Senior High School

Lesson Exemplar in General Science

Quarter 1

Lesson Exemplar

5

Lesson Exemplar for General Science
Quarter 1: Unit 1

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

I. OBJECTIVES *(Identifying the Goals)*	
Content Standard	*The learners learn that hydraulic systems exploit the relationship between pressure, force, and area to multiply forces and perform tasks;*
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	*The learners explain how simple hydraulic systems use fluid principles to enhance simple and compound machines;*
II. REFERENCES and MATERIALS	• *Pascal, B. (1663). Experiences nouvelles touchant l'équilibre des liquides et l'usage de la pression des eaux dans les machines. Mémoires de l'Académie Royale des Sciences, Paris.* • *Young, H. D., & Freedman, R. A. (2012). University Physics with Modern Physics (13th ed.). Pearson Education.* • *Halliday, D., Resnick, R., & Walker, J. (2018). Fundamentals of physics (11th ed.). Wiley.* • *Cutnell, J. D., & Johnson, K. W. (2018). Physics (11th ed.). Wiley.* • *Giancoli, D. C. (2013). Physics: Principles with applications (7th ed.). Pearson.* • *Hewitt, P. G. (2014). Conceptual physics (12th ed.). Pearson.Fundamentals of physics Resnick* • *https://www.youtube.com/watch?v=yPOAkcyjZtg*

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	(These shall be accomplished per topic)
III. CONTENT	*The physics of fluids*
IV. OBJECTIVES	1. *Recall the key concepts of pressure, fluid flow, and the behavior of liquids in enclosed systems.* 2. *Explain Pascal's Principle and how it applies to the transmission of pressure in fluids.* 3. *Illustrate the relationship between pressure, force, and area using the equation P=F/A.* 4. *Explain how hydraulic systems apply fluid pressure to enhance the function of simple and compound machines.*

IV. PROCEDURES	**ANNOTATION**
A. Activating Prior Knowledge	*Begin the lesson with open-ended questions to ignite curiosity and critical thinking:* *Key Questions to Explore:* • *Why does a balloon pop more easily when you press it with a needle than with your finger?* • *Why do car tires flatten slightly on the ground even when fully inflated?* • *Have you ever wondered how a small jack can lift a car? How do you think it works?* *Strategy Options for Engagement:*	*This is designed to spark curiosity and build foundational understanding of pressure in relation to force and area. The goal is not to deeply analyze fluid mechanics or mathematical computations yet, but rather to:* • *Activate prior knowledge and curiosity through real-world examples and inquiry.* • *Highlight key relationships (i.e., more force or smaller area increases pressure).*

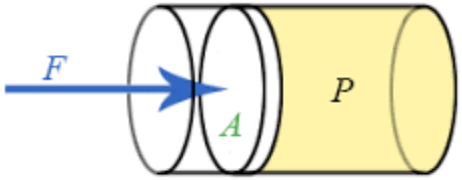
	Option 1: Think-Pair-Share (TPS) + Class Discussion 1. *Think: Individually, students think about each question for 1–2 minutes and jot down their thoughts.* 2. *Pair: Students discuss their answers with a seatmate or group of 3.* 3. *Share: Invite volunteers to share group insights. Write key ideas on the board.* ***Option 2: Four Corners Opinion Activity*** 1. *Label each corner of the room with choices: Strongly Agree, Agree, Disagree, Strongly Disagree.* 2. *Present a statement like:* ● *"Pressure is only affected by how much force is applied."* ● *"Machines that use fluids to lift heavy objects require less force."* 3. *Students go to the corner that matches their belief and defend their choice with reasoning.* ***Option 3: Visual Prompt Discussion*** 1. *Show images or videos (e.g., a person stepping on sand vs. nails, a car being lifted, a hydraulic press).* 2. *Ask: "What do you notice? What might be happening in terms of pressure and force?"* 3. *Use these prompts to encourage observation-based inferences.* *Gather and list responses on the board.*	● *Introduce the concept of pressure using the formula Pressure = Force / Area in a basic and intuitive way.* ● *Guide students toward observational reasoning rather than formal derivation.* *Avoid going into:* ● *Complex units and conversions* ● *Pascal's Principle details (this is covered in the next part)* ● *Advanced fluid dynamics or machine mechanics* *Keep the tone conversational and exploratory, ensuring all students feel confident contributing their ideas. Use analogies, visuals, and hands-on tasks to make the concept tangible and memorable.*

