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DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Science

Quarter 4
Lesson
5

Lesson Exemplar for Science Grade 8
Quarter 4: Lesson 5 of 8 (Week 5)
SY 2025-2029

Development Team

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SCIENCE (PHYSICS)/QUARTER 4/ GRADE 8

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	Kinetic energy is the energy of movement, and potential energy is stored energy.
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	1. Describe how kinetic energy and potential energy happen. *Lesson Objective 1: Define kinetic energy and potential energy.* *Lesson Objective 2: Differentiate kinetic energy and potential energy.* 2. Illustrate the transformation of kinetic energy to potential energy and vice versa. Lesson Objective 1: Identify examples of everyday situations that demonstrate how kinetic energy is being transformed into potential energy. Lesson Objective 2: Identify examples of everyday situations that demonstrate how potential energy is being transformed into kinetic energy; *3.* Explain that the mechanical energy of an object is the sum of the kinetic energy and the potential energy available to do work. Lesson Objective 1: Identify examples of everyday situations that demonstrate mechanical energy.
D. Content	**Kinetic and Potential Energy** *Kinetic Energy* ● Kinetic energy is the energy possessed by an object due to its motion ● Kinetic energy is directly related to an object's speed and mass, with the formula $KE = \frac{1}{2}mv^2$, where m is mass and v is velocity. *Potential Energy* ● Potential energy is the energy stored in an object due to its position or state, with the formula $PE = mgh$, where m is mass, g is gravity, and h is position height of the object.

	• When an object is raised to a certain height or distance from the ground, it gains potential energy. The higher the object, the greater its potential energy • Potential energy can be converted into kinetic energy when the object's position changes, such as when a ball falls from a height and gains speed. *Relationship Between Kinetic and Potential Energy* • Kinetic and potential energy are interrelated, with potential energy converting into kinetic energy and vice versa. • For instance, when a ball is released from a height, its potential energy converts into kinetic energy as it falls and gains speed. This conversion highlights the dynamic relationship between these two forms of energy. Mechanical Energy is the sum of Potential and Kinetic Energy • *Transformation* of Mechanical energy
E. Integration	Potential and Kinetic Energy in Sports and Safety in Driving.

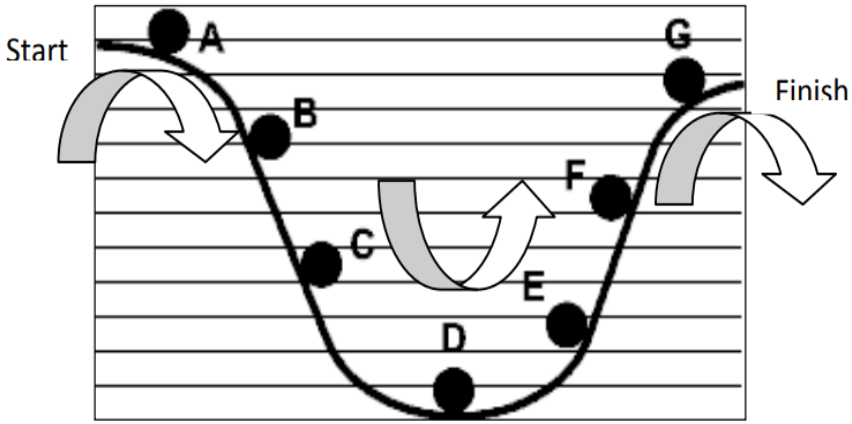
II. LEARNING RESOURCES
University of Colorado Boulder. (n.d.) Forces and Motion: Basics. https://phet.colorado.edu/sims/html/forces-and-motion basics/latest/forces-and-motion-basics_en.html (The Physics Classroom, n.d.) The Physics Classroom. (n.d.). https://www.physicsclassroom.com/class/newtlaws/Lesson-1/

III. TEACHING AND LEARNING PROCEDURE		**NOTES TO TEACHERS**
A. Activating Prior Knowledge	**DAY 1** **Activity 1.** Review of Force, Displacement & Velocity *Use the learning activity sheet for this activity (see page 1).* *Answer Key to Guide Questions* 1. There is a greater velocity when a greater force was applied and a lesser velocity when a lesser force was applied.	See Learning Activity Sheet: *Activity #1: Plastic Bottle Bowling* To teach this lesson, the students should already know the concepts of: • Force: a push or a pull applied on an object

