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DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Science

Quarter 4
Lesson
6

Lesson Exemplar for Science Grade 8
Quarter 4: Lesson 6 of 8 (Week 6)
SY 2025-2026

Development Team

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SCIENCE (PHYSICS) /QUARTER 4/ GRADE 8

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	1) As an object falls from a height, its energy is conserved because its potential energy is transformed to kinetic energy. 2) The resources of the Philippines provide many benefits to its people and their activities.
B. Performance Standards	*By the end of the Quarter,* learners demonstrate understanding of the technical meaning of acceleration and apply their understanding to everyday situations involving motion. They represent and interpret acceleration in distance-time and velocity-time graphs to make predictions about the movement of objects. Learners link motion to kinetic energy and potential energy and explain transformations between them using everyday examples. Learners relate understanding of kinetic energy and potential energy to an appreciation of the hydro-electric resources of the Philippines for the generation of electricity for use in homes, communities, and industries. They use scientific investigations to explore the properties of light and apply their learning to solving problems in everyday situations.
C. Learning Competencies and Objectives	Describe conservation of energy in everyday situations involving gravity, such as when objects fall; *Lesson Objective 1: Explain the condition of energy in an isolated system.* *Lesson Objective 2: Demonstrate practical examples of how energy is neither created nor destroyed but changes only into other forms.* Gather information from secondary sources to explain how potential energy stored in lakes and dams in the Philippines is used to produce kinetic energy to generate electricity for use in homes, communities, and industry; *Lesson Objective 1: Illustrate & explain the energy generation and transformation to energy distribution systems.* *Lesson Objective 2: Analyze and compare the different characteristics of the hydroelectric power plants in the Philippines.* *Lesson Objective 3: Discuss the impacts of dam construction on the natural ecosystem in the environment and local communities.*
D. Content	1. Conservation of Energy ***a. Principles of Conservation of Energy*** In an isolated system, energy remains constant and is neither created nor destroyed; it only changes from one form to another. ***b. Conservation in System*** Conservation of energy applies to isolated systems where no external forces are acting. In such systems, the total mechanical energy (kinetic + potential) remains constant over time. ***c. Energy Conversion*** As objects move in gravitational fields, their potential and kinetic energies interchange. For instance, a falling object converts potential energy into kinetic energy as it accelerates toward the ground.

	2. Utilizing Potential Energy from Lakes and Dams for Electric Generations **a. *Hydroelectric Power Generations*** Hydroelectric power generation involves converting the potential energy stored in water reservoirs behind dams into kinetic energy as water flows through the dam, turning turbines connected to generators that produce electricity. **b. *Energy Transformation*** The potential energy stored in elevated water bodies, such as behind dams, is transformed into kinetic energy as water descends through the dam structure, driving turbines that generate electrical energy. **c. *Engineering Applications*** Civil engineers design hydroelectric dams to capitalize on the conversion of water's potential energy to kinetic energy, which is then further transformed into mechanical and electrical energy for use in homes, communities, and industries. **d. *Environmental Considerations*** While hydroelectric power is a clean energy source, the construction of dams can impact natural ecosystems and local communities by altering water flow patterns and habitats.
E. Integration	Conservation of Energy in Hydroelectric Power Plants, Environmental Impacts of Dam Construction

II. LEARNING RESOURCES

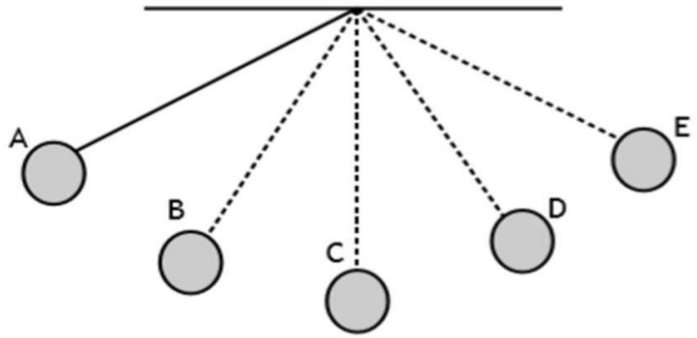
Hewitt, P.G. (2021). Conceptual Physics Global Edition (13th ed.). Pearson Addison-Wesley