	Highlight emerging ideas such as force concentration, surface area, and fluid response. *Introduce the key term "pressure" and the guiding question: How is pressure influenced by force and area?* *Introduce the idea of Pressure = Force / Area as a formal concept they'll explore next.* *Start the KWL Chart:* ● *"What do I already Know about pressure and fluids?"* ● *"What do I Want to know about how pressure works in machines?"* *Provide hands-on activity to help students visualize and experience pressure and force distribution. Select from the options below:* ***Option 1: Clay Press Activity*** 1. *Provide groups with soft modeling clay, a nail, and a coin.* 2. *Have them press both objects into the clay using the same amount of force.* 3. *Let students observe the depth and shape of the imprints.* 4. *Guide them to conclude that a smaller surface area results in greater pressure, evidenced by deeper indentation.*	*This is a brainstorming stage. You are not expected to correct misconceptions yet. Use this as a tool to identify students' interests and tailor discussions. Revisit these questions on the next part of this exemplar track progress and understanding.* *The hands-on activities aim to help students grasp pressure, surface area, and fluid transmission. In the Clay Press Activity, students will observe how a nail creates a deeper imprint than a coin, demonstrating how smaller surface area leads to higher pressure.*

	Option 2: Syringe Pressure Transmission Demo 1. *Use two connected syringes (no needle), filled with water and attached via clear tubing.* 2. *Push one plunger and observe how the other moves.* 3. *Prompt students to infer that pressure applied at one point in a fluid is felt throughout the system—a tangible example of Pascal's Principle.* ***Option 3: Multimedia Integration*** 1. *Show short videos or animated simulations of hydraulic systems (e.g., car lift, airplane brakes, dentist chairs). Links: https://www.youtube.com/watch?v=yPOAkcyjZtg https://www.youtube.com/watch?v=yPOAkcyjZtg https://www.youtube.com/watch?v=rKTjZaIo26w* 2. *Ask students to identify and describe what they think causes the heavy lifting or stopping power.* *Perform the following Recall Activity/ies to activate prior knowledge and connect past learning to the current topic. Select from the options below:* ***Option 1: Concept Mapping / Whiteboard Brainstorming***	*In the Syringe Pressure Transmission Demo, students will see how pressure applied to one syringe is transmitted to another, illustrating Pascal's Principle. Afterward, ask them to reflect on how the pressure spreads through the fluid.* *The Multimedia Integration uses videos of hydraulic systems like car lifts to show how pressure works in real-world machines. After watching, prompt students to discuss how pressure helps these machines lift heavy objects or stop vehicles. These activities are designed to encourage observation, discussion, and application of pressure concepts in practical scenarios.* *For the Recall Activities, begin with Concept Mapping, where students write key terms related to force, area, and machines, then connect them to visualize what they know and what they need to learn. In the KWL Chart, have students list what they know, want to know, and will learn, which they can fill out throughout the lesson. Lastly, use a Quick Review Game like "Physics Charades" or "Hot Seat" to*

	1. *Ask students to recall and write keywords or formulas related to force, area, and mechanical systems on the board or through sticky notes.* 2. *Encourage the students to connect these ideas using arrows or categories, forming a web that visualizes what they already know and what they need to learn.* ***Option 2: KWL Chart Activity*** 1. *Distribute individual or group KWL (Know–Want to Know–Learned) charts.* 2. *Students fill out the "K" column with what they know about pressure, fluids, and machines.* 3. *In the "W" column, they write what they want to know or questions they hope to answer by the end of the topic.* 4. *The "L" column will be filled in throughout for reflection and synthesis.* ***Option 3: Quick Review Game*** 1. *Conduct a game like "Physics Charades" or a "Hot Seat" where students answer rapid questions about force and area from previous lessons.* *To conclude, ask students: "What is pressure? How does surface area affect pressure?"*	*reinforce previous lessons on force and area in a fun and interactive way.* *Allow 1-2 students to share their answers.*
B. Instituting New Knowledge	*Briefly review what was discussed on the previous part.* *Revisit the KWL chart: Update what students already know about pressure and fluids and what they want to know.*	*Key Concept: Pressure = Force/Area* *Discuss any lingering questions from the conclusion.*

