8

DepED
DEPARTMENT OF EDUCATION

# Lesson Exemplar for Science

Quarter 4
Lesson
4

**Lesson Exemplar for Science Grade 8**
**Quarter 4: Lesson 4 of 8 (Week 4)**
**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** | Work is present when a force causes displacement of an object.<br>Power is the rate of work. |
| **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. Recognize that work is done when a force causes the displacement of an object.*<br>*Lesson Objective 1: determine whether work is present or not present given some different situation*<br>*Lesson Objective 2: illustrate how negative work is done*<br>*Lesson Objective 3: analyze and solve problems related to work*<br>*2. Recognize that power is the rate of doing work*<br>*Lesson Objective 1: demonstrate the presence of power*<br>*Lesson Objective 2: calculate the power exerted through an activity*<br>*Lesson Objective 3: illustrate the relationship between work and power* |
| **D. Content** | 1. Work and Power<br>*a.* What is work?<br>▪ Work is done when a force acts on an object to cause its displacement. For work to be considered, there must be both a force applied and a resulting displacement.<br>▪ The equation for work is given $W = F\ x\ d\ cos\ (\theta)$ where F is the force applied, $d$ is the displacement and $\theta$ is the angle between the force and displacement vectors.<br>*b. What is power?*<br>▪ Power is defined as the rate at which work is done, or energy is transferred. It measures how quickly work is performed or how quickly energy is converted.<br>▪ Mathematically, power can be expressed by P = $\frac{W}{t}$, where $P$ is power, $W$ is work done, and $t$ is time taken to the work done. |

| | |
|---|---|
| | *c.* What is the relationship between work and power?<br>▪ Power and work are closely related, with power indicating how quickly work is done. High power means that a large amount of work can be done in a short time, while low power implies slower work rates<br>▪ Understanding power helps in assessing efficiency and performance in various systems where work needs to be done consistently over time |
| **E. Integration** | Work and Power in Sports |

| **II. LEARNING RESOURCES** |
|---|
| The Physics Classroom. (n.d.). Work, Energy, and Power.<br>https://www.physicsclassroom.com/class/energy/Lesson-1/Definition-and-Mathematics-of-Work<br>UCLA Physics and Astronomy (n.d.) Force, Work and Power.<br>https://www.physics.ucla.edu/k-6connection/forwpsa.htm<br>LibreTexts.Physics (n.d.) Work and Power.<br>https://phys.libretexts.org/<br>https://phys.libretexts.org/Bookshelves/University_Physics/Exercises_(University_Physics)/Exercises%3A_College_Physics_(OpenStax)/07%3A_Work_Energy_and_Energy_Resources_(Exercises)<br>TeachEngineering. Ignite STEM Learning in K-12.<br>https://www.teachengineering.org/activities/view/cub_energy_lesson02_activity1 |

| **III. TEACHING AND LEARNING PROCEDURE** | | **NOTES TO TEACHERS** |
|---|---|---|
| **A. Activating Prior Knowledge** | **DAY 1**<br>**Activity 1.**<br>*Use the learning activity sheet for this activity (see pages 1 – 2)*<br><br>To teach this lesson, the learner should already know the following concepts:<br><br>1. net force & displacement<br>2. the net force as a vector quantity<br>3. displacement as a vector quantity | See Learning Activity Sheet: *Activity #1: There is WORK or NO WORK!*<br><br>**KEY to Activity 1**<br>1. YES<br>2. YES<br>3. NO |