University of Colorado(n.d.) Energy Skate Park.
https://phet.colorado.edu/sims/html/energy-skate-park/latest/energy-skate-park_all.html

Science Buddies. Paper Roller Coasters: Kinetic and Potential Energy.
https://www.sciencebuddies.org/teacher-resources/lesson-plans/roller-coaster-kinetic-potential-energy#

TeachEngineering. Ignite STEM Learning in K-12.
https://www.teachengineering.org/lessons/view/duk_rollercoaster_music_less

TeachEngineering. Ignite STEM Learning in K-12.
https://www.teachengineering.org/activities/view/cub_energy2_lesson08_activity2
https://education.nationalgeographic.org/resource/hydroelectric-energy/
https://www.usgs.gov/media/images/a-turbine-connected-a-generator-produces-power-inside-a-dam

III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	**DAY 1** **1. Short Review** ***Instruction*:** Make use of the figure below about the path of a swinging pendulum to answer the following questions: a. Which letter indicates the highest potential energy? b. Which letter indicates the greatest kinetic energy? c. Which letter indicates the lowest potential energy? d. Which letter indicates the lowest kinetic energy? e. Which letter indicates that kinetic energy and potential energy are equal? f. Neglecting friction, what is the value of the total energy at all points of a pendulum's path?  *Path of a Swinging Pendulum*	This may be done by demonstrating a swinging pendulum, followed by asking questions and giving an illustration of the path of the swinging pendulum. Note: In the illustration, A & E is assumed to have the same level. **KEY to Short Review** a. A & E b. C c. C d. A & E e. B & D f. KE + PE
B. Establishing Lesson Purpose	**1. Lesson Purpose** ***Instructions*:** Written below are the learning targets. Learners assess themselves in terms of their level of confidence in accomplishing the learning targets before and after learning the lesson. The learners will write the numbers before and after the instruction. 3 – Confident 2 – Moderately Confident 1 – Not Confident	

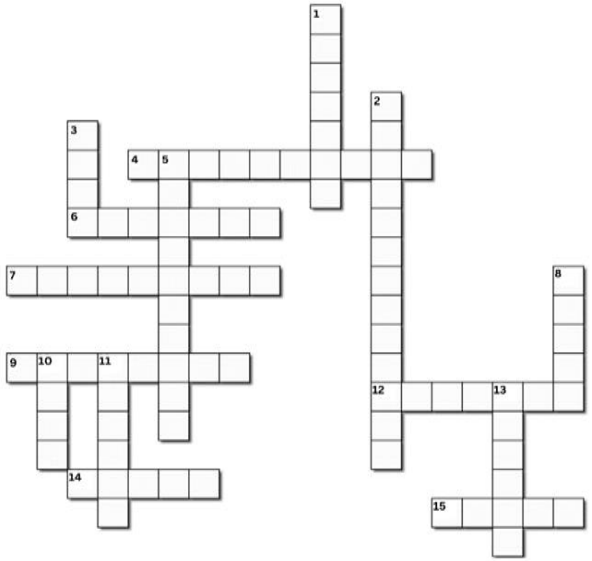
Learning Targets	Before Learning the Lesson	After Learning the Lesson
1) I can explain the condition of energy in an isolated system.		
2) I can demonstrate practical examples of how energy is neither created nor destroyed but changes only into other forms.		
3) I can illustrate & explain the energy generation and transformation to distribution systems.		
4) I can analyze and compare the different characteristics of the hydroelectric power plants in the Philippines.		
5) I can discuss the impacts of dam construction on the natural ecosystem in the environment and local communities.		

2. Unlocking Content Area Vocabulary

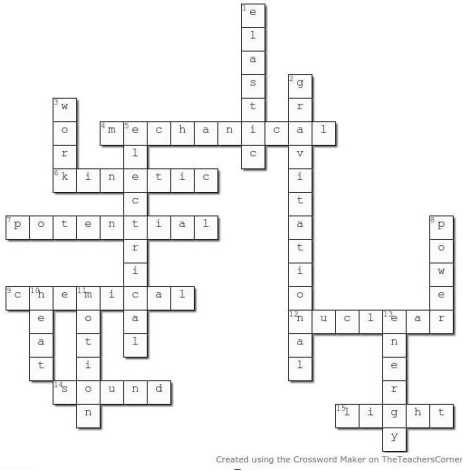
Instruction: Answer the following crossword puzzle.