	Start by engaging the students with a thought-provoking question: Have you ever wondered how a car can be lifted so easily in a repair shop using a hydraulic lift? What do you think happens to the fluid inside when pressure is applied? *Prompt students to think about their prior knowledge of pressure and force, setting the stage for the introduction of Pascal's Principle.* *Allow a few students to share their ideas briefly, encouraging them to consider situations where pressure is applied to fluids, such as in hydraulics or the pressure felt in a bottle when squeezed.* *Now, provide a concise and clear explanation of Pascal's Principle.* *Introduce a real-life example to help students connect the concept to something they can observe or experience. Select from the options below:* ***Option 1: Hydraulic Lift and Brake System Example*** *Example:* *"Hydraulic lifts in car service stations and brake systems in vehicles are real-world applications of Pascal's Principle."* *Explanation of the Example:*	*This question serves as a prompt to activate students' thinking and curiosity about how pressure behaves when it is exerted on a fluid within a closed system.* *Key Points to Emphasize:* • *Enclosed Fluid: Pressure is applied to a fluid that is confined within a container or pipe.* • *Transmission of Pressure: Any force applied to the fluid causes the pressure to spread evenly throughout the fluid, acting in all directions.* • *Undiminished: The pressure does not lose strength or reduce in magnitude as it travels through the fluid.* *When introducing real-life examples, start by explaining hydraulic systems in familiar contexts like car service stations or vehicle brake systems. Emphasize how small force applied to a small piston is transmitted through a fluid, creating enough pressure to lift heavy objects or stop a car. You can also introduce everyday examples like hydraulic systems in garbage trucks or excavators. Explain how these systems use Pascal's Principle to lift or*

	• *Hydraulic Lift: "In a hydraulic lift, a small amount of force is applied to a small piston. This force is transmitted through the fluid (like oil or water), and the pressure created by this force pushes up a much larger piston, which can lift a heavy object, such as a car."*  *Source: https://phys.libretexts.org/* • *Brake Systems: "In brake systems, pressure applied to a small piston in the brake master cylinder causes a much larger force to be transmitted through the fluid. This larger force is what ultimately pushes the brake pads against the wheels to stop the car."* *Conclusion:* *"Both hydraulic lifts and brake systems rely on Pascal's Principle to multiply force. The force applied to the smaller pistons is transmitted through the fluid, allowing for much greater force to act on the larger pistons."* ***Option 2: Everyday Examples of Hydraulic Systems*** *Example:* *"Think of the hydraulic systems in garbage trucks or construction machinery, like excavators. These systems also use Pascal's Principle to lift heavy loads effortlessly."*	*move heavy loads with relatively small amounts of force. Encourage students to understand the connection between pressure, force, and hydraulic systems, reinforcing the idea that Pascal's Principle allows small forces to be magnified and applied efficiently in various real-world applications.*

	Explanation of the Example: ● *Garbage Trucks: "In garbage trucks, hydraulic systems are used to lift the trash containers. A small force applied to a small piston pushes fluid, which then exerts pressure on a larger piston to raise the container, making it easier to empty large amounts of trash."* ● *Excavators: "Excavators use hydraulic cylinders to control the movement of the arm and bucket. A small force applied at one point is transmitted through the fluid, allowing the machinery to lift and move heavy materials."* *Conclusion:* *"These hydraulic systems work because Pascal's Principle allows a small force to be transmitted through fluid to produce a much larger force, making it possible to move or lift heavy objects."* *Visual Aid/Example – Hydraulic Lift. Select from the options below:* ***Option 1: Animation of Hydraulic Lift*** 1. *Show an Animation or Video* *Display an animated video that demonstrates a hydraulic lift in action. Ensure the video explains how a small piston creates pressure that is transmitted through the fluid to a larger piston.* *Links: https://shorturl.at/dGppQ / https://shorturl.at/Z0sDP* 2. *Guiding Questions for Observation:* *"What happens to the small piston when pressure is applied? How does this pressure transfer to the larger piston?"* 3. *Explanation:* *"In this animation, we see that when the small piston is pressed, it creates pressure in the fluid. This pressure is then*	*When presenting visual aids like animations or diagrams, explain how pressure is transmitted from the small piston to the large piston in hydraulic systems. For the animation, highlight how pressing the small piston creates pressure, which is then transferred through the fluid to lift a heavy object. Ask guiding questions to focus students' attention on the process, such as "What happens to the small piston when pressure is applied?" and "How does this pressure transfer to the larger piston?" For the diagram, explain the labels and arrows that show the pressure direction, helping students*

