LESSON PLAN TEMPLATE

Lesson Title	Mechanical Advantage and Hydraulic Force: Enhancing Machine Efficiency
Learning Area/s	General Science
Name of Teacher/s	DEPED TAMBAYAN PH
Grade Level and Section	Grade 11
No. of Sessions	4 Sessions
References	Uploaded Files: SHS_GS_Q1_LAS_LE1.pdf, SHS_GS_Q1_LAS_LE2.pdf, SHS_GS_Q1_LAS1_LE3.pdf, SHS_GS_Q1_LAS1_LE4.pdf, SHS_GS_Q1_LE1.pdf, SHS_GS_Q1_LE2.pdf, SHS_GS_Q1_LE3.pdf, SHS_GS_Q1_LE4.pdf
Declaration of AI use	This lesson plan was co-created using Gemini AI to assist with unpacking competencies into a 4-session learning design, structuring activities, and assessment formulation.

Intentions. **Meaningful learning experiences are anchored in how we frame them. Start by deciding what you want learners to master by the end of the lesson – keep it clear and simple.**	
Learning Competency and Curriculum Standards:	**Learning Competency:** • Explain the characteristics of efficient simple and compound machines. • Explain how simple hydraulic systems use fluid principles to enhance simple and compound machines. **Content Standards:** Physics principles apply to numerous aspects of everyday living. Understanding linear and angular quantities to describe motion helps in the design of efficient machines. The efficiency of simple and compound machines can be improved by applying basic physics principles. Hydraulic systems exploit the relationship between pressure, force, and area to multiply forces and perform tasks. Analysis of electricity generation, consumption patterns, and energy-efficiency practices can lead to better energy supply and management. An understanding of the properties of light and sound leads to their safe and productive application. Past research in the field of chemistry provides the foundations for the development of helpful products and processes. Household and personal care products contain chemical substances that determine their properties and guide their proper use and disposal. **Performance Standards:**

	By the end of the term, 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 and local businesses and explore the advantages and drawbacks of light and sound in medical imaging, security, communication, and entertainment.			
	Session 1	**Session 2**	**Session 3**	**Session 4**
Learning Objectives:	• Compare and contrast translational and rotational motion in the context of local Filipino machinery and daily tasks. • Identify the linear and angular quantities used to describe the motion of simple machines found in the community. • Describe how basic physics principles of motion are applied to improve the functionality of household tools.	• Define efficiency in relation to simple and compound machines used in local industries. • Analyze how friction, torque, and mechanical advantage affect the efficiency of a machine. • Propose improvements to enhance the efficiency of a selected simple machine.	• Explain the relationship between pressure, force, and area in hydraulic systems using Pascal's Principle. • Describe how simple hydraulic systems enhance the force of simple and compound machines. • Identify real-world applications of hydraulics in the local community.	• Design a working prototype of a simple or compound machine that incorporates a hydraulic system for increased efficiency. • Evaluate the design of a machine based on its practical use, sustainability, and mechanical advantage. • Present a prototype that addresses a specific need in the local Filipino community.
Learner Context:	The learners are Grade 11 students who show a strong	The learners have recently shown a keen interest in	Learners have shown significant curiosity about	At the end of the week, the learners are energized by

	interest in practical, hands-on applications rather than abstract formulas. Many demonstrate high engagement when lessons involve relatable community objects, such as the mechanism of a bicycle or a traditional 'poso' (water pump). However, some learners struggle with the mathematical transition from linear to angular quantities. There are a few students with identified learning barriers requiring visual aids and simplified text to process complex physics definitions. Generally, the class is collaborative and performs well during group-based physical activities.	how machines can save 'pagod' (effort). They respond enthusiastically to competitive activities but tend to overlook energy loss (friction). Observations suggest that while they can identify a machine, they find it difficult to explain why one ramp is 'better' than another. A subset of the class requires translated or simplified instructions for technical terms like 'Mechanical Advantage'.	'invisible' forces like air and water pressure. They often ask how a small person can lift a heavy car using a jack. Strength: They are good at observing cause-and-effect in physical demonstrations. Barrier: Understanding the inverse relationship between area and pressure can be counter-intuitive for some.	the prospect of 'building' something. They work best in small, diverse groups where tasks can be delegated (drawing, assembling, explaining). Barrier: Limited access to specialized materials outside of school. Interest: Designing solutions for their own families or community problems (e.g., lifting heavy items in the market).
Learning Experience. **A learning experience is like a thoughtfully designed journey. Each activity and interaction builds towards meaningful understanding and growth. Identify activities and interactions to help learners gain knowledge, skills, or understanding in a purposeful way.**				
Pre-Lesson:	• **Option 1: Collaborative Word Map** - Students	• **Think-Pair-Share:** Students list three tools they use at	• **Impulse Review:** A quick 'Egg Drop' demonstrati	• **Brainstorming:** 'The Community Problem Solver' - In

