Senior High School

DEPARTMENT OF EDUCATION

Lesson Exemplar in General Science

Quarter 1

Lesson Exemplar

3

Lesson Exemplar for General Science
Quarter 1: Unit 1

Development Team

Writer: Shiela Marie S. Quiamson

Consultant: Alfons Jayson O. Pelgone, PhD
Philippine Normal University

Learning Area Specialists: John Cyrus L. Doblada
Danilo G. Soriano, Jr.

Bureau of Learning Delivery
Bureau of Curriculum Development
Bureau of Learning Resources

Every care has been taken to ensure the accuracy of the information provided in this material. For inquiries or feedback, please write or call the Office of the Director of the Bureau of Learning Resources via telephone numbers (02) 8634-1072 and 8631-6922 or by email at blr.od@deped.gov.ph.

Republic of the Philippines

Department of Education

BUREAU OF LEARNING DELIVERY

LESSON EXEMPLAR			
Learning Area	General Science	**Grade Level**	11
Semester	1st	**Quarter**	FIRST

I. OBJECTIVES *(Identifying the Goals)*	
Content Standard	*By the end of this lesson, learners' efficiency of simple and compound machines can be improved by application of basic principles of physics.*
Performance Standard	*By the end of the quarter, learners identify general physics principles and their applications in daily life. They use scientific principles to solve problems, make informed decisions, and illustrate the applications of physics for self, society, and the environment. They design simple and compound machines and hydraulic systems to demonstrate applications of force, torque, center of mass, and hydraulic-related principles. They evaluate energy-efficient practices in electricity supply and consumption at home, in local businesses and in exploring advantages and drawbacks of light and sound in medical imaging, security, communication and entertainment.*
Learning Competencies	*By the end of this lesson, learners apply concepts of translational and rotational motion to design and build prototypes of efficient simple and compound machines.*
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Halliday, David, Robert Resnick, and Jearl Walker. Fundamentals of Physics. 11th ed. Hoboken, NJ: Wiley, 2018. Serway, Raymond A., and John W. Jewett Jr. *Physics for Scientists and Engineers*. 10th ed. Boston: Cengage Learning, 2019. Paredes, Rodrigo, and Jorge Angeles. 2020. "The Design of a Novel Pure-Rolling Transmission to Convert Rotational into Translational Motion." *Mechanism and Machine Theory* 148: 103782. https://doi.org/10.xxxx..

	Norman, J., and A. L. Liddle. 2019. "Rotational and Translational Motion Interact Independently with Form." *Vision Research* 162: 81–91. https://doi.org/10.xxxx.. Krynkin, Anton, Roger J. Sandberg, Paul D. Tait, and David M. J. S. Bowman. 2016. "Measuring Rotational and Translational Movements in Rotating Machines Using a Computer Vision Approach." *Journal of Mechanical Engineering Science* 230 (4): 610–623. https://doi.org/10.xxxx.. The Physics Classroom. "Types of Motion." Accessed May 13, 2025. https://www.physicsclassroom.com.. PhET Interactive Simulations. "Rotational Motion: Interactive Learning." University of Colorado Boulder. Accessed May 13, 2025. https://phet.colorado.edu/en/simulations.. TED-Ed. "How Wind Turbines Work." Accessed May 13, 2025. https://shorturl.at/ZPxag..
(These shall be accomplished per topic)	
III. CONTENT *(Sequencing Content)*	*Simple and compound machines*
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	*By the end of this lesson, the learners should be able to:* • *Define translational and rotational motion, as well as simple and compound machines, while recognizing their significance in daily life.* • *Identify examples of translational and rotational motion and explain their role in the functioning of simple and compound machines.* • *Show appreciation for motion principles by creating a simple or compound machine, demonstrating curiosity, teamwork, and perseverance.* • *Construct and present a working prototype, showcasing its practical use and effectiveness.*

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATION</th></tr>
<tr><td>A. Activating Prior Knowledge</td><td>
1. Activating Prior Knowledge
Option 1: K-W-L Chart (Know, Want to Know, Learned)

Ask students to create a K-W-L chart in their notebook with three columns:

K (Know): List what you already know about translational and rotational motion.
W (Want to Know): Write any questions you have about translational and rotational motion.

Ask the students to discuss their "K" and "W" entries with a partner or in small groups.
Throughout the lesson, let the students update the "L (Learned)" column with key takeaways.
At the end, ask the learners to share insights within their group before reflecting individually.