	transmitted through the fluid, causing the larger piston to move upwards and lift a heavy object." 4. *Key Concept Discussion:* *"This is how Pascal's Principle works in hydraulic systems: pressure is applied to the fluid and is transmitted undiminished to the larger piston, allowing us to lift much heavier objects with relatively little force."* ***Option 2: Diagram of Hydraulic Lift with Labels*** 1. *Show a Clear Diagram of a Hydraulic Lift* *Display a labeled diagram of a hydraulic lift system showing the small and large pistons, the fluid connecting them, and arrows indicating the direction of pressure transmission.* 2. *Guiding Questions for Observation:* *"Can you identify where the small piston applies pressure? How does this pressure affect the larger piston?"* 3. *Explanation:* *"In this diagram, the pressure applied to the small piston (indicated by the arrows) is transmitted through the fluid and causes the large piston to move upward. This is the principle behind hydraulic lifts, where the force is multiplied by the pressure transfer through the fluid."* 4. *Key Concept Discussion:* *"Just like in the animation, this diagram shows how pressure in the confined fluid is transmitted from the smaller piston to the larger one, demonstrating Pascal's Principle in action."*	*understand the hydraulic lift's function. Reinforce that both examples demonstrate Pascal's Principle: pressure is applied to the fluid and transmitted undiminished, allowing for the multiplication of force in hydraulic systems. Encourage students to observe how force is amplified with relatively little effort.*

	Ask a few review questions to connect with the previous discussion: • *"What is Pascal's Principle?"* • *"What happens to pressure in a confined fluid when force is applied?"* *Review key vocabulary: pressure, force, area, Pascal, fluid, hydraulic system.* *Ask: "How can we mathematically describe the effect of force and surface area on pressure?"* *Write the formula on the board: P = F / A* *Explain the inverse relationship between pressure and area when force is constant.* *Show unit analysis.* *Links: https://www.youtube.com/watch?v=lWR-KRlbFRo* *https://www.youtube.com/watch?v=pQ0xwoYeWoA* *https://www.youtube.com/watch?v=f-zVk_e9R0Q* *Select from the options below:* ***Option 1: Weight and Area Experiment*** 1. *Use a wooden block and a stack of weights.* 2. *Place the block flat on a sponge and measure the depth it sinks.* 3. *Then, place the block on its narrow side and repeat.* 4. *Ask: "Why does the same weight cause a deeper dent when the area is smaller?"* ***Option 2: Real-Life Analogy Discussion*** 1. *Compare high heels vs. flat shoes on soft ground.*	*For this activity, the goal is to reinforce the relationship between pressure, force, and area, and to help students practice applying the formula P = F / A. Start with a review of key concepts, like Pascal's Principle and the basic definitions of pressure, force, and area. Use the formula to show how pressure is calculated and explain the inverse relationship between pressure and area when force is constant. This will help students understand how pressure changes with surface area.* *For the Weight and Area Experiment, guide students to notice how the same force (the weight) creates different pressures depending on the surface area. When the area is smaller, the pressure increases, which is a great demonstration of the concept. Similarly, the Real-Life Analogy Discussion (comparing high*

