. Decrease
D. Fluctuate

12. Birds can safely stand on high voltage electric power lines. This is because ____.

A. they are at low potential with respect to the ground.
B. they offer no resistance to current.
C. they always choose power lines that are not in use.
D. the potential difference between their feet is low.

13. Household circuitry are prevented from overheating by means of which of the following below:

A. fuse
B. switch
C. socket
D. transformer

14. Which of the given statements below is **NOT** true about extension cords?

A. They are used for operating multiple electrical devices
B. Their current capacities are not specified if they are sold in the market
C. Overheating may result if the current exceeds its rating
D. None of these is true

15. You have this set of materials: cloth, rubber, water and copper. Which of these is known as a poor conductor of electricity?

A. Rubber
B. Copper
C. Water
D. Steel

16. Different circuits are used in households for different reasons or purposes. Why is the use of series circuits not advisable or practical?

A. The bulbs can be controlled individually
B. The current becomes slower as you add more output devices
C. The power stays the same if having multiple sources
D. Other devices will not be affected if one runs out or does not function

17. Circuit breakers are part of every household's electrical systems, which of the following below best explains how does it prevent electrical fires?

A. By storing potential energy for later use
B. By providing a path for excess charges to get to the ground
C. By reducing the voltage supplied to electrical devices
D. By melting if the current gets too high

18. You are asked by your teacher as your project to build a device that can conduct current but will be safe if touched by a person. Which of the following pairs of materials could you possibly use?

A. Glass as conductor, rubber as insulator

B. Copper as conductor, silver as insulator
C. Sand as conductor, plastic as insulator
D. Silver as conductor, plastic as insulator

19. Why does the body experience a shock after touching an electric wire?
A. The current flows the path of most resistance
B. The current flows through the person than the wire
C. The new path gives a small current
D. The new path has high resistance leading to high current

20. You are an electrical engineer who wants to help the people of your barangay to be informed about the importance of electrical safety in the household. Which of these statements is BEST to be given?
A. Accidents will never happen if the house does not have fuses and circuit breakers.
B. Octopus connections can be of great help with less risk in the household.
C. Parallel connections will allow the appliances to be used independently
D. The body is not that sensitive in case an electric shock happens

Lesson 4.1: Electric Current

EXPLORE

Every day, you face several devices that are run by electricity. You also see different devices that seemingly supply this electricity - there are the electrical outlets at home, and batteries in your flashlights and cars. A good question is "How do they supply energy?"

In a very ordinary manner, batteries are needed to run small devices like flashlight. What does the battery do? If the battery is totally consumed, what is being consumed? How do we moderate this consumption? Can this consumption be moderated? Answering these questions will move you nearer to answering **"What is the best way to save energy?"**

Let's begin by knowing the important players in this topic.

ACTIVITY NO. 1: KWHL Chart

In the KWHL chart below, fill in K, W and H columns with what you already know, what you want to know about electricity, and how you will find the information you need to know. Click "submit" when you're done.

ELECTRICITY

Things that I **KNOW**	Things that I **WANT TO KNOW**	**HOW** will I find it out	

When you are done with KWH portions of the first activity, reflect on some questions:

1. What are the concepts or ideas related with electricity that you know?
2. How did you know about these concepts or ideas that you have written in the chart?
3. How can you relate these ideas with what you have observed at home?
4. How do you save energy? Why is it important to do it?
   (EQ) "What is the best way to save energy?"

Let's start meeting what you want to know by doing this next activity.

ACTIVITY NO. 2: Getting to Know V, I, R

Read the article found in https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law/all and watch the video in (1) https://www.youtube.com/watch?v=nnLf090OPNg (2) (3) https://www.youtube.com/watch?v=yRirbKxnYc0 to describe voltage, current and resistance. Describe voltage, current and resistance and their relationship in analogy. Find an appropriate picture (not illustrations) of analogy from the internet. Below the picture, write the analogy.

PROCESS QUESTIONS:

1. Between thick wire and thin wire, which has greater resistance?
2. What does the voltage do to the electrons?
3. What is meant by big and small current?
4. How is current related with electrons?
5. How do the electrons pass energy?

End of EXPLORE:

You just tried finding out voltage, current and resistance and their roles in the circuit. You just shared your ideas about voltage, current and resistance and their respective roles in the circuit.