<table>
<tr><th>Types of Motion</th><th>What I Know?</th><th>What I Want to Know?</th><th>What I have learned?</th></tr>
<tr><td>Translational</td><td></td><td></td><td></td></tr>
<tr><td>Rotational</td><td></td><td></td><td></td></tr>
</table>
Option 2: Motion in Everyday Life Discussion
</td><td>
IDF RELEVANCE
One practice that enables students to list prior knowledge relevant to the learning skill is the KWL Chart. It allows the teacher to see what the students already know. As it helps the teacher contextualize activities and choose appropriate strategies that cater to the students' responses on the KWL chart, especially in the first two columns, this is in line with the IDF-relevant section.
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	• The teacher will begin by asking students to think about the machines they use every day and explain that motion plays a crucial role in how these machines operate. • Ask students to share examples of machines they frequently use (e.g., bicycles, fans, cars). Guide Questions: 1. *What are examples of machines you use every day?* 2. *How do they function in terms of motion?* **Option 3: Brainstorming Group Activity** • The teacher will divide the students into small groups (choose a specific number based on class size) and provide each group with chart paper and markers for recording ideas. • Each group will list different machines they frequently encounter at home, school, or in their community. The students will analyze how each machine moves and determine whether it uses rotational or translational motion (or both). Encourage discussion within groups and ensure everyone contributes. Guide Questions: 1. *What movements do these machines perform?*	NOTE FOR TEACHERS: Encourage open discussion using the guide questions. Guide students to identify the type of motion involved (e.g., rotational motion in wheels, translational motion in elevators) and highlight the significance of motion in making tasks easier and improving efficiency. If possible, show simple machines in action or use illustrations. Allow students to demonstrate motions they observe in their surroundings. NOTE FOR TEACHERS: Explain that students will brainstorm in small groups to identify common machines and categorize them by motion type (rotational or translational). • The teacher will suggest that students think beyond obvious examples—how do machines like escalators, wind turbines, or sewing machines apply motion? • The teacher prompt groups with guiding questions

	2. *How does this motion help the machine function?* • Each group present their findings to the class, explaining their reasoning for categorizing each machine. • The teacher will allow students to compare results and refine their understanding of motion concepts. 2. Establishing the Purpose of the Lesson After the conduct of the activities in activating prior knowledge, the teacher will ask the students about the relevance of having knowledge on translational motion and rotational motion. **Option 1: Real-World Applications** • The teacher will divide the class into three (3) groups. All the students will ask to watch the videos. Each group will be assigned to examine a specific video showing how translational and rotational motion are used by real-world machinery such as wind turbines, bicycles, and cranes, and thoroughly examine how these two motion types affect the equipment's function. • Each group will be guided by the following guide questions. *Guide Questions:* • **How Wind Turbines Work – TED-Ed Animation** 1. What type of motion do the blades of a wind turbine exhibit?	• The teacher will ask the students - how does understanding motion help improve machine design? • The teacher will connect the activity to real-world applications, like engineering and technology advancements. NOTE FOR TEACHERS: • The teacher will begin by explaining that machines rely on different types of motion to function effectively. Introduce translational motion (straight-line movement) and rotational motion (circular movement). • State the goal: Students will analyze motion types in wind turbines, bicycles, and cranes using real-world examples. • Show videos or pictures illustrating these applications to create context.

	2. How does rotational motion in the blades convert into electrical energy? 3. What role does wind speed play in the efficiency of the turbine's motion? 4. Could a wind turbine function with only translational motion? Why or why not? ● **Bike Wheel Experiment: Angular Momentum** 1. What type of motion does the bike wheel demonstrate? 2. How does rotational motion influence balance and stability in bicycles? 3. How do gears and pedals contribute to both translational and rotational motion in a bicycle? ● **How Cranes Work – Animation** 1. What components of a crane use rotational motion? 2. How does translational motion help crane lift and move heavy loads? 3. Why is the combination of translational and rotational motion important in crane operation? 4. How advancements in motion mechanics improved the efficiency and safety of cranes over time? **Option 2: Inspire Innovation: Comparison from Old to Present Designs**	*1. How Wind Turbines Work – TED-Ed Animation (https://shorturl.at/ZPxag)* *2. Bike Wheel Experiment: Angular Momentum (https://shorturl.at/LlfNs)* *3. How Cranes Work – Animation (https://shorturl.at/sJB3I)* NOTE FOR TEACHERS: ● The teacher will begin by discussing the role of translational and rotational

	• The teacher will divide the students into small groups and assign each group a specific machine type. • The teacher will provide students with the comparison readings showing old vs present designs for: 1. Bicycle Design 2. Wind Turbines 3. Cranes and Lifting Machines 4. Cars and Engines *Guide Questions:* *1. How do old and new machine designs use rotational and translational motion differently?* *2. How do modern machines convert rotational motion into translational motion more efficiently?* *3. What improvements in motion mechanics make modern machines better than older ones?*	motion in engineering and design. Explain that students will compare past and present designs to see how motion mechanics have evolved. • **Set the goal**: Identify how technological advancements have improved efficiency and usability through motion principles. • Each group presents their findings, explaining key advancements. • **Encourage reflection**: *How could future innovations use motion concepts even more effectively?* • The teacher will wrap up by connecting motion principles to real-world problem-solving and creative design thinking. **IDF RELEVANCE** The IDF for these activities focuses on engaging students in analyzing translational and rotational motion in real-world applications and engineering innovations. The **Real-World Applications** activity uses videos and guided discussions to help students explore how motion affects the functionality of wind

		turbines, bicycles, and cranes. The **Inspire Innovation** activity encourages students to compare historical and modern machine designs, highlighting improvements in efficiency and usability through motion mechanics. Both approaches integrate active learning, collaboration, and real-world problem-solving, fostering critical thinking and creativity in technological advancements.
B. Instituting New Knowledge	1. Presenting Examples **Option 1: Demonstration of a Simple Machine: The Lever** ● The teacher will prepare all the needed materials for the activity. ○ A sturdy plank or ruler (lever) ○ A block or small object (fulcrum) ○ A weight (such as a book or small bag of sand) ○ A handle or force application point (where students apply pressure) ● Introduce the concept ○ Explain the basic parts of a lever: fulcrum, effort, and load.	NOTE FOR TEACHERS: ● The teacher will demonstrate a lever using a fulcrum, weight, and handle. Ask students to observe the transformation of forces through translational motion to lift the weight easily.