	2. *Ask: "Why do sharp objects (e.g., nails, tacks) exert more pressure even with less force?"* *Discuss Conclusion:* *These real-life examples reinforce the idea that a smaller surface area leads to greater pressure when force is constant.* *Solve the following problems using the formula: $P=F/A$; $F=P\times A$; or $A=F/P$. Show your complete solutions in the Learning Activity Sheet titled Calculating Pressure in Real-Life Situations provided.* *Sample Problems:* 1. *A woman weighing 600 N wears heels with a heel area of 0.001 m^2. What pressure does each heel exert on the ground?* 2. *A block exerts 600 Pa of pressure on the floor. The area of contact is 0.5 m^2. What is the force exerted by the block?* 3. *A refrigerator with a weight of 1200 N exerts a pressure of 800 Pa on the floor. What is the area of its base?* 4. *A man standing on snowshoes exerts a force of 800 N on snow. The total area of the snowshoes is 0.4 m^2. What pressure is applied to the snow?* 5. *A suitcase exerts a pressure of 4000 Pa on the floor. Its base area is 0.05 m^2. What is the weight of the suitcase?* *Interactive Activity: "Pressure Match-Up" Game. Select from the options below:*	*heels vs. flat shoes) helps students connect these ideas to their daily experiences.* *In the Learning Activity Sheet titled Calculating Pressure in Real-Life Situations, guide students step-by-step on how to use the formula. Allow them time to work individually on the problems. Afterward, review the answers as a class, highlighting the correct application of the formula and addressing common mistakes that students may encounter.*

	Option 1: Pressure Calculation Stations • *Prepare cards with values for force, area, and pressure.* • *Students rotate in groups to different stations and solve the missing variable in each card.* ***Option 2: Formula Challenge*** *Give students quick challenges:* • *"If the area is doubled and the force remains the same, what happens to pressure?"* • *"If pressure increases but area stays constant, what can you say about the force?"* *Class Wrap-Up Discussion:* *Ask: "What did you discover about how pressure, force, and area are connected?"* • *"I now understand that pressure increases when…"* • *"A real-life situation where I can apply P = F/A is…"* • *Update the "L" column in the KWL chart with what they've learned today.*	*For the "Pressure Match-Up" game, ensure students work in groups to rotate through stations, solving for missing values using the formula P = F / A. Walk around to provide guidance and support, especially if they struggle with the calculation. For the Formula Challenge, give quick questions that encourage students to think about the relationship between pressure, force, and area, like how doubling the area affects pressure or what happens when pressure increases but area stays the same. Afterward, facilitate a class discussion where students share what they've learned and update the "L" column of their KWL chart. The aim is to reinforce their understanding of the formula and its practical applications in real life.*
C. Demonstrating Knowledge and Skills	*Recall the past lesson. Select from the options below:* ***Option 1: Pair-and-Share Prompt*** *Ask the following questions:* • *"What do you remember about Pascal's Principle?"* • *"What does the formula P = F/A tell us?"* • *"How can machines become easier to use with pressure?"* ***Option 2: Visual Recall*** *Show images of a car jack, dump truck, or backhoe.*	*For the recall activity, engage students with the pair-and-share prompt. Ask them to discuss Pascal's Principle, the formula P = F / A, and how pressure makes machines easier to use. This will help reinforce their understanding. For the visual recall option, show images of machines like a car jack, dump truck, or backhoe, and encourage students to identify common features and discuss how pressure is*

	Ask the following questions: ● *"What do these have in common?"* ● *"How do you think pressure plays a role on how these machines work?"* *Introduce the Hydraulic-Enhanced Machines* *Ask: "How does pressure help simple and compound machines work more efficiently?"* 1. *Recall of Machine Types* *Start by reviewing the six types of simple machines:* ● *Lever (e.g., seesaw, crowbar)* ● *Inclined plane (e.g., ramp)* ● *Wedge (e.g., axe blade)* ● *Screw (e.g., jar lid)* ● *Wheel and axle (e.g., steering wheel)* ● *Pulley (e.g., flagpole)* *Explain that compound machines are devices that combine two or more simple machines to accomplish work more efficiently.* *Examples include:* ● *Scissors (wedge + lever)* ● *Wheelbarrow (wheel and axle + lever)* ● *Car jack or crane (lever + hydraulic system)* 2. *Introduction to Hydraulics in Machines*	*involved in their functioning. This will help them connect the concept of pressure in hydraulic systems to real-world applications. Be sure to guide the discussion and prompt students with follow-up questions to clarify their thoughts and ensure they grasp the core ideas.* *For this section, start by reviewing the six types of simple machines and explain how compound machines combine two or more simple machines to perform tasks more efficiently. This will help students connect the hydraulic systems to machines they already know. Emphasize how hydraulic systems use fluid pressure to enhance the function of simple and compound machines, making them more efficient by multiplying force.*