	create a word map centered on 'Motion' using Manila paper, categorizing terms into things that move straight or things that spin. ● **Option 2: Lava Floor (Review)** - Students move to 'True' or 'False' sides of the room based on statements regarding distance, displacement, and speed to activate prior knowledge of kinematics.	home (e.g., scissors, hammer, stairs) and discuss with a partner how these tools make their chores easier. ● **Video Prompt:** A short clip showing an old, rusty pulley versus a well-oiled one, asking: 'Which one would you rather use and why?'	on (from LE 1) where an egg is dropped on a hard surface vs. a sponge. The teacher asks: 'How does the surface spread the force?' to bridge into fluid pressure. ● **Hydraulic Hunt:** Students list places in the community where they see heavy things being lifted (e.g., vulcanizing shops, barber chairs).	groups, students identify one local task that is physically exhausting (e.g., lifting sacks of rice, moving heavy furniture during floods). ● **Resource Check:** Students inventory the available materials (recycled cardboard, syringes, tape, sticks).
Flow:	**1. Motion Commotion Activity:** The teacher sets up a 'walking zone' in the classroom. One student performs various movements (walking straight, turning, speeding up). The class observes and classifies these as linear displacement, velocity, or acceleration. **2. Scaffolding**	**1. Efficiency Exploration:** The teacher demonstrates a lever (plank and block). Students predict and then test how moving the fulcrum closer to the load changes the effort required. This provides a concrete experience of mechanical advantage. **2. Interactive Simulation:** Using	**1. Syringe Discovery:** In pairs, students use two syringes of different sizes connected by a tube filled with water. They feel the difference in force when pushing the small plunger versus the large one (Social Learning/Scaffolding). **2. Theoretical Input:** The teacher uses the chalkboard to	**1. The Design Challenge:** Groups are tasked to design a 'Hydraulic Crane' or 'Mechanical Lifter' using recycled materials. They must incorporate at least one simple machine (lever or pulley) and one hydraulic component. **2. Prototyping Phase:** Students work in groups to build their models.

	Concepts: The teacher introduces the characteristics of Translational Motion (all points moving together) versus Rotational Motion (points moving around an axis) using a spinning electric fan and a sliding drawer as examples. Checks for understanding are conducted by asking students to identify which parts of a bicycle undergo which motion. **3. Gallery Walk:** Students visit four stations featuring photos of Filipino life (e.g., a 'padyak' driver, a spinning 'parol', a fish swimming). In pairs, they must identify the motion type and the physical quantities involved (Active Retrieval). **4. Social Learning:** Groups discuss how understanding these motions helps a 'padyak' driver exert less effort when starting from rest.	a projector, the teacher demonstrates a PhET simulation on 'Torque'. Students suggest changes to weights and distances to see the impact on balance and efficiency (Checks for Understanding). **3. Case Study Analysis:** Groups analyze the 'Motion Analysis Assignment' (from the Learning Activity Sheet). They select a machine like a bicycle or a wind-up toy and diagram the forces (friction, weight, torque) that might slow it down. **4. Modeling Efficiency:** The teacher introduces the formula for efficiency (Work Output / Work Input) and discusses how lubrication and material choice (e.g., using bamboo versus heavy steel) affect performance in a Philippine context.	derive Pascal's Principle (P = F/A). Using the syringe experience, students are guided to see that the pressure stays the same, but because the area is larger on one side, the force is multiplied. **3. Hydraulic Enhancement:** The teacher explains how hydraulics are combined with levers (like in a hydraulic jack). They watch a short video clip of a car lift in action (Active Retrieval of machine concepts). **4. Real-world Check:** Students brainstorm how hydraulics help in heavy machinery used for local road construction or flood control gates.	The teacher moves around, checking for understanding of how the rotational motion of the lever is enhanced by the hydraulic pressure (Scaffolding/Social Learning). **3. Efficiency Audit:** Before presenting, groups must identify one part of their design where friction might be a problem and propose a 'lubrication' or 'material' fix (Active Retrieval of Session 2 concepts). **4. Class Presentation:** Each group demonstrates their prototype, explaining the physics principles involved and how it helps the community. Peers provide feedback using a rubric (Social Learning).
Learning Resources:	• Manila paper and markers • Adhesive tape for the 'walking zone'	• Wooden board/sturdy plank • Blocks/textbooks (fulcrums) • Weights	• Plastic syringes of different sizes (e.g., 10ml and 50ml) • Flexible	• Recycled cardboard, BBQ sticks, string • Syringes and tubing from the