	2. Yes, there is work done on the ball. The force applied to the ball caused a displacement which is in the same direction as the force. 3. The moving ball will cause the bottles to fall. 4. Energy in motion	• Displacement: distance with direction • Velocity: fastness of a moving object with direction
B. Establishing Lesson Purpose	**1. Lesson Purpose** **Activity 2.** *Use the learning activity sheet for this activity (see page 2).* **2. Unlocking Content Area Vocabulary** **Activity 3.** *Use the learning activity sheet for this activity (see page 3).* *Answer Key to Guide Questions* 1. Energy: the ability to do work 2. Motion: change of position 3. Position: location of an object at any given time 4. Kinetic: energy of motion 5. Potential: stored energy due to position 6. Mechanical: sum of kinetic and potential energy After the game, ask the class what their ideas about the meaning of the vocabulary they unlocked.	See Learning Activity Sheet: *Activity #2: Identifying Kinetic and Potential Energy* and *Activity #3: Charade Game* **Option 1:** On the day of the activity, the teacher may allow the class to find a partner and discuss with their partner whether the activity is a form of potential or kinetic energy. **Option 2:** The teacher may show the learners a picture of each activity and let the learners paste the picture on the column of either potential or kinetic energy. The words for each group to act are: 1) Energy 2) Motion 3) position 4) kinetic 5) potential 6) mechanical
C. Developing and Deepening Understanding	**SUB-TOPIC 1: KINETIC ENERGY & POTENTIAL ENERGY** **1. Explicitation** **Activity 4.** *Use the learning activity sheet for this activity (see pages 4 – 5).*	See Learning Activity Sheet: *Activity #4: Pendulum Swing: Exploring Potential and Kinetic Energy* Safety precautions: Ensure there is enough clearance around the

2. Worked Example

Example 1: A ball is allowed to roll from a basin. The graph below shows the path of the ball when it rolled from point **A** to **G**.



Guide Questions:

1	At which point does the ball has its maximum kinetic energy?	**D**
2	At which point does the ball has its maximum potential energy?	**A**
3	At which point does the ball has its least potential energy?	**D**
4	At which point does the ball has the least kinetic energy?	**A**
5	At which point does the ball has just a little kinetic energy than A?	**G**
6	Which letter shows the ball when it has just a little more potential energy than letter C?	**F**
7	Which letter shows the ball when it has just a little less potential energy than letter C?	**E**
8	Which letter shows the ball when it has just a little less kinetic energy than letter D?	**E**
9	Which letter shows the ball when it has just a little more kinetic energy than letter G	**B**

pendulum's path to avoid hitting objects or people.

KEY to Activity 5.4 Guide Questions

1. As the length increases, the period also increases.
2. The period is related to kinetic energy; the shorter the period, the higher the kinetic energy is.
3. Potential energy is increased when you increase the amplitude of the pendulum, and then, by releasing the bob of the pendulum, the potential energy is transformed into kinetic energy by moving it back and forth. Due to air friction, the pendulum will eventually come to a stop.

DAY 2
Lesson Activity
Activity 5.
Use the learning activity sheet for this activity (see pages 6 – 7).

Answer Key to Guide Questions

1. The potential energy is increased by inflating the balloon more. Beware not to inflate the balloon too much to avoid the balloon from popping up.
2. The potential energy is converted to kinetic energy by the movement of the car after the inflated balloon is released.
3. The distance the car travels can be maximized by ensuring that the axle spins freely and making use of light plastic bottle.
4. Real cars store energy through the chemical energy present in gasoline and battery cars and is converted to kinetic energy by powering out the car's engine in order to make the wheels of the car spin.

See Learning Activity Sheet: *Activity #5.: Balloon Powered Cars*

Students will design, build, and race balloon-powered cars in this activity to illustrate the occurrence of kinetic and potential energy.

Note: For sanitary purposes, allow only 1 student to blow the balloon. If that student gets tired, attach another straw to the balloon.

DAY 3
SUB-TOPIC 2: Relationship Between Kinetic and Potential Energy

1. Explicitation: Brainstorming Activity

Cite some real-life situations (at least 4) that transform kinetic energy into potential energy and potential energy into kinetic energy.

Kinetic Energy to Potential Energy	*Potential Energy to Kinetic Energy*

Sample real-life situations:

Kinetic to Potential Energy

a. Shooting a basketball
b. Playing High Jump
c. Launching a Cannonball
d. Lifting up a ball

Potential to Kinetic Energy

a. Waterfalls
b. Leaves fall during autumn
c. Rock falls off a cliff
d. Bow is stretched before an arrow is launched

2. Worked Examples

Instructions:

1. Assign the class to 5 members in a group. Provide each group with a rubber ball. Remind each group that potential energy can be transformed into kinetic energy, and kinetic energy can be transformed into potential energy.
2. Each group will be given the following questions to brainstorm as a group and then write their answers on a piece of paper after their discussion. Each group representative will be given time to explain their answers in front of

the class.