<table>
<tr>
<td></td>
<td>After the learners recall the net force and displacement and their direction, they will conduct another activity to introduce the topics.<br><br>Guide Questions:<br>1. Situation 1, 2, 3, 4, 5<br>2. Situation 6, 7, 8<br>3. Situation 1, 2, 4<br>4. Situation 3, 5</td>
<td>4. YES<br>5. NO<br>6. NO<br>7. NO<br>8. NO</td>
</tr>
<tr>
<td>B. Establishing Lesson Purpose</td>
<td>1. Lesson Purpose<br>a. Self-Assessment<br>Instruction: Read the learning targets below. Let the students assess themselves in terms of their confidence level in accomplishing the learning targets before the lesson. Allow students to rate themselves after learning the lesson.<br><br>1 – Very not confident to do it<br>2 – Not confident to do it<br>3 – Undecided/Neutral<br>4 – Confident to do it<br>5 – Very confident to do it<br><br>
<table>
<tr><th>Learning Targets</th><th>Before learning the lesson</th><th>After learning the lesson</th></tr>
<tr><td>1. I can determine whether work is present or not present, given some different situations.</td><td></td><td></td></tr>
<tr><td>2. I can illustrate how negative work is done.</td><td></td><td></td></tr>
<tr><td>3. I can analyze and solve problems related to work.</td><td></td><td></td></tr>
<tr><td>4. I can demonstrate the presence of power.</td><td></td><td></td></tr>
<tr><td>5. I can calculate the power exerted through an activity.</td><td></td><td></td></tr>
<tr><td>6. I can illustrate the relationship between work and power.</td><td></td><td></td></tr>
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</td>
<td>The self-assessment will be discussed as a group. Learners are required to copy the learning targets on an index card indicating their ratings before the start of the lesson. The index cards will be submitted to the teacher and the teacher identifies those who are already confident of their skills or not. After instruction, the index cards will be returned, and let the learners rate their level of confidence in doing the tasks.</td>
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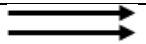
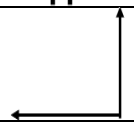
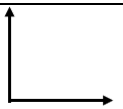
|---|---|---|
| | **2. Unlocking Content Area Vocabulary**<br>**Instruction:** Allow learners to give their definitions to the following vocabularies below. Then after they give their definitions, present the correct definition of the terms.<br>1. Displacement<br>2. Force<br>3. Parallel Vectors<br>4. Perpendicular Vectors<br>5. Time | **KEY to Vocabulary**<br>1. **Displacement:** a vector quantity that is the shortest distance from the initial to the final point.<br>2. **Force:** a push or a pull<br>3. **Parallel:** vector quantities that move in the same direction<br>4. **Perpendicular:** vectors that form a right angle to each other<br>5. **Time:** duration of events |
| **C. Developing and Deepening Understanding** | **SUB-TOPIC 1: What is WORK?**<br>**Timeframe: 2 days**<br>**1. Explicitation**<br>Relate the learner's responses on Activity 3.1 to the subtopic: **What is work?**<br><br>**a. Work Brainstorming Activity**<br>Ask the learners what comes into their mind when the word WORK is mentioned. Expectedly, the learners will have different answers like anything that will make a person sweat, hungry, and anything that requires effort. Relate their answers to the definition of WORK in physics.<br>The definition of work in physics will then be introduced:<br>▪ Work is done when a force acts on an object to cause its displacement. For work to be considered, there must be both a force applied and a resulting displacement.<br>▪ The equation for work is given $W = F\ x\ d\ cos\ (\theta)$ where F is the force applied, $d$ is the displacement, and $\theta$ is the angle between the force and displacement vectors.<br><br>**b. Activity 2.**<br>*Use the learning activity sheet for this activity (see pages 3 – 4)* | See Learning Activity Sheet: *Activity #2: Applied Force & Displacement* |

| Situation # | Direction of Applied Force | Direction of Displacement | Description of the Direction of Both Vectors | |
|---|---|---|---|---|
| 1 | to the right | to the right |  | parallel |
| 2 | upward | upward |  | parallel |
| 3 | inward | tangential |  | perpendicular |
| 4 | towards the person | towards the person |  | parallel |
| 5 | upward | to the right |  | perpendicular |
| 6 | to the left | none | | |
| 7 | none | none | | |
| 8 | none | none | | |

*Guide Questions*

1. Positive
2. Zero
3. Zero
4. Minimum if the force and displacement is perpendicular. Maximum if the force and displacement are parallel.

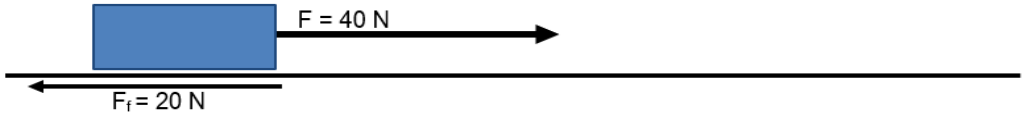
**2. Worked Example**

After defining work, it is important to note that work is caused by forces present to an object undergoing displacement.