	○ Discuss how translational motion is used to make lifting easier. ○ Ask students to predict how shifting the fulcrum might affect force efficiency. ● Set Up the Demonstration ○ Place the fulcrum (block or object) near the center or one end of the plank. ○ Position the weight (load) on one side of the lever. ○ Ask a student to apply force on the opposite end (handle) to lift the weight. ● Observation and Discussion ○ Have students observe how the force transforms through motion. ○ Ask: ***Does moving the fulcrum closer to the weight make lifting easier?*** ○ Discuss real-world examples like seesaws, crowbars, and scissors. ● Hands-On Application	● Ask students to identify examples of levers they encounter in daily life. ● Relate the activity to motion mechanics in machinery and construction. ● Wrap-Up & Reflection ○ Discuss: ***Why are levers important in engineering and everyday tools?***

	○ Allow students to adjust the fulcrum's position and test different force applications. ○ Encourage them to compare the effort required at different points. **Option 2: Interactive Physics Simulations** ● The teacher will ensure access to PhET or other online simulations that model motion principles. ● Provide students with devices (or pair them in groups if limited resources are available). ● *Introduction and Learning Goals* ○ Explain the purpose of using simulations—to observe motion changes dynamically by adjusting variables. ○ Define translational vs. rotational motion and highlight their real-world applications. ● *Guided Exploration* ○ The teacher will demonstrate how to navigate the simulation interface. ○ Show students how to adjust variables (force, mass, friction, etc.) and predict outcomes. ● *Student Experimentation and Observation* ○ Allow students to test different settings and observe motion behaviors. ○ Encourage them to identify patterns in translational and rotational effects. ○ Have students record findings and compare cause-effect relationships. ● *Discussion and Analysis*	NOTE FOR TEACHERS: ● Utilize digital simulations (like PhET) to showcase translational and rotational motions through interactive experiments. Allow students to manipulate variables and observe outcomes. ● The teacher will use the following PhET: ● https://phet.colorado.edu/en/simulations/rotation ● https://phet.colorado.edu/en/simulations/torque ● The teacher will shortly discuss how virtual simulations help visualize physics concepts. ● Ask students to relate findings to real-world machines (e.g., bicycles, gears, pulleys).

	○ Use guiding questions to deepen understanding: 1. *How does increasing mass affect translational motion?* 2. *What happens when rotational speed increases?* 3. *How do friction and external forces impact movement?* **Option 3: Mechanical Toys Exploration** ● *Preparation and Setup* ○ The teacher will gather mechanical toys that demonstrate both translational (linear) and rotational (circular) motion, such as: ➢ *Wind-up cars* ➢ *Spinning tops* ➢ *Gears and pulley toys* ➢ *Toy trains or vehicles with rotating wheels* ○ The teacher will arrange a hands-on exploration station where students can freely interact with the toys. ● *Introduction and Learning Goals* ○ The teacher will begin by explaining the importance of mechanical motion in toys and everyday machines.	● Assign a short reflection where students explain their observations in relation to engineering applications. NOTE FOR TEACHERS: ● The teacher will ask the students to bring in mechanical toys that utilize both types of motion. Have students analyze and describe the movements happening in the toys and relate them back to concepts discussed in class. ● For Wrap-Up & Reflection, the teacher will ask the students to summarize how mechanical toys demonstrate fundamental principles of motion and engineering design. ● The teacher will challenge students to identify other objects in their daily lives that utilize both motion types. ● Consider assigning a creative follow-up: *Design a toy concept that effectively uses both rotational and translational motion.*

	○ Review the concepts of translational vs. rotational motion, ensuring students understand their real-world applications. ○ Ask students to predict which types of motion each toy might exhibit before testing them. ● *Observing and Analyzing Motion* ○ Allow students to manipulate the toys and observe their movement. ○ The teacher will guide the students in identifying which parts of the toy use rotational motion (gears, wheels, spinning components) and which use translational motion (straight-line movement, sliding parts, shifting pieces). ○ Encourage discussions using guiding questions: 1. *What type of motion does the toy primarily exhibit?* 2. *How does force transfer from one part of the toy to another?* 3. *Would the toy function differently if it used only one type of motion?* ● *Group Discussion and Concept Application*	**IDF RELEVANCE** This Instructional Design Framework (IDF) engages students in hands-on learning through three interactive activities, each highlighting translational and rotational motion in different contexts. The **Demonstration of a Simple Machine: The Lever** allows students to observe force transformation in lifting a weight, reinforcing how levers improve mechanical efficiency. The **Interactive Physics Simulations** provide a **digital exploration** of motion principles, enabling students to manipulate variables and analyze their effects dynamically. Lastly, the **Mechanical Toys Exploration** fosters **critical thinking and real-world connections** as students examine how toys utilize motion mechanics in design and function. Together, these activities encourage **active learning, experimentation, and innovation**, strengthening students' understanding of motion applications in engineering and everyday life.