What you will learn in the next sections will also enable you to do the final project which involves making an effective educational campaign about prudent and safety use of electricity.

FIRM-UP

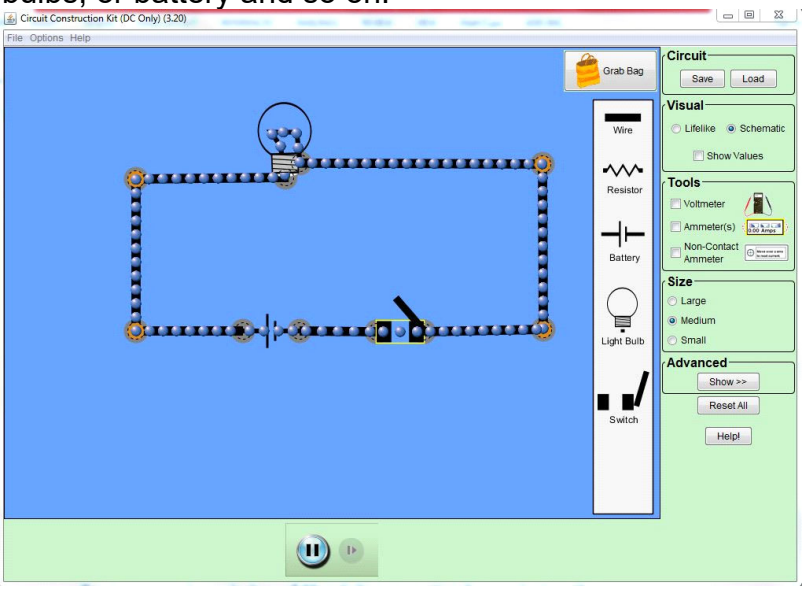
Your goal in this section is to learn and understand key concepts about electrical current and circuits. By doing this next activities, you will be able to investigate the relationship among voltage, current and resistance in different types of circuits. Also, we will be reflecting on the given questions*:*
How do electrons flow? How do electrons pass energy? **What is the best way to save energy?**

ACTIVITY NO. 3: A Simple Circuit

Follow the steps below to complete this activity.

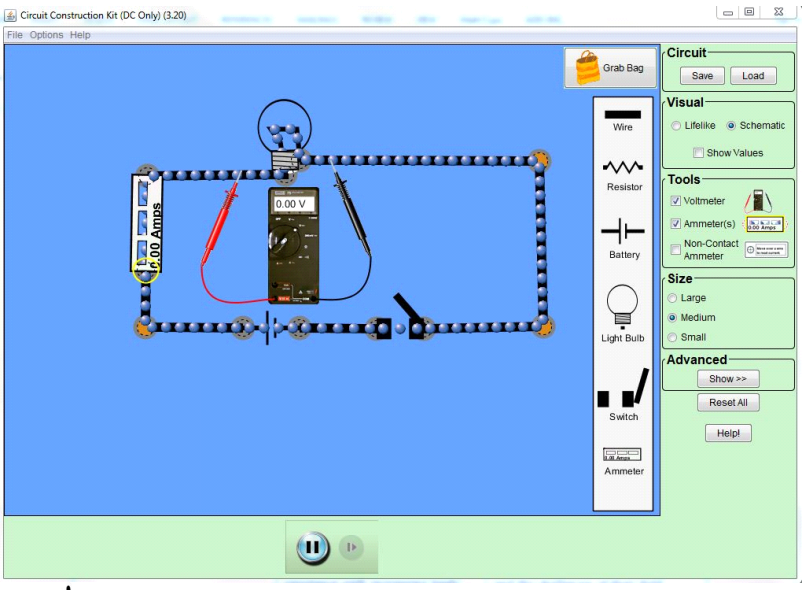
Part 1: Construct a circuit

1. Open the simulation on http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc-virtual-lab
2. Download the sims. Java player is required so that it can run.
3. In the main panel on the right, choose **Schematic** for **Visual.**
4. Construct a simple circuit similar to the one below. Take your time to explore around the applet. Try splitting a junction, adding additional wire, or light bulbs, or battery and so on.



5. Now try adding voltmeter and ammeter.
   a. *What do ammeter and voltmeter measure?*
   b. *How are they connected in the circuit?*

   Refer to the next picture for the answer.