Did you Know?

Complete the crossword puzzle below.



Answers to the Crossword Puzzle



	Across 4. Sum of kinetic and potential energy 6. Energy of motion 7. Stored energy 9. Energy present in gasoline 12. Energy released from the core of atoms 14. Mechanical energy transmitted through a medium 15. Form of electromagnetic radiation **Down** 1. Energy present in springs 2. Energy present in going at a certain height 3. Product of force and displacement 5. Energy due to motion of electric charges 8. Rate of doing work 10. Transfer of energy from a high temperature to a lower temperature 11. Change of position 13. Ability to do work	*Across* 4. mechanical 6. kinetic 7. potential 9. chemical 12. nuclear 14. sound 15. light *Down* 1. elastic 2. gravitational 3. work 5. electrical 8. power 10. heat 11. motion 13. energy
C. Developing and Deepening Understanding	**DAY 1** **SUB-TOPIC 1: Conservation of Energy** **1. Explicitation** **Activity 1.** *Use the learning activity sheet for this activity (see page 1).* **KEY to Guide Questions:** 1. No, the ball did not return to the drop height after rebounding because as the ball hits the surface, some energy is transformed into thermal energy from the friction created, sound energy, and some becomes elastic potential energy, which makes the ball bounce or rebound and then transformed again into kinetic energy but is less than the original kinetic energy. 2. The rubber ball bounces the highest. The rubber ball bounces the highest because it has the greatest elasticity. When the rubber ball hits the ground, it gets compressed, and because it is highly elastic, it returns to its original shape. When this happens, it pushes back into the surface and returns to the air. The marble, which is the hardest, has the least elasticity, so it does not bounce as much as the rubber ball and ping-pong ball. 3. When the ball rebounds, some energy is transformed into heat because of friction, others into sound, and some into elastic potential energy, which is transformed into kinetic energy, so the ball moves up again.	See Learning Activity Sheet: *Activity #1: Ball Drop Activity* Before the activity is conducted, the teacher will ask the class what happens to the ball when it is dropped at a certain height. Possible Answers of learners are: • The ball will hit the floor. • The ball will bounce back. • The ball will increase its speed.

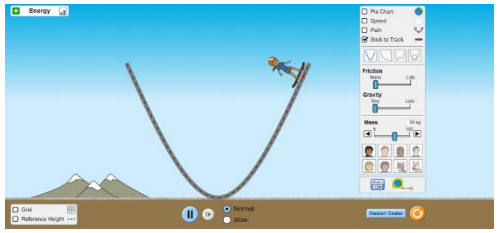
DAY 2

2. Worked Example

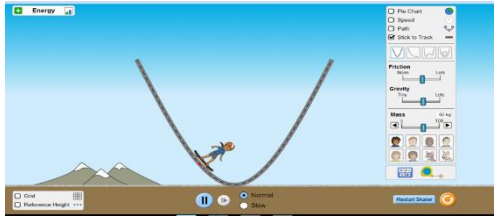
Using PHET, the learners should be able to do the following:

a. recognize the effect of friction and gravity on the motion of the Skater;
b. observe the transformation of kinetic energy to potential energy and potential energy to kinetic energy;
c. investigate the conservation of energy; and
d. calculate the speed or height of the Skater.

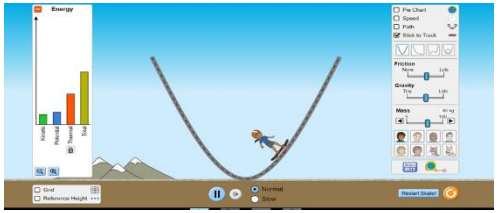
Part I: Click on the intro tab and play around with the simulation. Answer the following guide questions as you follow each condition:



1. Describe the motion of the skater when you set the friction and gravity to zero.



2. Describe the motion of the skater when you set the friction and gravity at the middle part where the friction and gravity are being controlled.