	○ The students will compare different toys and classify their motion types. ○ The teacher will lead a discussion on how these mechanical principles are applied in real-world machines like bicycles, cranes, or cars. ○ Ask students to think creatively: *How could understanding motion lead to the design of better toys or machines?* 2. Discussing New Concept In this part, the teacher may provide students with reading materials that they can use in the conduct of the selected activity. **Option 1: Peer Teaching** ● *Introduction and Group Formation* ○ The teacher will begin by explaining the peer teaching method—students will work in pairs to research and teach the class about a machine. ○ Clarify the difference between simple machines (one mechanism) and compound machines (multiple working parts). ○ Assign or allow students to choose their machine to research.	NOTE FOR TEACHERS: ● This task requires students to conduct research on a simple or compound machine in pairs, produce a brief presentation, and share their results with the class. In addition to improving their presentation and teaching abilities, this will assist students gain a deeper grasp of how various machines operate, especially with regard to translational and rotational motion.

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- *Research and Preparation*
  - The teacher will provide students with reliable sources (textbooks, websites, simulation tools like PhET).
  - Instruct pairs to investigate how their machine utilizes translational and rotational motion.
  - Have each group prepare a short presentation (3-5 minutes) with:
    - A basic explanation of how the machine works
    - Examples of real-world applications
    - A visual aid (drawing, model, or digital slide)
- *Presentation and Demonstration*
  - Each pair presents their findings to the class, explaining the motion principles involved.
  - Encourage students to ask questions after each presentation.
  - If possible, allow groups to demonstrate the machine physically or using simulations.

Option 2: Group Discussion on Forces

- *Introduction and Concept Explanation*
  - The students will define translational motion (linear movement) and rotational motion (circular movement).
  - The teacher will introduce key forces acting on machines:

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- Assign a follow-up task: *How would you modify or improve your machine using motion principles?*
- The teacher will summarize key insights, emphasizing the role of motion in mechanical efficiency and discuss how innovations in machine design improve real-world applications.

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	➢ **Friction:** Resistance that slows motion. ➢ **Weight:** Force due to gravity affecting movement. ➢ **Tension:** Force applied through cables, ropes, or strings. ➢ **Torque:** Rotational force affecting spinning objects. ○ Set the discussion goal: *Students will analyze how these forces shape machine efficiency and motion.* ● *Guided Discussion Using Real-World Examples* ○ Divide the class into small groups and assign each force to a group to explore. ○ Present everyday machines that experience these forces, such as: ➢ **Friction:** Bicycle gears, car brakes, or conveyor belts. ➢ **Weight:** Elevator systems, cranes lifting materials. ➢ **Tension:** Pulley systems, suspension bridges.	NOTE FOR TEACHERS: ● The teacher will lead a discussion centered around the forces acting on machines in translational and rotational motion. Use examples of friction, weight, and tension, torque to illustrate concepts using guiding questions to facilitate dialogue. Students will investigate how forces like friction, gravity, and tension affect the motion of actual devices like wind turbines, bicycles, and cranes. ● The teacher will assign a follow-up task: *Find a machine in daily life and identify which forces influence its motion.* **IDF RELEVANCE** This Instructional Design Framework (IDF) promotes **active learning, collaboration, and critical thinking** through two structured activities. The **Peer Teaching** method engages students in researching and presenting information on simple and compound machines, reinforcing their understanding of

	➢ **Torque:** Wind turbine blades, rotating bicycle wheels. • *Use Guiding Questions to Facilitate Dialogue*: ○ **Friction:** *How does friction help or hinder machine performance?* ○ **Weight:** *Why must engineers consider weight when designing mechanical systems?* ○ **Tension:** *How do tension forces contribute to motion stability in machines?* ○ **Torque:** *What factors influence torque in rotational systems?* • *Encourage Peer Interaction and Critical Thinking* ○ Have each group discuss and analyze how their assigned force affects motion. ○ Ask groups to **present key insights** to the class, demonstrating examples of force interaction. ○ Encourage debate: *How could reducing or increasing each force improve efficiency?* 3. Developing Mastery **Option 1: Motion Analysis Assignment**	translational and rotational motion through hands-on explanation and demonstration. The **Group Discussion on Forces** deepens comprehension by exploring friction, weight, tension, and torque, using real-world examples and guiding questions to facilitate dialogue and analysis. Both activities encourage **student engagement, knowledge application, and inquiry-based learning**, helping learners connect motion principles to engineering and everyday applications.

	● The students will observe and analyze a simple machine (such as a bicycle or wind-up toy) in their daily environment, collecting data on translational and rotational motion and the forces affecting movement. ● **Introduction and Assignment Explanation** ○ The teacher will begin by reviewing motion principles, defining translational (linear) and rotational (circular) motion. ○ Explain the assignment: *Students will observe, analyze, and diagram the motion of a simple machine found at home or in daily life.* ● **Selecting a Machine and Observing Motion** ○ Ask students to choose a simple machine they frequently encounter, such as: ➢ **Bicycle** – Observe the wheels (rotational motion) and forward movement (translational motion). ➢ **Wind-Up Toy** – Analyze how gears rotate and drive motion in a straight line. ➢ **Scissors or Lever** – Examine force application and movement efficiency.	NOTE FOR TEACHERS: ● This activity aims to get students to watch and examine how a simple machine (such a bicycle or a wind-up toy) works in their daily lives. In order to strengthen their grasp of motion principles, students will gather data on translational and rotational motion, examine the forces at work, and present their results using diagrams through a home experiment. ● Connect the assignment to **mechanical innovations and real-world applications**.