It should be noted that the voltmeter measures the potential difference, so one (black electrode) must be connected to the region where the energy of the electrons has not been used up yet and the other one (red electrode) must be connected to the region where the electrons have already given up some of their energy to the bulb. That should give you a difference.

Note: Connect the black electrode to any part in the right side since this part has not used up the energy yet while the red electrode must be attached to the part nearer the bulb.

6. Close the switch. Take note of the reading of the ammeter and voltmeter. Now try moving the electrodes of voltmeter around like putting on the same point or interchanging their places.

    a. *What voltmeter reading do you get when the electrodes are on the same point? Why is that so?*
    b. *What voltmeter reading do you get when the electrodes are interchanged? Why is that so?*
    c. *Why is the ammeter connected in such a way? What does it measure?*

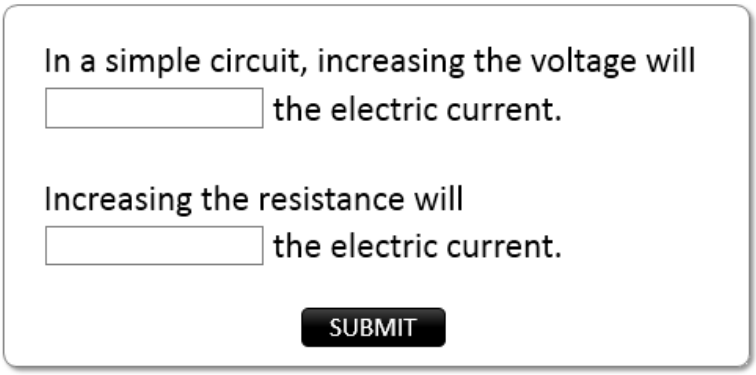
7. Hit the pause button. With all parts of the circuit in place, add one more battery. Close the circuit and note the reading. You can add more batteries to explore.

    a. *When adding battery to the circuit, what does it have to do with the electrons?*

8. Hit the pause button. With all parts of the circuit in place, remove the battery until there is just one in the circuit. But increase the number of bulbs to two, three and four. Note: the black electrode should always be on the region before the electrons' energy are used up and the red electrode should always be on the region on the region after the electrons have given their energy to all the bulbs in the circuit. Close the circuit and note the readings.

    1. *When light bulbs are added to the circuit, what does it have to do with the electrons?*

9. Now summarize your findings in the field below



10. Fill in the 3-2-1 field.

11. Save your work for compilation.

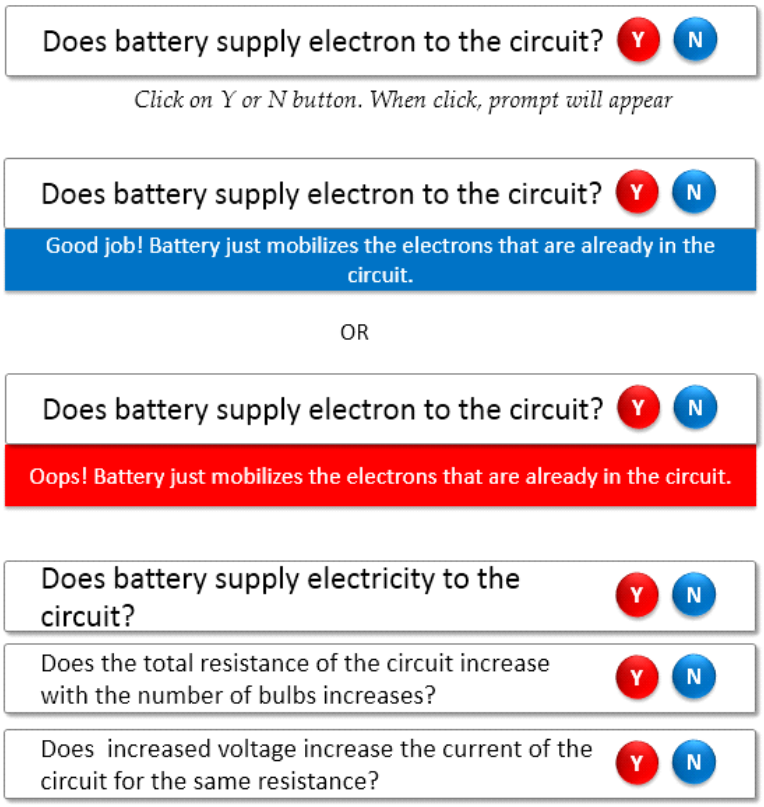
You have just established the most basic yet important relationship that all engineers and scientists need to know.