3. With the same condition in number 2, click on the energy graph. What happens to kinetic and potential energy as you release the skater?

4. What energy gradually increases and eventually causes the skater to come to a stop?
5. What causes the increase of thermal energy?

Use this link to access the simulation: https://phet.colorado.edu/sims/html/energy-skate-park/latest/energy-skate-park_all.html

KEY TO Worked Example

Part I.

1. Uniform transformation between the kinetic energy and potential energy is taking place.
2. The motion of the skater eventually comes to a stop.
3. There is a decrease in the kinetic and potential energy until it suddenly comes to a stop.
4. Thermal Energy
5. The increase in thermal energy is due to the presence of friction.

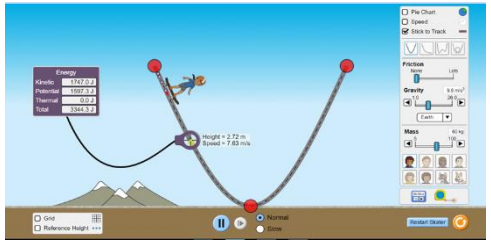
Part II: Click on the measure tab. You should see a purple device to measure energy. Put the skater on the track and use the measuring tool to measure kinetic and (gravitational) potential energy.

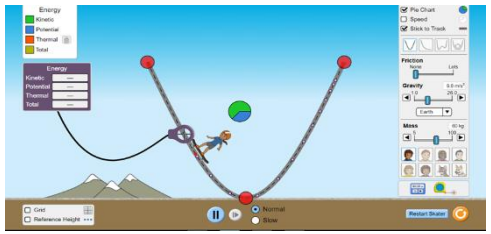
1. What happens to the kinetic energy as you go along the track?

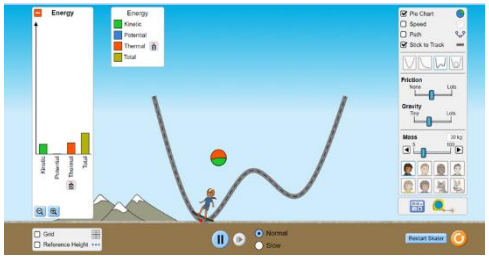
2. What happens to the gravitational potential energy as you go along the track?

3. Click on the pie chart at the top. What happens to the kinetic and (gravitational) potential energy on the chart as the skater goes down the track?

4. Repeat with a different track or different mass/gravity/friction. Did anything change?







Part III: Problem Solving

1. What will the speed of the 75 kg Skater be in 2 seconds? Refer to the indicated data below:

Part II.

1. *When friction is set to zero, the kinetic energy increases when the skater goes down, while it decreases when it moves up to the track.*
2. *When the friction is set to zero, the gravitational potential energy increases when it goes higher, and it decreases when the skater moves down.*
3. *The color green signifies the kinetic energy in the pie chart, which increases when the skater moves down the track.*
4. *Answer: When the friction, mass, and gravity is increased, the skater eventually comes to a stop. The kinetic energy and potential energy both decreased while the thermal energy increased.*

Part III.

1. Solution: $K.E. = \frac{1}{2}\, mv^2$

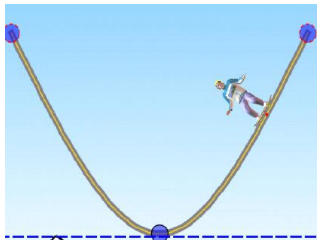
$$mv^2 = 2K.E.$$

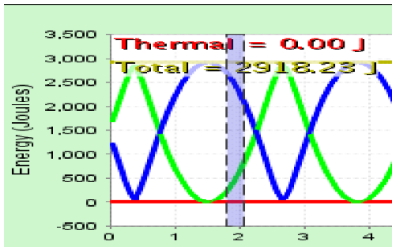
$$v = \sqrt{\frac{2K.E.}{m}}$$

$$v = \sqrt{\frac{2\,(509\,J)}{75\,kg}}$$

K.E. = 509 J
P.E. = 2408 J

P.E. = 0 at dotted line





2. At what height is the 75 kg skater at 2 seconds?

A. Lesson Activity

Activity 2.