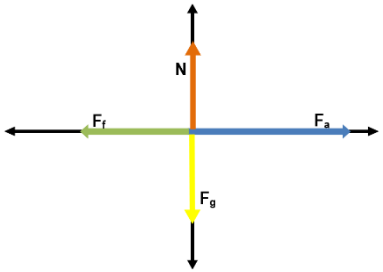
In the following example, a 40-N force was applied to a 10-kg wooden block placed on a cement floor having a frictional force of 20N. The force caused the wooden block to move 5-m to the right. Calculate the work done by:

**KEY to Activity 2**

In the worked example, ensure that the learners are well-versed with the previous lesson about free-body diagram.

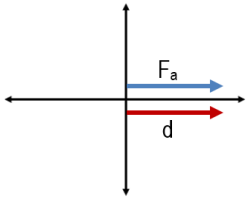



a) applied force (Fa)
b) frictional force ($F_f$)
c) normal force (N)
d) gravitational force (Fg)
e) net force (Fn)

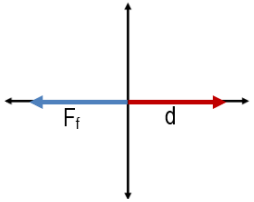



**Free- Body Diagram (FBD):**

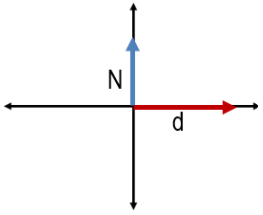
a) Work done by the Force Applied ($W_a$)




b) Work done by the Frictional Force ($W_f$)

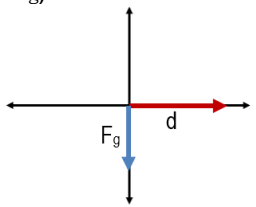



c) Work done by the Normal Force ($W_N$)

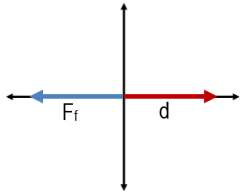



The teacher's role is to facilitate discussion while learners are engaged in doing the following tasks:
1. identifying the forces acting in the wooden block
2. draw the free-body diagram of the identified forces
3) identify the net force applied
4) calculate the work produced by the different forces

d) Work done by the Gravitational Force ($W_g$)




e) Work done by the Net Force ($W_f$)




**DAY 2**

**3. Lesson Activity**

**Activity 3.**

This simple activity demonstrates how work is produced by supplying force to the wooden block.

*Use the learning activity sheet for this activity (see pages 5-6).*

See Learning Activity Sheet: *Activity #3: Work Done to a Wooden Block*

*Work Done by a Constant Force*

| **Force** *Newton (N)* | **Displacement** *Meter (m)* | **Time** *second (s)* | **Angle** *Between Force (F) and Displacement (d)* | **Work** *Newton-meter Nm, Joules (J)* | **Work** *dyne-centimeter, dyne-cm (erg)* |
|---|---|---|---|---|---|
| | | | $0^0$ | | |
| | | | $30^0$ | | |
| | | | $60^0$ | | |

**SUB-TOPIC 2: WHAT IS POWER?**

**1. Explicitation**

Introduce this lesson by asking them about their idea of power. After gathering all ideas about power, then the definition of power in physics is introduced.

From the data gathered in Activity 3, calculate the value of power as a rate of doing work and as a function of velocity and supply the information gathered to the table below.

*Calculating the Power Produced*

| **Force** *Newton (N)* | **Displacement** *Meter (m)* | **Time** *second (s)* | **Angle** *Between Force (F) and Displacement (d)* | **Work** *Newton-meter Nm, Joules (J)* | **Power** (P=Work/time) (J/s or watt) | **Power** (P=$Fvcos(\theta)$ (watt) |
|---|---|---|---|---|---|---|
| | | | $0^0$ | | | |
| | | | $30^0$ | | | |
| | | | $60^0$ | | | |

*Guide Questions:*

1. What is power?
2. With the same amount of work, how do we produce the greatest value of power?
3. How do you compare the value of power obtained as a rate of work from the value of power as a function of velocity?