Guide Questions: (possible answers are given)

1. How can you throw a ball and have its energy change from kinetic to potential and back to kinetic without touching the ball once it is released from your hand?
   Answer: *By throwing the rubber ball straight up into the air.*
2. What has more potential energy: a big boulder on the ground or a feather 20 feet in the air? Why?
   Answer: *The feather 20 feet in the air since the big boulder has zero potential energy because it is located on the ground, so height is zero.*

Worked Sample Problems:

Problem 1: A baby carriage is sitting at the top of a hill that is 21 m high. The carriage with the baby has a mass of 7.5 kg. The carriage has _____ energy. Calculate the amount of energy of the baby carriage.

Answer: *Potential energy*

$$Potential\ Energy\ (PE)\ =\ mass\ (m)\ x\ acceleration\ due\ to\ gravity\ (g)\ x\ height\ (h)$$

$$P.E. = mgh$$

$$P.E. = (7.5kg)\left(9.8\frac{m}{s^2}\right)(21m)$$

$$P.E. = 1543.5\ N.m\ or\ Joules\ (J)$$

Problem 2: You serve a volleyball with a mass of 280 g. The ball leaves your hand at a speed of 30 m/s. The ball has _____ energy. Calculate the energy of the ball.

Answer: *Kinetic energy*

$$Kinetic\ Energy\ (K.E.)\ =\ \frac{1}{2}\ mass\ x\ (velocity)^2$$

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

$$K.E. = \frac{1}{2}\ (0.28\ kg)\ (30\ \frac{m}{s})^2$$

$$K.E. = 126\ N.m\ or\ Joules\ (J)$$

3. Lesson Activity

Activity 6.

Use the learning activity sheet for this activity (see pages 8 -9).

Answer Key to Guide Questions

1. The potential energy of the ball can be calculated with the formula: **PE = mgh**.

The kinetic energy just before it hits the cup is equal to the potential energy with the assumption that the friction as it rolls along the ramp is zero.

2. The velocity can be derived with the formula for kinetic energy:

$$KE = \frac{1}{2}v^2$$
$$v^2 = 2KE$$
$$v = \sqrt{2KE}$$

3. If h is doubled:

$$PE = KE$$
$$mgh = \frac{1}{2}mv^2$$

m can be cancelled out,

$$2gh = v^2$$
$$2g = v^2/h$$

let the velocity of the original height be (v_1) and the height is (h_1). Then the velocity if the height is doubled is v_2 while the height is h_2 or $2h_1$;

Equation 1: $2g = \frac{v_1^2}{h_1}$

Equation 2: $2g = \frac{v_2^2}{h_2}$

Substituting Eq. 1 to Eq. 2, the equation becomes,

$$\frac{v_1^2}{h_1} = \frac{v_2^2}{h_2}$$

since, $h_2 = 2h_1$ use $2h_1$ for h_2

$$\frac{v_1^2}{\cancel{h_1}} = \frac{v_2^2}{2\cancel{h_1}} \Longrightarrow \quad v_1^2 = \frac{v_2^2}{2}$$

by cross multiplication, the equation becomes,

$$2v_1^2 = v_2^2$$

simplifying further the equation

$$v_2 = \sqrt{2}\,(v1)$$

Therefore, if h is doubled, then v_2 will increase by a factor of $\sqrt{2}$.

See Learning Activity Sheet: *Activity #6: Ball Rolling Down a Ramp Activity*

If a golf ball is not available, this activity may be conducted with the use of other balls of similar size, like rubber balls, etc.

If h is quadrupled or increased 4 times, v becomes

$$v2 = \sqrt{4}\,(v1)$$

$$V_2 = 2\,(v_1)$$

or v is doubled.

4. To decrease the distance of the travel of the cup is to lower the ramp because it will have less energy when it hits the cup. To increase the distance of travel by the cup is to make the ramp higher in order to have a greater initial potential energy hence a greater kinetic energy before it hits the cup

DAY 4

SUB-TOPIC 3: Mechanical Energy

1. Explicitation

Brainstorming Activity

Ask the students the following:

1. discuss their understanding of mechanical energy
2. enumerate daily activities that exhibit mechanical energy
3. explain why these activities exhibit mechanical energy

2. Worked Example

Mr. Lee Ben Fardest, an American ski jumper, made a record of one of his record-setting jumps as he glides down a hill. The diagram below depicts his motion and the values of the kinetic and potential energy at different points.