Congratulations! As we proceed, you will watch this video and take note of some important details about series and parallel connections. Do as good or better as you did your previous activity.

ACTIVITY NO. 4: Note Taking from a Video Lecture

1. Click on the link https://www.youtube.com/watch?v=d_5CWIYUoqk listen to the lecture.
2. Take some important notes so you can answer the following questions.

   Click on Y button if your answer to the question is YES and N button if it is a NO.



If you got 4 out of 6 parts, then you did a good job!
You have done a **good** *job in this activity. You are now ready to take the next Laboratory Simulation.*

You have done **fair** *job in this activity. If you need clarification of some concepts, you can go back to the activity or leave your teacher a question for clarification.*

The previous activity allowed you to use the materials in making a circuit. You were able to realize that electrons that flow in a circuit can produce electricity lighting bulb

ACTIVITY NO. 5: Ohm's Law in Series and in Parallel Circuits

1. Before we proceed to measuring the current and voltage, click on this site and practice your skill on building circuit: http://thefusebox.northernpowergrid.com/page/circuitbuilder.cfm
After that practice, you are now equipped to test the current and voltage in series and parallel circuits.

2. This activity uses the same application that you used in Activity 1.3. Open that application if you have downloaded it or click on this link:

https://phet.colorado.edu/en/simulation/circuit-construction-kit-ac . Although your work and submission is online, it is better though to print this handout for you to write the data you will obtain from the virtual lab.

3. Read the printed handout carefully as this will guide you to assemble your set up.

   a. *What happens to the voltage across each bulb in series circuit as the number of bulbs increases? What about the current?*
   b. *What happens to the brightness or performance of each bulb as their number is increased?*
   c. *What happens to the voltage across each bulb in parallel circuit as the number of bulbs increases?*
   d. *What happens to the brightness or performance of each bulb as their number is increased?*
   e. *Which type of circuit must the one used at home be?*
   f. *What happens if there are more and more bulbs connected in parallel?*
   g. *What happens when there are more and more appliances connected to the outlets found in homes?*

In the previous activity, you learned the effect of increasing number of loads to voltage drop and total current. You will need to do some intelligent reasoning for the next activity. Let us see how sound how much you have learned.

ACTIVITY NO. 6: How Electricians Work

Interview an electrician in your locality. Take note of some important information you need to know from him and from his work. Your task is to tell potential electricians how useful electricians are. You will also tell them common precautionary measures that they have to consider while working. you will compose your report using voki application (www.voki.com). Find time to explore the application first. If you need some clarification, ask your teacher.

1. *What safety precautions electricians have to consider when working?*

2. *What types of circuit are they installing and when do they use each type?*
3. *Can they add an infinite number of appliances to the circuit at home? Why or why not?*
4. *What safety features do they install to avoid problems caused by electricity?*
5. *What tips can they give to reduce energy consumption?*
6. *Why are these tips they important for people to do in the society?*

ACTIVITY NO. 7: Power and Voltage

Your task in this activity is to simple differentiate and relate electrical power and voltage. You will differentiate them in electron level that is, talk about power and voltage in the perspective of electrons. You will end your work by telling the relationship of power and voltage in the perspective of an electrician. Your work will be published online using prezi application (www.prezi.com). Explore the application and if there are questions, fell free to ask your teacher. Reminder, prior to working with prezi, have the the information verified by your teacher.

ACTIVITY NO. 8: Power Consumption Inventory

List down all available appliances in use at home. Write them on the table and complete the table.

Appliance	Wattage	Time of usage (30 min, 1hr etc)	No. days used (per week)	No. weeks used	Cost per day	Cost per month
TOTAL						

To calculate the daily and monthly cost, click on *http://apps.meralco.com.ph/appcal/* . Calculate the daily power cost of each appliance and get the total.

1. *Is the bill you calculate almost the same as what your family actually pays? Why or why not?*
2. *Can you say that you are a wise user of energy?* Why?