	• Printed photos of local scenes (sprinter, dog, bicycle) • Smart TV/Projector for visual prompts	(bags of sand or books) • PhET Interactive Simulations (Torque/Rotation) • Worksheets for Motion Analysis	plastic tubing • Water (colored for visibility) • Illustrations of a hydraulic jack and a barber chair	previous session • Glue/Tape • Protractors and rulers for motion diagrams
Opportunities for integration:	• **Physical Education:** Analysis of human movement during traditional Filipino games like 'Sipa' or 'Patintero'. • **Local Arts:** Examining the rotational symmetry and motion of the 'Gigantes' puppets or local dance movements.	• **Agriculture:** Evaluating the efficiency of traditional farming tools versus modern hand-tractors. • **Economics:** Discussing how machine efficiency reduces operational costs in small local businesses (e.g., a local bakery's mixer).	• **Environmental Science:** Analyzing the use of hydraulic systems in waste management trucks (garbage compactors). • **Health:** Understanding blood pressure as a fluid principle in the human circulatory system.	• **Entrepreneurship:** Developing a simple 'pitch' for their invention, focusing on cost-efficiency and utility. • **Social Studies:** Discussing the impact of affordable technology on the productivity of local Filipino workers.
Assessment. **Assessments reveal what learners have gained and what they still need help with. These are helpful in providing you with information to guide your future instruction throughout the entire session.**				
Formative Assessment:	• **Quick Recall Game:** '4 Pics, 1 Word - Physics Edition' where	• **The 'Efficient Tool' Challenge:** Students are presented with a	• **Predict-Observe-Explain (POE):** Before the syringe activity, students predict	• **Prototype Rubric:** Evaluation based on clarity of motion (translational/rotational),

	students identify the core concept (Force, Energy, or Motion) connecting four images. ● **Exit Ticket:** Students must write one sentence explaining the difference between the 'linear velocity' of a sliding box and the 'angular velocity' of a spinning wheel.	scenario: 'Lifting a heavy rice sack to a loft.' They must choose between a steep ramp, a long ramp, or a pulley, justifying their choice based on efficiency and friction. ● **Labeled Diagrams:** Students draw a simple machine and label where energy is likely lost as heat due to friction.	which syringe will be harder to push and then explain their observation using the words 'Force' and 'Area'. ● **Star-Rating Feedback:** During the discussion, the teacher uses a 3-star system to provide immediate feedback on student explanations of Pascal's Principle.	use of hydraulic principles, and identified efficiency factors. ● **Peer Review:** Each group must 'critique' another group's design, offering one way to make it more energy-efficient.
Ways Forward. **Meaningful learning can also happen beyond the classroom – for both the learners and the teacher. Pause and reflect on what happened today.**				
Extended learning opportunities:	● **Home Observation:** Students are tasked to find one object at home that exhibits both translational and rotational motion simultaneously and sketch it for the next	● **Interview:** Ask a local 'mekaniko' (mechanic) or 'karpintero' (carpenter) how they maintain their tools to keep them working smoothly.	● **Creative Sketching:** Draw a 'Super-Tool' that uses both a lever and a hydraulic syringe to help an elderly person lift heavy water containers.	● **Reflection Paper:** A short write-up on how they could improve their prototype if they had access to industrial materials like metal or high-pressure pumps.

	session.			
Reflections:	• How well did the students distinguish between linear and angular quantities during the 'walking zone' activity? • Which learners required additional scaffolding when identifying motion in the Gallery Walk? • Did the use of local examples increase engagement among the struggling learners?	• Were the students able to connect the physical feeling of 'easier work' with the concept of mechanical advantage? • How did the students with learning barriers respond to the visual simulations? • What local tools were mentioned most frequently by the students?	• Did the syringe activity successfully bridge the gap between theory and practice for the visual learners? • What common misconceptions about pressure and force emerged during the session? • How can I further simplify the math for the students struggling with the F/A ratio?	• Which groups demonstrated the most seamless integration of mechanics and hydraulics? • How did the learners respond to the 'real-world problem' framing of the design challenge? • What adjustments are needed for the next unit based on the technical skills observed during prototyping?