Use the learning activity sheet for this activity (see page 2).

KEY to Guide Questions

1. Possible challenges that will be encountered by the learners are that the marble might not be able to reach the end path of the roller coaster as it might get stuck along the way, or it might escape from the ramp when the marble passes through the loop.
2. These challenges were solved by making some adjustments to the paper roller coaster until it worked. Possible adjustments such as clearing some obstacles along the path and adjusting how the loop was positioned.
3. The potential energy is at its maximum at the start of the ramp, at the same time, kinetic energy is zero. While the marble rolls down, the marble gains kinetic energy while the potential energy decreases. When no external forces are present, the loss of the potential energy is the gain of kinetic energy. At the lowest part of the ramp, the kinetic energy is at its maximum while the potential energy is zero.
4. Some of the marble's energy is converted to other forms. When there is friction, some of the energy is converted to heat energy, some may be converted into heat energy, and others might be converted into elastic potential energy when there is bending and stretching of the path.
5. If frictionless, the sum of the potential and kinetic energy at any point is constant.

$$v = \sqrt{\frac{1018\ \cancel{kg}\ \frac{m^2}{s^2}}{75\ \cancel{kg}}}$$

$$\boldsymbol{v = 3.7\ m/s}$$

2. Solution: $P.E. = mgh$

$$h = \frac{P.E.}{mg} = \frac{2408\ \cancel{kg}\ \frac{\cancel{m^2}}{\cancel{s^2}}}{(75\ \cancel{kg})\ (9.8\ \frac{\cancel{m}}{\cancel{s^2}})} = \frac{2408\ m}{735} = \boldsymbol{3.3\ m}$$

See Learning Activity Sheet:
Activity #2: Paper Roller Coaster

This activity may be done by a group of 4-5. The template sheets which is used to make the paper roller coaster may be downloaded through this link: https://www.sciencebuddies.org/cdn/science-activities/paper-roller-coaster-template-kit-2022-07-11.pdf

6. At any point along the track, the total energy is still the same if friction is present. The kinetic and potential energy are transformed into other forms, such as heat, sound & elastic energy.

The questions for the brainstorming activity may be assigned to the learners prior to the day of discussion so that the learners will have time to read about the topic to be discussed during the activity.

DAY 3

SUB-TOPIC 2: Utilizing Electric Energy from Lakes and Dams for Electric Generations

1. Explicitation

Brainstorming Activity

The following questions will be the focus of the brainstorming activity:

1. What are the advantages of using renewable energy sources?
2. What was the history and uses of the waterwheel?
3. How is hydropower used in everyday life?

2. Worked Example

Create a flow chart of the energy transformation in a hydroelectric power plant:

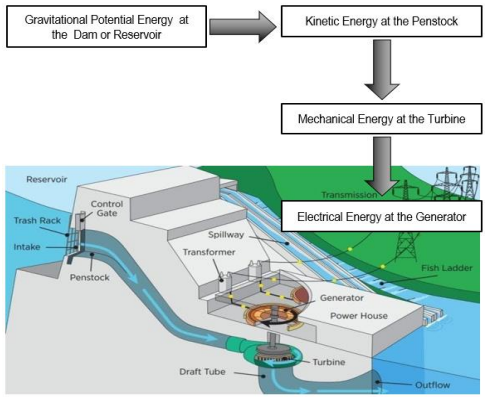


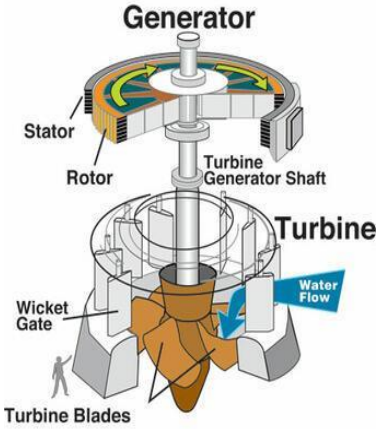
Image Source: National Hydropower Association