**2. Worked Example**

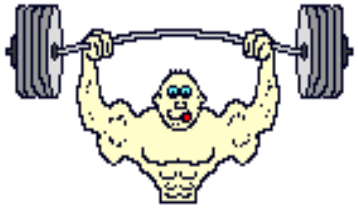


Image Source: *physicsclassroom.com*

1. Two classmates named Nathan and Jesse did some weightlifting activity. Nathan can lift the 40-kg barbel 10 times in one minute while Jesse can lift the barbel 10 times in 10 seconds. Which student does more work? Which student has the most power?

This activity will be done per group.

Materials needed for the activity:

1) Wooden block
2) Spring balance (0 – 20 N)
3) protractor
4) string

Students' answers may include influence, might, strength or anything associated with superpowers. While these may be the general definition of power, physics has its definition.

**KEY to Guide Questions**

1. Power is: work divided by time or rate of doing work.

Power is also a function of velocity:

| | | |
|---|---|---|
| | *a. Nathan and Jesse did the same amount of work.*<br>*b. Jesse had the most power since he could do the same work in a shorter time.*<br><br>2. While doing a chin-up, Hannah lifts her 42.0-kg body a distance of 0.25 meters in 2 seconds. What is the power delivered by Hannah's biceps?<br><br>$P = \frac{Work}{time} = \frac{(42\ kg)\ (9.8\ m/s^2\ )\ (0.25m)}{2\ s} = \frac{102.9\ Nm}{2\ s} = 51.45\ \frac{J}{s} = 51.45\ watts$<br><br>**DAY 3**<br>**3. Lesson Activity**<br>**Activity 4.**<br>*Use the learning activity sheet for this activity (see pages 7 – 8).*<br><br>**KEY to Guide Questions:**<br>1. Doing more work in a shorter period of time.<br>2. Negative work is produced when force and displacement are opposite. Examples: work done by friction; work done by gravitational force to a person climbing stairs.<br>3. It is a unit of electric energy. Kilo-watthour means the use of 1000 watts in 1 hour.<br><br>**DAY 4**<br>**SUB-TOPIC 3: RELATIONSHIP BETWEEN WORK & POWER**<br>**1. Explicitation**<br>Based on the results of the last activity, let each group identify who has the greatest power and who has the least power. Let the group explain why their answers.<br><br>**2. Worked Example**<br>**3.** A 75-kg man is riding an elevator in a shopping mall. The elevator moves the man at a constant velocity from the ground level to the floor above which has a vertical height of 4.6m. What is the work done on the man by:<br>a) the elevator?<br>  | $P = W/t = Fdcos(\theta)/t$<br>$= Fvcos(\theta)$<br><br>2. The greatest power is produced with the shortest time used to complete the work.<br>3. The value of power is the same.<br><br>See Learning Activity Sheet: *Activity #4: Calculating Human Power*<br><br>This activity may be done by 4-5 students in a group. The learners should be informed earlier to measure their mass in kg. |

b) the gravitational force?
c) If the elevator can lift 1000 kg at a distance of 100m at a velocity of 4m/s, what is the average power the elevator exerts during this trip?

| *Work done on the man by the elevator ($W_e$)* | Work done on the man by the gravitational force ($W_g$) |
|---|---|
| | |

| *Average power exerted by the elevator* |
|---|
| |

**4. Lesson Activity**
**Activity 5.**
See Learning Activity Sheet: *Activity #5: Problem Solving Activity on Work & Power (pages 9 and 10).*

This may be done individually or in pairs.