3. *What tip can you give to people who might want to save power consumption?*

EQ: "What is the best way to save energy?"

End of FIRM UP:

You have completed a more demanding segment of your learning module with good responses. You are such a fast learner! Take note of what you've learned because you will be needing them to complete your performance task. To reach to your performance task, you have to complete four more little tasks.

DEEPEN

Your goal in this section is to learn safety in electrical connections. The task you are to complete in this segment is very important in completing your performance task and in answering the questions- **What is the best way to save energy?**

Why don't you start with the next activity?

ACTIVITY NO. 9: Safety Connections

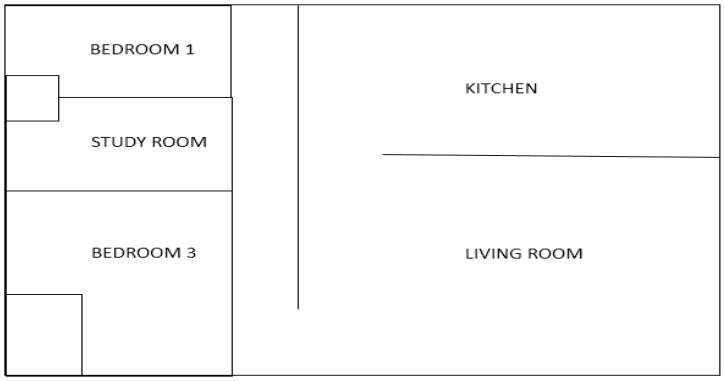
Search from the net from electricians the safety devices they installed in the home electrical wiring system to make it safety to use without the threat of overloading, overheating and eventually fire. List them in the table below

Safety device	Picture	How to use	benefits

You now know the safety devices that electricians use to keep our electrical lines at home safety. Let's see if you can successfully install them at home by doing the next activity.

ACTIVITY NO. 10: Connection Challenge

Assign the given sets of appliances to 5 different areas in the house. Show where to safely put the safety devices and show how to connect these appliances. Your goal is make an energy saving and safety connection.



15	20-watt	light bulb
4	10-watt	lamp shade
3	90-watt	TV set
2	500-watt	Refrigerator
5	50-watt	Electric fan

1. *Describe the work of an electrician.*
2. *Is there any other possible way of connecting them to make the electrical system as safety by more energy-saving?*
3. *How should homeowners make their connections safety and energy-saving?*

ACTIVITY NO. 11: Let Me Analyze

You are given three different situations below. Analyze each and answer the question/s that follow/s:

Situation 1:

Leah is fond of doing things all at the same time. She watches her favorite tv show every 7:00 in the evening, while chatting with her friends on line. She

stays in their living room, but did not use the lights, as she wants to save electricity.

What can you say about Leah's activity?
How does she conserve electricity?

Situation 2:

Alex wants to invite his friends in their house this Saturday. He plans to have his group play video game all day. His mother told him that they can also watch their favorite movie or listen to music if they want to. Upon hearing this, he's so happy that he starts calling his friends on the phone to give this good news.

Will Alex be able to save electricity? Why? Why not?
How will he conserve electricity considering his plan?

Situation 3:

Kyle was asked by his parents to look after his younger sister. He was in his room when his mom called him. Before going out of his room, he made sure the lights were off, the tv unplugged and aircon switched off.

Did you agree on what Kyle was doing? Why did you say so?
How did Kyle save electricity?

Which among the three given situations showed the **best way of saving electricity?** Based on the given situation, what generalization can you now make about the best way to save electricity? What does savings depend on?

ACTIVITY NO. 12: First Step to Safety

Now you are given a chance to plan for your own dream house and put as many appliances as you need but have in mind the safety and energy-saving. Make a rough floor plan of your dream house and put the lights, the kind of light, the appliances that you need, the ventilation etc. most importantly, include the safety devices that you wish to use in the electrical connections. You may refer to some energy-saving house models from the net. Take picture of your floor plan and upload it for submission.

Click to upload picture

Write your description here

End of DEEPEN:

Fantastic! You have completed this segment with your beautiful and safety dream house! In the next segment, we will examine some models of energy-efficient and safety houses. Few more steps and were done.

TRANSFER

Your goal in this section is to tell others the best way to make our connection energy-saving and safe.