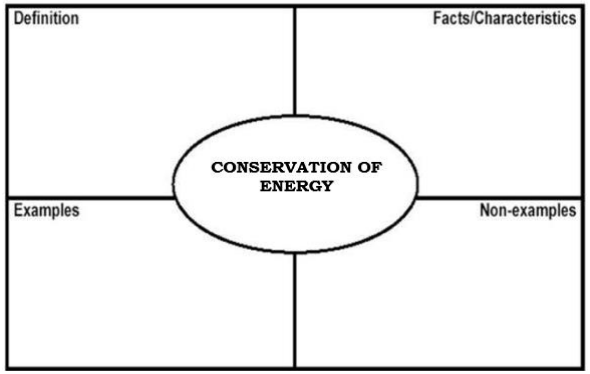
Discuss energy transformation in a hydroelectric power plant.

1. **Dam & Reservoir**: the first thing that needs to be done is to ensure the water source, then followed by the construction of a dam at an elevated area. The

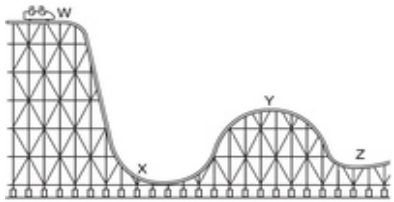
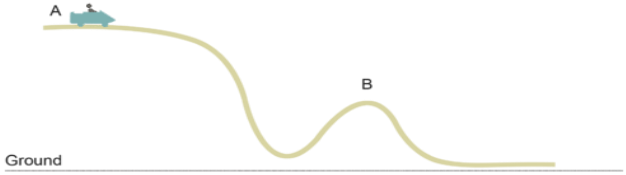
Possible answers to Brainstorming questions:

1. Answers may vary.
2. Before the development of steam power during the colonial and industrial revolution eras, waterwheels were the only sources of power (besides human or animal power). Often, towns were built close to a river so waterwheels could be built nearby.
   Uses of Waterwheels:
   1. grind grains into flour
   2. saw timber
   3. power farm equipment
   4. drive pumps
   5. trip hammers
   6. forge iron
   7. power textile mills
3. Hydropower is used in everyday life by providing electricity to homes, industries, and schools so that machinery will be functional. Telecommunication is possible, and light and heat are

	position of the water in the reservoir or a dam increases the water's gravitational potential energy. 2. **Control Gate**: gateway of the water from the dam and reservoir. It regulates the amount of water flowing to the penstock. When the control gate is opened, the water flowing through the penstock has kinetic energy. 3. **Penstock**: transports water from the reservoir to the turbine made up of massive steel pipe. So, the water's gravitational potential energy is converted into kinetic energy. 4. **Water Wheel or Turbine**: due to the kinetic energy of water, the turbine, which is connected to the generator, turns. The generator then converts mechanical energy into electricity. Explain power generation in a hydroelectric power plant. 1. **Generators**: the turbine is connected to generators, and when the turbine rotates, electricity is generated.  Image Credit: U.S. Army Corps of Engineers 2. The principle of electromagnetic induction by Michael Faraday, which states that a changing magnetic field induces electric current is the principle applied in the generation of electricity of a hydroelectric generator. 3. Applying the electromagnetic induction to hydroelectric generators, as shown in the above figure, we can find the rotating rotor, which mounted around its perimeter are field poles that contain electromagnets made by circulating direct current through loops of wire wound around stacks of magnetic steel laminations.	provided. During a hot summer day, the air conditioning unit makes the room temperature cooler as well. This waterwheel activity shall be conducted outside the classroom or in a sink.

	4. The rotor is then attached to the turbine generator shaft and rotates at a fixed speed. When the rotor turns, it causes the field poles (the electromagnets) to move past the conductors mounted in the stator. This, in turn, causes electricity to flow and a voltage to develop at the generator output terminals. **DAY 4** **3. Lesson Activity** **Activity 3.** *Use the learning activity sheet for this activity (see pages 3 - 4).* *KEY to Guide Questions:* 1. The water wheel rotated. 2. The rate of rotation decreased. 3. Engineers would learn about the different paddle or blade designs to see how well they moved the weight. The better the blade design, the faster the waterwheel turned and moved the weight upwards. They would use this information to design a turbine that will generate the most electricity from the turning wheel. 4. Water dropped from a container to spin the blades just like water runs from a dam to spin the blades of a turbine. The spinning water wheel was used to do work just like the spinning blades of turbines make electricity, which we use to do work.	See Learning Activity Sheet: *Activity #3: Waterwheel Work: Energy Transformation and Rotational Rates*
D. Making Generalizations	**1. Learners' Takeaways** **Direction:** Using the Meg Thomas' Frayer Model to make a graphic organizer, summarize the concepts learned about the conservation of energy.  	