	Connect the concept of hydraulics to these machines by explaining that: ● *Hydraulic systems use fluid pressure to transmit force.* ● *According to Pascal's Principle, when pressure is applied to a confined fluid, the pressure is transmitted equally in all directions.* ● *This means a small input force on a small piston can generate a larger output force on a larger piston.* *State that by combining this principle with simple or compound machines, we get tools that can do heavy lifting, pushing, or movement with less human effort.* *3. Concrete Examples* *Hydraulic Press:* *Used in industries to shape metal or crush materials.* ● *It applies a small force over a small piston, transmitting pressure through a fluid to a larger piston that exerts a strong force.* ● *This makes it ideal for compacting or stamping.* *Hydraulic Jack:* *Used in auto repair shops to lift cars.* ● *Combines a lever (to pump the jack) and fluid pressure to amplify force.* ● *A small effort with the lever sends fluid to a piston that lifts a heavy vehicle with ease.* *Backhoe or Excavator:* *Used in construction to dig and move earth.*	*Introduce concrete examples of hydraulic systems in use, like the hydraulic press, jack, and backhoe, to help students visualize how pressure is applied and transmitted to lift heavy objects with less effort. Make sure to explain the application of Pascal's Principle in each example, showing how a small force applied to a small piston can result in a larger force on a larger piston.*

	• *Combines levers (arms and bucket movement) with hydraulic pistons that apply force.* • *The operator uses small controls to move massive parts thanks to hydraulic power.* 4. *Visual Aid / Diagram* *Show a simple diagram or animation of a hydraulic jack:* *Highlight the small piston, the fluid reservoir, and the larger piston lifting a car.* *Ask the following questions:* • *"Where is pressure applied?"* • *"Where is the force being exerted?"* • *"How does this reduce effort for the user?"* *Emphasize:* *"This system allows a person to lift a heavy car by applying a relatively small force—because of how pressure is multiplied and distributed by the hydraulic fluid."* *Group Activity – Match the Machine. Select from the options below:* ***Option 1: Matching Cards + Justification Task*** 1. *Create three sets of cards:* *Column A: Machine names (e.g., hydraulic car jack, bulldozer arm, scissors with a hydraulic chamber, excavator).*	*As you discuss these examples, use a diagram or visual aid to further demonstrate how pressure is transmitted in hydraulic systems. This will reinforce the concept and provide a clear visual connection to the machines in real life. Make sure to guide students through each example, encouraging them to relate the principle to the machines they encounter daily.* *For this activity, explain to students how hydraulic systems make machines more powerful by multiplying force. They can lift heavy objects, like a car, with less effort because the hydraulic fluid spreads the pressure across the system.* *In the group activity, students will match machines to their functions and explain how pressure helps each one work. They should describe how Pascal's Principle applies and how it makes lifting or moving easier.*

	Column B: Type of machine (simple or compound) and primary function. *Column C: Description of how pressure assists or enhances its mechanical operation.* 2. *Group Task* *Match the cards (as in the basic version), then complete an additional sheet where they:* ● *Justify their matches using Pascal's Principle and mechanical advantage.* ● *Compare how different machines utilize pressure differently based on their design and function.* ● *Evaluate which machines benefit most from fluid pressure and why, citing physical principles.* ***Option 2: Interactive Chart*** 1. *Prepares a Blank Chart:* *Machine Name | Simple/Compound | Fluid Use | Mechanical Advantage | Real-World Application | Explanation/Justification* 2. *Fill in the chart using real-world examples.* 3. *For the "Explanation/Justification" column, students must analyze the system using pressure-area-force relationships.* 4. *In small groups, select one machine and prepare a mini-case analysis (2–3 minutes oral or written) on:* ● *How fluid pressure is applied and transmitted.* ● *What simple machines are involved?* ● *How does this setup reduce effort or increase efficiency?*	*For the interactive chart, students will use real-world examples of hydraulic machines and explain how they work. They'll analyze how pressure, force, and area are connected and how different machines use hydraulics to make tasks easier.* *The goal is to help students understand how pressure and hydraulics make machines more efficient and to connect these ideas to real-life examples.*