ACTIVITY NO. 12: Best Practices

Examine some best practices of energy-saving. Find at least three models from various sources: internet, magazine, books, etc. There are several in architecture sites and magazines.

Describe their common way of making energy-efficient homes. Have them describe in a blog. (WordPress)

1. *What are the commonalities among these energy-efficient homes?*
2. *What safety features are installed?*
3. *Can that be imitated in a simple house? Why or why not?*
4. *What do you suggest to a simple homeowner to make their connections energy-saving and safe?*

Good job! You are now qualified to make a campaign. Alas! This is your last task so make it the best.

ACTIVITY NO. 13: Save and Safety Campaign

You live in a barangay where residents frequently experience fires due to electrical failures. As a head of the local electric company, you will make a campaign that will educate the residents on safety and energy-saving practices. Your campaign will consider informative contents, accuracy of the contents, effective strategy and engaging. Therefore, you have the freedom to choose your own way to disseminate information in the most efficient way. The questions below will serve as your guide in your campaign presentation.

1. *Why do you think your work is effective?*
2. *What do you think would be the audiences' response to your campaign?*
3. *What problems did you think may occur in this project?*
4. *How will you manage it?*
5. *How will you convince your audience about the best way to save and safety electrical connections?*

Also, you will be graded based on the given rubric:

RUBRIC: Campaign Presentation

CRITERIA	4 ADVANCED	3 PROFICIENT	2 DEVELOPING	1 BEGINNING
Informative 35% Ability to supply content and organize ideas clearly and orderly that are relevant to the theme	The content of the campaign ad encourages the people to promote the purpose and importance of saving energy . Its ideas show clarity and correct information. It is scientific and supported by interesting details	The content of the campaign ad encourages the people to promote the purpose and importance of saving energy . The ideas show clarity. The content is scientific and free from errors	The content of the campaign ad encourages the people to promote the purpose and importance of saving energy but some of the information is erroneous	The content of the campaign ad does not encourage the people to promote the purpose and importance of saving energy . The content is not scientific at all.
Creativity 20% Ability to exhibit and execute concept creatively.	The concept used in the campaign ad is unique and appealing	The concept used in the campaign ad is common, well executed, and catches attention.	The concept used in the campaign ad is heavily borrowed and lacks appeal.	The concept used in the campaign ad is ambiguous and does not catch attention
Effectiveness 25% Ability of the presenter to exhibit mastery and clarity in introducing the campaign ad.	The campaign ad communicates opinions and information in a striking way.	The campaign ad communicates opinions and information in a clear way.	The campaign ad communicates opinions and information of the maker with some effectiveness in a distracting way.	The campaign ad communicates opinions and information of the maker with limited effectiveness .
Engaging 20% Ability to capture the audience to participate thoroughly in the discussion during the campaign ad	The audience's attention and interest (are sustained) are enthusiastic throughout the campaign and audience interact	The audience's attention and interest are sustained throughout the campaign	Audience's attention and interest (are caught at the beginning of the campaign but not necessarily sustained) are inconsistent	Campaign did not catch the attention and interest of the audience

End of TRANSFER:

In this section, your task was to tell others the best way to make our connection energy-saving and safe.

How did you find the performance task? How did the task help you see the real world use of the topic?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment test.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next lesson. If your score is not at the expected level, you have to go back and take the lesson again.

1. Which of the following will you increase if you want to increase the flow of current in a circuit?
   A. load
   B. temperature
   C. resistance
   D. voltage

2. Which of the following statements does NOT represent Ohm's law?
   A. resistance x potential difference = current
   B. potential difference/current = constant
   C. current x resistance = potential difference
   D. current/potential difference = constant

3. Which of the following is TRUE about the current in a wire?
   A. it depends on the potential difference applied
   B. it depends on both resistance and potential difference
   C. it depends only on the resistance of the wire
   D. it does not depend on resistance and potential difference

4. Which of the following is needed for the charges to flow through a circuit?
   I. resistor or another electrical component
   II. a potential difference
   III. a conducting path
   A. I only
   B. II only
   C. I and II only
   D. all of the above

5. The resistance of a conductor does NOT depend on its _____.
   A. length
   B. cross-sectional area
   C. mass
   D. resistivity