Materials:
1) stopwatch
2) meterstick/ruler

a) The teacher may emphasize that since the elevator moves at a constant velocity, the force exerted by the elevator to the man in going up is the same as his weight.
b) The time of travel of the elevator in part c is calculated by the formula of uniform motion:

$$v = \frac{distance\ (d)}{time\ (t)}$$

$$t = \frac{d}{v} = \frac{100m}{4\ \frac{m}{s}} = 25\ sec$$

**ANSWER KEY:**
1) a. 144 Joules
b. 168 J/s or Watts
2) **a.13.1 seconds**
$P = W/t$
$t = W/P = 3600J/275J/s$
$t = 13.1\ sec$
**b. 5.54 meters**
$P = W/t = Fd/t = Fv$
$v = P/F = 275Nm/s/650\ N$
v = 0.423 m/s
$v = d/t$
$d = vt = (0.423m/s)\ (13.1s)$
d = 5.54 m

| | | |
|---|---|---|
| | | 3) Work = 3640 Nm or J<br>b. Power = 242.7 Watts |
| **D. Making Generalizations** | **1. Learners' Takeaways**<br>**Real Life Connection**<br>1. How is work and power being manifested in other sports activities?<br>2. How do the concepts of work and power affect the engineering design of items such as race car engines, elevators and power plants?<br>3. In designing a car or elevator system, what might be some constraints encountered when they decide how powerful these systems are?<br><br>**2. Reflection on Learning**<br>The students will be asked to write their takeaways, realizations and the concepts they learned for the week in their journal. | Let the learners answer the Self-Assessment which they answered before the class starts. |

| **IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION** | | **NOTES TO TEACHERS** |
|---|---|---|
| **A. Evaluating Learning** | **1. Formative Assessment**<br>**I. MULTIPLE CHOICE:** Choose the letter for the correct answer.<br>1) Joshua raises a box with a weight of 120N at a height of 2m. The work done by Joshua is<br>a. 60 J b. 120 J c. 180 J d. 240 J<br><br>2) What is the power output when a 20 J of work is done by an object for 5 seconds?<br>a. 1 watt b. 2 watts c. 3 watts d. 4 watts<br><br>3) What is the value of 5.5 kwh in Joules?<br>a. $14 \times 10^6$ J b. $16 \times 10^6$ J c. $19.8 \times 10^6$J d. $9.8 \times 10^6$ J<br><br>4) What is the work done to a 10-kg object that is raised to a height of 2 meters?<br>a. 196 J b. 345 J c. 132 J d. 100 J | ANSWER KEY:<br>**I. Multiple Choice**<br>1) b<br>2) d<br>3) c<br>4) a<br>5) c |

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<td></td>
<td colspan="3">5) How much work is consumed when a 500-W blender runs for 8 seconds?<br>a. 40 J b. 400 J c. 4000 J d. 40,000 J<br><br>II. MODIFIED TRUE or FALSE<br>Write True if you agree with the statement and write False if you disagree with the statement. If your answer is False, change the underlined word to make it correct.<br>1) Work is a <u>vector</u> quantity.<br>2) The faster work is accomplished, the <u>higher</u> power is produced.<br>3) Frictional force produces negative work for a moving object.<br>4) <u>Maximum</u> work is produced when the force and displacement are perpendicular to each other.<br>5) Power is <u>directly</u> proportional to time and <u>inversely</u> proportional to work.</td>
<td>II. TRUE or FALSE<br>1) False, vector<br>2) True<br>3) True<br>4) False, zero<br>5) False, inversely, directly</td>
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<tr>
<td rowspan="5">B. Teacher's Remarks</td>
<td>Note observations on any of the following areas:</td>
<td>Effective Practices</td>
<td>Problems Encountered</td>
<td rowspan="5">This lesson design component prompts the teacher to record relevant observations and/or 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.<br><br>Notes here can also be on tasks that will be continued the next day or additional activities needed.</td>
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<tr>
<td>strategies explored</td>
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<td>materials used</td>
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<td>learner engagement/ interaction</td>
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<td>Others</td>
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|---|---|---|
| **C. Teacher's Reflection** | *Reflection guide or prompt can be on:*<br>▪ *<u>principles behind the teaching</u>*<br>*What principles and beliefs informed my lesson?*<br>*Why did I teach the lesson the way I did?*<br><br>▪ *<u>students</u>*<br>*What roles did my students play in my lesson?*<br>*What did my students learn? How did they learn?*<br><br>▪ *<u>ways forward</u>*<br>*What could I have done differently?*<br>*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. |