	Real-World Application Discussion. Select from the options below: ***Option 1: Case Study Presentation*** 1. *Present a short video or story (e.g., how hydraulics work in fire trucks or airplane landing gear).* 2. *Ask the following questions:* ● *"What simple/ compound machines are involved?"* ● *"How does fluid pressure improve their function?"* ***Option 2: Scenario Problem Solving*** 1. *Pose this:* *"If you had to design a machine to lift heavy boxes using limited human effort, what simple machine would you choose? How could a hydraulic system make it better?"* 2. *Students brainstorm in pairs and share ideas.* *Synthesis Task – Create and Explain. Select from the options below:* ***Option 1: Machine Task*** 1. *Task: Draw a simple or compound machine (e.g., ramp, lever, pulley) and add a hydraulic system to enhance its function.* 2. *Include labels:* ● *Where the pressure is applied* ● *What kind of fluid might be used* ● *How work becomes easier* ***Option 2: Explain-a-Machine Poster*** 1. *Choose a machine from real life (e.g., bulldozer, lift, log splitter)*	*For the real-world application discussion, show a video or tell a story about how hydraulic systems are used in fire trucks or airplane landing gear. Ask students to identify the simple or compound machines involved and discuss how fluid pressure improves their function. This helps students see hydraulics in action and understand its importance in various real-world scenarios.* *For scenario problem solving, encourage students to think creatively about designing a machine to lift heavy boxes using minimal human effort. Ask them to consider which simple machine they would use and how hydraulics could make it more efficient. This encourages practical application of their knowledge.* *For the synthesis task, students will either draw a simple or compound machine and enhance it with a hydraulic system or create a poster explaining how a real-life machine uses hydraulics. They should focus on explaining where pressure is applied, what type of fluid might be used, and how the hydraulic system makes the work easier. This allows students to*

	2. *Write:* • *What type of machine is it* • *How fluid pressure helps* • *What Pascal's Principle has to do with it* *Do the reflection and KWL completion. Select from the options below:* ***Option 1: Quick Write Prompt*** • *"Hydraulics make machines more powerful because…"* • *"One way pressure improves a compound machine is…"* ***Option 2: Complete the KWL Chart*** • *Students fill in the "L" (Learned) column form the previous discussions.* • *Share 2–3 insights with the class*	*apply their understanding of hydraulic systems and Pascal's Principle creatively.* *For the reflection and KWL completion, you can have students engage in a quick write prompt by asking them to complete sentences like, "Hydraulics make machines more powerful because…" or "One way pressure improves a compound machine is…" This allows students to summarize and apply what they've learned in their own words, reinforcing key concepts.* *Alternatively, you can have students fill in the "L" (Learned) column of the KWL chart from the previous discussions. Afterward, ask students to share 2–3 insights with the class. This not only allows for reflection but also gives students the opportunity to articulate their understanding and hear from their peers, creating a deeper connection to the topic.*
V. ASSESSMENT	***Part I. Choose the letter of the best answer.*** *1. What happens to pressure when force is applied to a confined fluid?* *a) The pressure increases.* *c) The pressure remains constant.* *b) The pressure decreases.* *d) The pressure becomes uneven.* *2. Pascal's Principle states that pressure applied to a confined fluid is transmitted equally in all directions. Which of the following is an example of Pascal's Principle in action?* *a) Water rising in a straw when you suck on it.*	

b) A car jack lifts a car with the application of a small force.
c) Water flowing down a river.
d) A balloon expands when air is pumped inside.