6. Which among the given materials have the highest resistivity?
   A. silver B. aluminum C. glass D. polystyrene

7. The purpose of fuses and circuit breakers is to _____.
   A. decrease the resistance in a series circuit

B. prevent breaks in the circuit
C. prevent circuits from overheating
D. allows the overheating of circuits

8. According to Ohm's law, as the resistance in a circuit _____, the current _____.
A. increases, remains constant
B. increases, doubles
C. increases, decreases
D. decreases, decreases

9. When a portable radio is playing, the current in the radio is 0.3 A. If the resistance of the radio is 30.0 Ω, what is the voltage supplied by the radio battery?
A. 9 V B. 15 V C. 6V D. 12 V

10. What is the equation to find current in a series of three resistors?
A. $I = V(R_1 + R_2 + R_3)$
B. $I = V/ (R_1 \times R_2 \times R_3)$
C. $I = V/ (R_1 + R_2 + R_3)$
D. $I = V (R_1 \times R_2 \times R_3)$

11. A 3 pcs 30 Ω resistors are connected in parallel. This group is then connected in series with a 20 Ω and 40 Ω resistors. What is the equivalent resistance of the circuit?
A. 50 Ω B. 60 Ω C. 70 Ω D. 100 Ω

12. As a safety precaution, what should be done first before plugging in the power cord?
A. check that the tool belongs to you
B. mark a danger zone or area
C. keep the tool storage box handy
D. make sure the switch is in its "off" position

13. Where is the most dangerous place to use electrical equipment?
A. indoors
B. near water
C. outdoors
D. near other electrical equipment

14. You discover the electrical cord on a drill has been damaged and some of the cord's insulation is missing. What should be done to fix this?
A. wrap tape around the damaged spot to prevent electrical shocks
B. check to see if the drill still works
C. tag the drill out of service and notify the department responsible for equipment maintenance
D. make sure that the cord does not come in contact with the floor

15. Injuries from electricity can include which of the following?
A. electric shock that may or may not result in electrocution

B. falls
C. burns
D. all of the above

16. What happens when an electric switch is turned off?
A. A circuit breaker turns off
B. The circuit is broken
C. The circuit becomes a series circuit
D. There is a short circuit

17. If you have a 90 V power source with a 30 Ω and 60 Ω resistor in series, what is the voltage drop over the 60 Ω resistor?
A. 2 V B. 30 V C. 60 V D. 90 V

18. If you have two lights in parallel and you add another identical light in parallel, what happens to the total current?
A. it increases
B. it decreases
C. it remains the same
D. it becomes zero

19. Why must an ammeter have an extremely low resistance?
A. High resistance reduces risk of fire.
B. High resistance changes the voltage reading
C. High resistance will change the current in the circuit you want to measure
D. High resistance ensures that there are fewer ohms

20. What must a voltmeter have to function properly?
A. it must have very low resistance
B. it must have very high voltage
C. it must have high currents
D. it must have high resistance

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law/all
https://www.youtube.com/watch?v=nnLf090OPNg
https://www.youtube.com/watch?v=yRirbKxnYc0
These sites contain articles and video presentations that will help the students do the activity in the Getting to Know part about the relationship between Voltage, Current and Resistance (V, I, R)

http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc-virtual-lab
This site is for the simulation activity of the student about making a simple circuit. They will be able to have a visual presentation using Java player of a simple circuit

https://www.youtube.com/watch?v=d_5CWIYUoqk
This link is for a video lecture about circuit making. Students can get additional information watching this video about circuit making

http://thefusebox.northernpowergrid.com/page/circuitbuilder.cfm
This site is to provide students additional practice skill on building a circuit

https://phet.colorado.edu/en/simulation/circuit-construction-kit-ac .
This is for the virtual lab of making a simple and parallel circuit. Students will have a better idea about the difference in the making of a simple and parallel circuit

www.voki.com
In this site, students will be asked to submit their activity on how electricians do their work and how to give importance to saving electricity

www.prezi.com
This is for students output on power and voltage similarities and differences. They will make a presentation for the given topics

http://apps.meralco.com.ph/appcal/ .
This link is for students' calculations of the given power supply. This is for the activity Power Consumption Inventory

http://www.glencoe.com/qe/scienceOLC.php?qi=7933
This site contains some questions for electrical circuits