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Data Collection and Motion Analysis

Guide students to record:

Which parts of the machine move in translational motion?
Which parts rotate, and how does rotational motion contribute to function?
What forces (friction, weight, tension, torque) affect movement efficiency?

Diagram and Presentation Preparation

Have students create labeled motion diagrams of their chosen machine.
Encourage them to explain:

How motion types contribute to functionality?
What improvements could be made to enhance efficiency?

Class Discussion and Reflection

Students present their observations and findings to the class.

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Please see the prepared learning activity sheet entitled “Motion Analysis Assignment”.
In grading this activity, see the attached rubric on page 28.

IDF RELEVANCE
This activity encourages critical thinking, observational skills, and applied science, helping students visualize physics in action.
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	○ Facilitate a discussion: *How do these motion principles apply to larger machines in engineering?*	
C. Demonstrating Knowledge and Skills	1. Finding Practical Application **Machine Dissection** ● The teacher will divide the students into small groups (3-5 members per team). Each group will choose a format on how they will present their findings: ○ **Option I - Video demonstration** – Show step-by-step disassembly and motion analysis. ○ **Option II - Infographic or poster** – Visually display labeled parts and motion explanations. ○ **Option III - Live presentation** – Explain findings to classmates through a guided walkthrough. ● *Introduction and Concept Explanation* ○ The teacher will explain the purpose of machine dissection—to explore how components interact through motion. ○ The teacher will review key motion concepts: ➢ Translational Motion: Parts moving in a straight path (e.g., sliding gears, pistons).	NOTE FOR TEACHERS: ● The teacher will inform students in advance to bring an old, non-functioning machine (e.g., clocks, toys, kitchen appliances). ● Arrange workstations with basic tools (screwdrivers, pliers, gloves). **Ensure safety guidelines are discussed before handling materials.** ● Discuss how motion principles guide engineering designs. ● Relate findings to real-world applications in technology and mechanics. ● Encourage students to reflect: *How would you improve the machine's efficiency using motion principles?*

	➢ Rotational Motion: Circular movement (e.g., gears, wheels, rotating motors). ○ Set expectations for observing, labeling, and recording findings. ● *Group Formation and Machine Disassembly* ○ Each group carefully disassembles their machine, documenting the process. ○ Guide them to **label parts** and categorize motion types. ● *Analysis and Reflection* ○ Ask guiding questions: ➢ *Which components exhibit translational motion?* ➢ *How do rotational parts affect movement efficiency?* ➢ *What forces (friction, torque) influence the machine's functionality?* ○ Encourage groups to compare **similarities and differences between machines**. 2. Making Generalization	● ***Please see the attached rubric for the "Machine Dissection Activity" on page 29.*** **IDF RELEVANCE** This hands-on activity fosters critical thinking, collaboration, and real-world engineering connections, helping students visualize motion mechanics through practical exploration. After then, the lesson shifts to synthesis and individual learning integration. Students go over and finish the "What I Learned" portion of

Option 1: KWL Continuation

The students will continue filling the last part of their KWL Chart-What I Learned column. In this part, they will summarize key takeaways from the lesson using the table:

Types of Motion	**What I Know?**	**What I Want to Know?**	**What I have learned?**
Translational	Objects move in a straight line or along a path without rotating	How does translational motion apply to machines in everyday life?	Translational motion helps in transportation.
Rotational	Objects spin around an axis, like wheels or gears	How does rotational motion contribute to machine efficiency and power generation?	Rotational motion is essential in machines like wind turbines, bicycles, etc.

Option 2: Concept Mapping

- The teacher will ask the students to define translational and rotational motion and give real-world examples. Discuss their differences, focusing on how motion influences machine functionality.

their KWL Chart in Option 1: KWL Continuation. By assisting students in solidifying their comprehension and visualizing their learning progress, this structured reflection fosters metacognitive development. Additionally, it improves the ability to evaluate oneself, which is essential in technical and safety-oriented education. The KWL exercise is a low-stakes but effective reflective assessment technique that corresponds with the ADDIE model's Evaluation stage.

NOTE FOR TEACHER:

- The teacher will introduce concept mapping as a visual way to organize ideas.

	• Provide guiding questions:
	  ○ *How does translational motion differ from rotational motion?*
	  ○ *What machines rely on each type of motion?*
	  ○ *How do forces interact with both motion types?*
	• Presentation and Class Discussion
	  ○ Each group presents their concept map to the class, explaining their connections.
	  ○ Facilitate peer questions and discussions:
	    ➢ *Which machines combine both motions?*
	    ➢ *How do engineers optimize motion for efficiency?*
	• Assign a **reflection task**, asking students to consider: *How could understanding motion principles improve machine design?*
	Option 3: Reflection Journals
	• The students will write reflections on what they learned about translational and rotational motion, summarizing key takeaways and generalizing principles for future applications.
	  ○ Guide Questions:
		• Divide students into pairs or small groups to brainstorm and organize ideas.
		• Instruct students to create a comparison chart, dividing sections into:
		  ○ Definition: Explain each motion type in simple terms.
		  ○ Examples: List everyday objects demonstrating these motions.
		  ○ Machine Applications: Identify engineering uses, such as pulleys, wheels, and turbines.
		• Encourage them to add arrows, links, and annotations showing how both motions interact.
		• Ask students to highlight key forces affecting each motion (e.g., friction, torque, gravity).
		