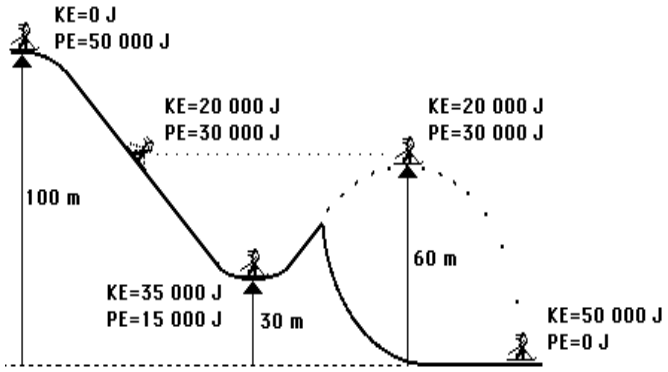


Image Source: *physicsclassroom.com*

Answers to Brainstorming Activity

1. Mechanical energy is the sum of kinetic and potential energy. It is present in objects in motion and due to the composition or position of objects.
2. Sample activities:
   - Hammering a nail
   - Brushing teeth
   - Showering
   - Breathing in and out
   - Exercising
   - Sharpening a pencil
   - Washing dishes
   - Preparing a Dough
   - Blowering your hair
3. These activities exhibit movement.

The **formula for mechanical energy** is:
Mechanical Energy (M.E.) = Kinetic Energy (K.E.) + Potential Energy (P.E.)
M.E. = K.E. + P.E.

1. Calculate the value of the mechanical energy at a height of:

a. 100 m	M.E. = K.E. + P.E. M.E. = 0 J + 50,000 J M.E. = 50,000 J
b. 30 m	M.E. = K.E. + P.E. M.E. = 20,000 J + 30,000 J M.E. = 50,000 J
c. 60 m	M.E. = K.E. + P.E. M.E. = 30,000 J + 20,000 J M.E. = 50,000 J
d. 0 m	M.E. = K.E. + P.E. M.E. = 50,000 J + 0 M.E. = 50,000 J

2. What happens to the potential energy as he goes down the hill?
   The potential energy decreases.
3. What can you infer about the mechanical energy at all points of the travel?
   The mechanical energy at all points is constant.

3. Lesson Activity

Activity 7.

Use the learning activity sheet for this activity (see pages 10-11).

See Learning Activity Sheet:
Activity #7: Bouncing Ball: Investigating Energy Transfer

Safety precaution: Ensure the experiment area is clear of obstacles and that participants stand clear of the dropping path of the bouncing ball.

Answer Key to Guide Questions

1. Before dropping, the potential energy is at its maximum while it goes to the floor it decreases until the potential energy becomes zero when it hits the ground while the kinetic energy is at its maximum. During the bounce, the kinetic energy decreases while the potential energy increases.
2. There is energy loss because the maximum height after rebound is lesser than that of the initial height of dropping. The energy loss is attributed to the conversion of mechanical energy into other forms of energy, such as thermal energy, etc.
3. The total mechanical energy is not the same at all points due to some external forces that have affected the kinetic and potential energy of the ball.

D. Making Generalizations	**1. Learners' Takeaways** Make a summary table of the concepts learned about kinetic and potential energy: Potential Energy | Kinetic Energy **2. Reflection on Learning** In your notebook, write your realizations after undergoing the lesson. There might be some misconceptions that were corrected. Include also some values you learned during the process of learning.	Kinetic and Potential Energy Concepts: **Potential Energy:** ● Energy due to position or composition. ● It can be transferred to kinetic energy. ● Present even if the object is moving. ● It comes in different types like gravitational, chemical and elastic. **Kinetic Energy** ● Energy due to motion. ● Can be transformed into potential energy ● Present in moving objects only.

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		**NOTES TO TEACHERS**
A. Evaluating Learning	**1. Formative Assessment** This assessment evaluates the learning of the topics discussed: A. Match the type of energy to the illustration. Write the letter of your answer in the blank provided.	**KEY to Assessment** **A. Matching Type** 1. d 2. b

	_____ 1.  _____ 2.  _____ 3.  _____ 4.  a. Elastic Energy b. Gravitational Potential Energy c. Chemical Energy d. Kinetic Energy B. Classify the following as a type of potential energy or kinetic energy (use the letters **K** for Kinetic Energy or **P** for Potential Energy) 1. A bowling ball rolling down the alley. 2. An archer with his bow drawn. 3. Sitting at the top of a tree. 4. A volleyball player spiking a ball. 5. The wind blowing your hair. 6. The chemical bonds in sugar.		3. a 4. c Image Sources: in.pinterest.com etfdb.com lintsteels.com wired.com **B. Kinetic energy (K) or Potential Energy (P)** 1. K 2. P 3. P 4. K 5. K 6. P
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
	strategies explored			

				critical teaching events that 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:* ▪ *<u>principles behind the teaching</u>* *What principles and beliefs informed my lesson?* *Why did I teach the lesson the way I did?* ▪ *<u>students</u>* *What roles did my students play in my lesson?* *What did my students learn? How did they learn?* ▪ *<u>ways forward</u>* *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.