	2. Reflection on Learning Make a summary of what you learned (realizations) and what you want to know about: ***What I learned:*** | ***What I want to know more:***	

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		**NOTES TO TEACHERS**
A. Evaluating Learning	**1. Formative Assessment** **Multiple Choice:** Choose the letter of the correct answer. Use the figure below to answer questions 1 – 2:  1. Which has the greatest gravitational energy? a. W b. X c. Y d. Z 2. Which has the greatest kinetic energy? a. W b. X c. Y d. Z The mass of the roller coaster cart below is 80 kg. It starts from rest at a height of 30 m and reaches a speed of 20 m/s at Point B. Assume no energy is lost due to dissipative forces such as friction.  3. What is the total mechanical energy of the roller coaster cart at Point A? a. 800 J c. 23,520 J b. 2400 J d. Not enough information 4. What is the total mechanical energy of the roller coaster cart at Point B?	**Answer Key:** 1. A 2. B 3. C 4. C 5. D 6. A 7. B 8. C 9. C 10. A

a. 800 J c. 23,520 J
b. 2400 J d. Not enough information

5. What is the amount of potential energy at Point A?
a. O J c. 2400 J
b. 800 J d. 23,520 J

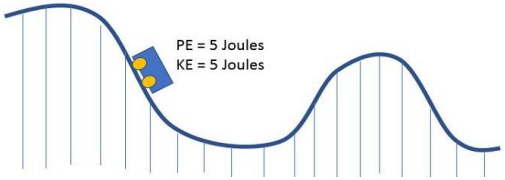
6. What is the amount of kinetic energy at Point A?
a. O J c. 16000 J
b. 8000 J d. 24000 J

7. What is the amount of potential energy at Point B?
a. O J c. 16000 J
b. 7520 J d. 24000 J

8. What is the amount of kinetic energy at Point B?
a. O J c. 16000 J
b. 8000 J d. 24000 J

9. Using the figure below, what is the total mechanical energy of the cart?
a. 0 J b. 5 J c. 10 J d. cannot be determined

10. Using the figure below, what is the value of its kinetic energy when the cart reaches the highest point?
a. 0 J b. 5 J c. 10 J d. cannot be determined



3. Homework (Optional)

1. Create an infographic about the different hydroelectric power plants in the Philippines.
2. Identify the impacts on the natural ecosystem and local communities in the dam construction and enumerate ways or practices that lead to minimization of the impacts.

B. Teacher's Remarks	*Note observations on any of the following areas:*	**Effective Practices**	**Problems Encountered**	This lesson design component prompts the teacher to record relevant observations and/or critical teaching events that
	strategies explored			

				he/she can reflect on to assess the achievement of objectives. The documenting of experiences is guided by possible areas for observation including teaching strategies employed, instructional materials used, learners' engagement in the tasks, and other notable instructional areas. Notes here can also be on tasks that will be continued the next day or additional activities needed.
	materials used			
	learner engagement/ interaction			
	others			
C. Teacher's Reflection	*Reflection guide or prompt can be on:* ▪ *principles behind the teaching* *What principles and beliefs informed my lesson?* *Why did I teach the lesson the way I did?* ▪ *students* *What roles did my students play in my lesson?* *What did my students learn? How did they learn?* ▪ *ways forward* *What could I have done differently?* *What can I explore in the next lesson?*			This lesson design component guides the teacher in reflecting on and for practice. Entries on this component will serve as inputs for the LAC sessions, which can center on sharing the best practices discussing problems encountered and actions to be taken; and identifying anticipated challenges and intended solutions. Guide questions or prompts may be provided here.