		NOTE FOR TEACHERS:
		• Provide students with time at the end of each class to write reflections on what they learned about translational and

	➢ *What is the most important concept you learned today?* ➢ *How does translational or rotational motion apply to machines you use daily?* ➢ *What principles from today's lesson could help in designing better technology?* ➢ *How did this lesson change your understanding of motion and forces?* 3. Evaluating Learning **Option 1: Self-Assessment** ● Provide students with a structured questionnaire that includes: 1. **Concept Understanding:** ○ *Can I clearly define translational and rotational motion?* ○ *Can I identify real-world examples of each motion type?* ○ *Do I understand how forces (torque, friction, gravity) affect motion?*	rotational motion. Ask them to generalize a principle or concept that they can apply to future tasks. Allocate 5-10 minutes at the end of class for students to write their reflections. Encourage clear organization, using headers such as: ○ Key Lesson Takeaways – Briefly summarize the main motion concepts learned. ○ Real-World Applications – Describe where they see these principles in action. ○ Future Connections – Predict how motion principles might help in future challenges. NOTE FOR TEACHERS: ● Explain the importance of self-reflection in learning, helping students gauge their comprehension of motion principles.

	2. **Application of Concepts:** ○ *Can I explain how motion principles improve machine efficiency?* ○ *Can I analyze how motion contributes to engineering advancements?* ○ *Am I able to describe how machines integrate both motions?* 3. **Confidence Level and Areas for Growth:** ○ *Which motion concept do I feel most confident in?* ○ *What specific topic do I need to review or understand better?* ○ *What strategies can help me strengthen my understanding?* **Option 2: Exit Ticket** At the end of the lesson, students submit an exit ticket responding to the question: *"How do translational and rotational motions work together in machines?"* ● **Review Before Submission** ○ Before answering, **guide a short class discussion** on examples:	● **Set expectations**: This is a personal evaluation, designed to help students recognize what they know and what they need to revisit. ● Allocate **10–15 minutes** for students to **answer honestly** and reflect on their learning. ● Encourage students to **write down examples** or concepts they need clarification on. NOTE FOR TEACHER: ● Explain that this quick reflection helps gauge student comprehension of motion concepts.

	➢ **Bicycles:** Rotational motion in the wheels creates translational movement forward. ➢ **Wind Turbines:** Rotational blades convert energy into usable electrical motion. ➢ **Cars:** Rotational motion in the wheels enables linear movement. ● **Writing the Exit Ticket Response** ○ Provide students with **index cards, paper slips, or digital forms** to submit answers. ○ Instruct them to **write a concise response (2–3 sentences)** explaining: ➢ *How both motions interact in a machine of their choice* ➢ *Why combining motion types improves functionality* 4. Additional Activity **Case Study Analysis: Motion-Based Innovations** ● The teacher will provide students with relevant resources (articles, engineering reports, or video documentaries).	● Encourage students to think critically about how machines integrate both types of motion. ● Gather responses to **analyze understanding trends** (strengths, misconceptions, gaps). ● Use student answers to **guide future lessons or clarifications** on motion principles.

	• Divide students into small groups (3–5 members per team).
	• Instruct students to investigate their case study, focusing on:
	  ○ *How motion principles influenced efficiency improvements?*
	  ○ *What forces (friction, torque, tension) contributed to functionality*
	  ○ *How the invention evolved over time*
	• The teacher will encourage the students to gather diagrams, key findings, and historical comparisons.
	• Guide each group to structure their 5–7-minute presentation, including:
	  ○ *Overview of the invention and its purpose*
	  ○ *How translational and rotational motion were applied*
	  ○ *What design changes led to efficiency improvements*
	  ○ *Visual representation (graphs, diagrams, or digital slides)*
	• Each team presents their case study findings.
	• Encourage peer engagement by allowing classmates to ask questions.
		NOTE FOR TEACHERS:
		• Assign a case study on an invention that improved efficiency through the application of motion principles. Groups will present their findings to the class.
		• Select or allow students to choose a motion-based invention, such as:
		  ○ Wind turbines – Efficiency in energy generation.
		  ○ Bicycles – Optimization of rotational motion for speed and balance.
		  ○ Hydraulic cranes – Translational and rotational integration for lifting heavy loads.
		  ○ Conveyor belts – Motion mechanics for industrial efficiency.
		• Summarize key takeaways from each case study.
		• Relate findings to modern-day engineering challenges and future innovations.

<table>
<tr><td></td><td>Facilitate a discussion: How do motion principles drive engineering advancements?</td><td>Assign a follow-up task: How could motion principles be applied to solve current efficiency problems in technology?</td></tr>
<tr><td>V. ASSESSMENT
(Assessing Learnings)</td><td colspan="2">Performance Task

*(The teacher can integrate this performance task in the next lesson focused on efficiency)

Engineering Motion: Building Efficient Machines
The learners will work in small groups to design, build, and test a working prototype of a simple or compound machine that demonstrates both translational and rotational motion. They will then explain the physics behind the motion of their machine and reflect on its efficiency.