3. *Which correctly represents the relationship between pressure, force, and area?*
   a) $P = F + A$
   b) $P = F / A$
   c) $P = A / F$
   d) $P = A * F$
4. *Which of the following best describes how hydraulic systems work?*
   a) They use air pressure to transmit force.
   b) They use gravitational force to lift objects.
   c) They use electrical pressure to transmit energy.
   d) They use fluid pressure to transmit force and multiply it.
5. *What is the primary advantage of using a hydraulic system in machines like car jacks or excavators?*
   a) It reduces the energy required to move objects.
   b) It decreases the amount of fluid needed.
   c) It multiplies force to lift or move heavy objects with less effort.
   d) It increases the speed at which objects can be moved.

Part 2: Answer the following questions in 2-3 sentences.

Pointing System:

- ***2 pts*** *– The answer/solution is accurate, complete, and clearly demonstrates understanding of the physics principle using appropriate science terms or examples.*
- ***1 pt*** *– The answer/solution is partially correct, related to the question, and shows basic understanding, but lacks depth or clarity.*
- ***0 pt*** *– The answer/solution is incorrect, incomplete, or not related to the question.*

1. *Explain how Pascal's Principle applies to hydraulic systems.*
2. *A force of 100 N is applied to a small piston with an area of 0.2 m^2 in a hydraulic system. What is the pressure applied to the fluid? (recall $P = F / A$)*
3. *Describe how pressure, force, and area are related in the context of a hydraulic lift. Why does a small force on a small piston result in a large force on a large piston?*

	4. *A hydraulic lift is used to raise a 2000 N car. If the small piston has an area of 0.05 m² and the large piston has an area of 2 m², calculate the force applied to the large piston using Pascal's Principle. (Hint: Use the formula P = F / A for both pistons and set the pressure equal on both pistons.)* 5. *In the case of dentist chairs and other surgical tables, how does the hydraulic system make the machine more efficient?*
VI. REFLECTION	*Teachers are encouraged to record relevant observations or any critical teaching events that influence the attainment of the lesson objectives. You can also note tasks that will be continued the next day or additional activities needed. Entries on this section are teacher's reflection on the implementation of the entire lesson which will serve as inputs for the LAC sessions.*

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KEY TO CORRECTION

Part I.

Item Number	*Correct Answer*	*Rationalization*
1	*A*	*When force is applied to a confined fluid, the pressure increases because pressure is directly proportional to force.*
2	*B*	*A car jack is a classic example of Pascal's Principle: a small force applied to a confined fluid is transmitted equally, allowing a larger force to lift the car.*
3	*B*	*The correct formula is P=F/A, where pressure (P) equals force (F) divided by area (A).*
4	*D*	*Hydraulic systems use fluid pressure to transmit and multiply force through confined liquids, enabling heavy lifting with minimal effort.*
5	*C*	*The main advantage of hydraulic systems is force multiplication, allowing users to move or lift heavy objects with much less input force.*

Part II.

1. *Pascal's Principle explains that pressure applied to a confined fluid is transmitted undiminished in all directions. In hydraulic systems, this means a small force can generate a larger force in another part of the system, allowing for efficient lifting or pushing.*
2. *Solution: $P = 100\ N / 0.2\ m^2 = 500\ Pa$*
3. *Pressure is inversely proportional to area. In a hydraulic system, when force is applied to a small piston with a smaller area, the pressure is high. This pressure is transmitted through the fluid to the large piston, where the larger area results in a larger force.*
4. *Solution: $P = F / A$, so $P = 2000\ N / 0.05\ m^2 = 40{,}000\ Pa$.*
   Since the pressure is the same on both pistons, $P = 40{,}000\ Pa$.
   Force on the large piston: $F = P * A = 40{,}000\ Pa * 2\ m^2 = 80{,}000\ N$.
5. *In the case of dentist chairs and surgical tables, hydraulic systems allow the chair or table to be raised or lowered smoothly with minimal effort. When pressure is applied to a small piston, it is transmitted through the fluid to a larger piston, which lifts the heavy chair or table. This makes positioning patients easier and safer for both the operator and the patient. The hydraulic system increases efficiency by providing controlled, powerful movement using small input forces*

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