Materials (Suggested)
Cardboard, wood, strings, pulleys, rubber bands
Screws, nails, glue, hot glue gun
Plastic wheels, gears, syringes (for hydraulics)
Rulers, protractors, stopwatch, weights
(Students are encouraged to reuse/recycle materials as much as possible.)
Before the Activity
Review the Concepts:
Quick recap of rotational motion</td></tr>
</table>

	○ Quick recap of translational motion ○ Introduce types of simple machines (lever, pulley, inclined plane, wheel and axle, wedge, screw) ○ Explain compound machines and examples 2. Form Student Groups: ○ Assign or let students form groups of 3–5 ○ Each group should have mixed strengths (builders, thinkers, writers) ○ Provide guidelines **During the Activity** ● Over 2–3 class sessions (or assigned as a project over 1–2 weeks): ● Allow time for designing, building, and testing ● Encourage iteration (test, observe, improve) ● Walk around to ask probing questions and ensure concepts are applied **After the Activity** ● Each group submits: ○ Prototype (demonstrated in class or through video) ○ Written Report ○ Presentation **Requirements** 1. Must include:

- At least **one rotating component** (wheel, gear, pulley, etc.)
- At least **one translational component** (sliding, pushing, lifting, etc.)
- At least one **simple machine** (lever, pulley, etc.)

2. Must **accomplish a useful task**, such as:
   - Lifting a weight
   - Moving an object
   - Launching something
3. Use **recycled or low-cost materials**

Deliverables

1. **Prototype** (presented in class or video demonstration)
2. **Written Report** (2–3 pages) with:
   - Description and labeled diagram of your machine
   - Explanation of how it works using physics terms
   - Calculations of force, torque, efficiency (if applicable)
   - Reflection on design process and teamwork
3. **Short Group Presentation** (3–5 minutes):
   - Show the working prototype
   - Explain how translational and rotational motion are involved

Sample Scoring Rubric:

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Needs Improvement
Prototype Design and Construction	Machine is well-constructed, sturdy, and demonstrates a high level of craftsmanship using appropriate materials.	Machine is functional, mostly sturdy, with good material usage, though minor flaws exist.	Machine is partially functional, but construction has weaknesses affecting performance.	Machine is unstable, poorly assembled, or fails to function as intended.
Motion Integration and Functionality	Clearly demonstrates both **translational** and **rotational** motion with strong alignment to physics principles.	Shows both motion types but may lack full precision or consistency in demonstration.	Displays motion types inconsistently or with unclear physics connections.	Motion types are not properly demonstrated or missing entirely.
Innovation and Problem-Solving	Highly original design; effectively incorporates creativity and engineering concepts. Shows strong problem-solving ability during testing and refinement.	Design is innovative with practical improvements; problems are mostly addressed successfully.	Design is somewhat creative, but problem-solving approach lacks depth or execution.	Shows minimal creativity or effort in troubleshooting; no significant improvements made.

Written Report Quality	Thorough, well-structured, includes clear diagrams, accurate physics explanations, and insightful reflection.	Clear and well-organized, includes diagrams and explanations, though some details lack depth.	Report is basic; diagrams or explanations are incomplete or unclear.	Report is poorly structured, lacks clarity, or missing required components.
Presentation and Communication	Engaging and well-organized presentation with confident explanation and strong visual aids.	Presentation is structured and clear, though may lack engagement or supporting visuals.	Presentation lacks clarity or confidence, with minimal supporting materials.	Presentation is disorganized, unclear, or missing key explanations.

Summative Assessment: The students will be assessed through a summative assessment. The teacher may opt to use Multiple Choice items, or open-ended questions.

Multiple Choice: Read each question carefully and choose the best answer.

1. Which of the following best describes rotational motion?
   A. An object moves along a straight path
   B. An object vibrates in place
   C. An object spins around a fixed axis
   D. An object stays at rest
2. What type of simple machine is a lever?
   A. A wheel with a rope
   B. A rigid bar that pivots on a fulcrum
   C. A flat surface raised at an angle
   D. A circular ramp

3. Which parts of a bicycle demonstrate both rotational and translational motion?
   A. Frame and handlebar
   B. Seat and pedals
   C. Wheels and chain
   D. Bell and lights
4. Which of the following are examples of translational motion?
   A. Clock hand turning
   B. Car driving on a highway
   C. Blender spinning
   D. Ceiling fan rotating
5. Why is it more efficient to use a wheelbarrow (compound machine) than to carry heavy loads by hand?
   A. It has a nice design
   B. It is fun to use
   C. It combines simple machines to reduce effort
   D. It can only be used by adults
6. How do gears contribute to the efficiency of a compound machine?
   A. They slow down the machine
   B. They transfer rotational motion to different parts
   C. They stop friction completely
   D. They change color under pressure
7. A crane uses both rotational and translational motion. Which parts represent each?
   A. The hook rotates; the boom slides
   B. The base rotates; the arm lifts and moves loads vertically
   C. The tires rotate; the seat vibrates
   D. The cable rotates; the hook rests
8. Which improvement could best increase the energy efficiency of a wind turbine?
   A. Using heavier blades
   B. Designing blades with optimized shape for wind flow
   C. Removing the rotor entirely
   D. Painting it a darker color
9. If a group is building a prototype machine that lifts objects using both types of motion, what would be the best design feature?

A. Only one wheel to reduce complexity
B. Fixed parts with no moving elements
C. Rotating gears connected to a sliding arm
D. Lightweight decoration only

10. Why is understanding motion important in designing machines for real-world applications?
A. To impress engineers
B. To reduce energy use and improve functionality
C. To follow tradition
D. To make machines more colorful

Answer Key:

ITEM	ANSWER	RATIONALIZATION
1	C	Rotational motion involves an object turning around an internal or external axis, unlike translational motion, which involves straight-line movement.
2	B	A lever is a straight, rigid bar that rotates around a fixed point (fulcrum) to lift or move loads.
3	C	The bicycle wheels rotate (rotational motion) and drive the bike forward (translational motion); the chain rotates to transfer force.
4	B	A car moves from one point to another in a straight path, which is the definition of translational motion.
5	C	A wheelbarrow is a compound machine using wheel and axle (rotation) and lever (lift), reducing the force needed.
6	B	Gears redirect or amplify rotational motion, improving performance and control in complex machines.
7	B	Cranes rotate at the base for positioning and use translational motion in the arm to lift/lower loads.

	8	B	Aerodynamic blade design maximizes wind capture and rotation, increasing the conversion of wind energy to electricity.
	9	C	A rotating gear system combined with a sliding mechanism integrates both rotational and translational motion effectively.
	10	B	Applying motion principles enables engineers to create efficient, effective machines that use less energy and perform better.
VI. REFLECTION *(Feedback and Continuous Improvement)*	*Teachers can take note tasks that will be continued the next day or additional activities needed. They are also encouraged to record relevant observations or any critical teaching events that influence on the attainment of the lesson objectives.*		

Prepared by:

JOHN-JOHN Q. GARCIA
Assistant Principal II

Reviewed by:

ALFONS JAYSON O. PELGONE, PhD
Philippine Normal University, Manila

Approved by:

JOHN CYRUS L. DOBLADA
General Science Specialist
BLD-TLD

Motion Analysis Assignment Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Needs Improvement
Observation and Data Collection	Data is comprehensive, accurate, and clearly organized; observations show deep attention to motion details.	Data is mostly accurate and well-organized; observations demonstrate a solid understanding of motion.	Data has some inaccuracies or is incomplete; observations lack clarity or depth.	Data is largely incorrect or missing; observations are unclear or insufficient.

Motion Analysis and Concept Understanding	Demonstrates a strong grasp of motion concepts, making insightful connections to real-world applications.	Shows good understanding with relevant analysis, though connections may lack depth.	Displays partial understanding with some misinterpretations or missing details.	Shows minimal understanding, with significant errors or lack of analysis.
Diagram and Labeling	Diagrams are clear, well-structured, and accurately labeled to represent motion concepts.	Diagrams are well-labeled but may lack precision or clarity in some areas.	Diagrams are basic, with some labeling errors or unclear representation of motion.	Diagrams are incomplete, poorly labeled, or missing essential details.
Presentation and Explanation	Explanation is highly engaging, articulate, and well-supported by evidence; demonstrates confidence.	Explanation is clear and organized, though may lack depth or engagement.	Explanation is somewhat unclear or disorganized, missing supporting details.	Explanation is difficult to follow, lacks clarity, and does not support findings.
Application and Reflection	Thoughtful reflection on motion concepts, demonstrating strong connections to real-world implications.	Reflection includes relevant applications but may lack deeper insights.	Reflection is basic, with limited connection to practical applications.	Reflection is superficial or missing, with little effort to apply concepts.

Machine Dissection Rubric

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Needs Improvement
Introduction and Concept Explanation	Clearly demonstrates deep understanding of motion concepts, explaining translational and rotational motion with precision.	Shows good grasp of motion concepts, with explanations that are mostly clear and accurate.	Displays basic understanding but lacks depth; explanations may have minor errors.	Shows little understanding of motion concepts, with unclear or inaccurate explanations.

Group Formation and Machine Disassembly	Works effectively in a group, carefully disassembling the machine while thoroughly documenting and labeling components.	Collaborates well, disassembles machine successfully, but documentation or labeling lacks some detail.	Participates in disassembly but documentation is incomplete or lacks organization.	Struggles with teamwork or documentation; disassembly lacks care or accuracy.
Analysis and Reflection	Thoughtful, detailed responses to guiding questions; makes strong connections to motion principles and efficiency.	Provides reasonable responses to guiding questions, showing understanding of motion concepts.	Responses are basic, missing deeper analysis; connections to motion principles are unclear.	Responses are incomplete or inaccurate, showing little effort in analysis and reflection.
Creative Presentation	Engaging, well-structured presentation with clear explanations and strong visual or demonstrative elements.	Presentation is clear and informative but lacks originality or depth.	Presentation is somewhat unclear or lacks strong supporting visuals and explanations.	Presentation is disorganized or missing essential components, making findings difficult to understand.