Strengthened Senior High School

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Lesson Exemplars for Domestic Refrigeration and Air-Conditioning Servicing

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Lesson Exemplar for Domestic Refrigeration and Air Conditioning **Grade 11-Term 1**

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LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**1**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and air-conditioning units.	
B. Performance Standard	The learner performs the installation of domestic refrigeration and air-conditioning units with safety precautions	
C. Learning Competencies	Discuss overview of Refrigeration and Air Conditioning servicing	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Air Conditioning and Refrigeration by Miller (Ch.1); PEC 2017 Part 1 **Materials:** Projector, laptop, speakers, sample service contract, job order forms, whiteboard	
III. CONTENT	Overview of Refrigeration and Air Conditioning servicing	
IV. OBJECTIVES	At the end of the lesson learners should be able to: **Identify** at least three current trends in the HVAC industry. **Classify** career opportunities in Contracting, Merchandising, Manufacturing, and Consulting. **Explain** the basic principle of heat transfer using everyday examples. **Appreciate** the role of DRAC technicians in Philippine society.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** Good morning! Let's start with a quick activity called Hot or Cold. I'll show you pictures. Raise your left hand if it needs refrigeration (kept cold). Raise your right hand if it needs air conditioning (space cooling).	**Facilitation:** Use local items: *tuyo (dried fish), fresh pork, computer server, jeepney, vaccine vial, mangoes.*

	The teacher shows images one by one. Why do we need to cool these? What happens if we don't? (Call 3 students). **2. Establishing the Purpose of the Lesson** Today we are looking at a billion-peso industry. DomRAC is not just repair, it's a path to owning a business, working abroad (Canada, Japan, UAE) or becoming a technical expert. Let's map the big picture.	**Rationale:** Activates schema about the *need* for cooling in daily Filipino life. **Rationale:** Connects to career aspirations and economic mobility—primary motivators for SHS-TVL students.
B. Instituting New Knowledge	**3. Presenting Examples** Watch these three short clips. Write one observation per clip. *Clip 1:* Technician using digital manifold gauge and thermal camera. *Clip 2:* Contractor signing maintenance deals for a mall. *Clip 3:* News report on global warming increasing AC demand. What did you see? (Write answers on board). You saw *technology*, *business*, and *environmental issues*. These are our three pillars. **4. Discussing New Concept** The teacher says: Copy this table in your notebook. **Topic A: Current Trends (Write 'T-G-S-P')** **Smart Technology:** You can cool your room using your phone before you get home. Wi-Fi thermostats.	**Facilitation:** Pause after each clip. Ask specific questions. **Rationale:** Structured, explicit lecture and local analogies.

	G - Green Refrigerants: Old ACs used R-22 (nakakasira ng ozone). New ones use R-32 or R-290 (environment-friendly). **S - Energy Efficiency (Inverter):** Look for the Philippine Energy Label (4-5 stars). Inverter technology saves 40% of electricity. **P - Predictive Maintenance:** Use thermal cameras to see a failing part *before* it breaks. No more waiting for a total breakdown. **Topic B: Career Pathways (CTEM Model)** **C - Contracting:** Bidding for projects. Example: Installing 20 ACs for a new BPO building. Requires license and capital. **T - Trading/Merchandising:** Selling compressors, copper tubes, tools. You need product knowledge, not necessarily repair skills. **E - Employment/Manufacturing:** Working for companies like Carrier, Daikin, Samsung. Stable income, benefits. **Maintenance/Consulting:** House-to-house service. This is the most common entry point for NC II holders. Low startup capital. **Teacher Ask:** Which path requires the least startup capital? **Topic C: Basic Principles** Forget magic. Refrigeration is simply **moving heat from where it is not wanted to where it doesn't matter**."	**Facilitation:** Fast-paced, buzzer system. The first correct answer gets a plus.

	5. Developing Mastery **Activity: "4 Pics 1 Word"** *Set 1:* [Phone+AC app] + [Wi-Fi] + [Thermostat] + [Mobile] = **SMART AC** *Set 2:* [Hard hat] + [Blueprint] + [Building] + [Money] = **CONTRACTING** *Set 3:* [Flame] + [Ice melting] + [Arrow] + [Sun] = **HEAT TRANSFER**	**Rationale:** Gamification increases dopamine and recall.
C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** Teacher says: Scenario: Aling Nena says, "why hire a certified technician? My brother can install the AC. Based on what you learned, what do you tell her? **2. Making Generalization** Teacher Says: Complete this sentence: Refrigeration and Air Conditioning servicing is not just about fixing broken units; it is about _____. Collect 3-4 answers. **3. Evaluating Learning** I. Multiple Choice (10 pts). Encircle the letter. 1. Which refrigerant is environmentally friendly? a) R-22 b) R-32 c) Freon-12 d) Gasoline 2. Which career pathway involves bidding for large installation projects? a) Merchandising b) Manufacturing c) Contracting d) Consulting	**Facilitation:** Role-play. One student acts as Aling Nena. **Rationale:** Forces synthesis into a personally meaningful statement. **Rationale:** Moves from theory to persuasive communication and professional ethics.

	3. Refrigeration is simply... a) Creating cold air b) Moving heat c) Removing humidity d) Freezing water 4. Which trend allows smartphone control? a) Green Refrigerants b) Smart HVAC c) Predictive Maintenance d) Manual Control 5. What is the function of the refrigerant? a) Produce electricity b) Carry heat c) Clean filter d) Lubricate fan 6. Which career is "house-to-house repair"? a) Manufacturing Engineer b) Sales Agent c) Maintenance Technician d) Architect 7. Natural heat flow moves from... a) Cold to hot b) Hot to cold c) Left to right d) Low to high pressure 8. An NC II holder CANNOT: a) Install window-type AC b) Diagnose leak c) Design 20-story building HVAC d) Clean condenser 9. Predictive Maintenance uses a... a) Hammer b) Thermal camera c) Soldering iron d) Stethoscope 10. Which is Merchandising? a) Selling copper tubes b) Repairing freezer c) Teaching HVAC d) Installing ducts **ANSWER KEY** 1-b, 2-c, 3-b, 4-b, 5-b, 6-c, 7-b, 8-c, 9-b, 10-a **4. Additional Activities** Interview one appliance store salesperson: What is the most common complaint about AC units? Report in 2 sentences.	*Give short and direct questions based on the lesson objectives*

VI. ASSESSMENT	***Performance Task:*** ***Scenario-Based Interview (15 pts)*** *Situation: A family friend, Mr. Reyes, is planning to buy two air conditioners for his small resort in Batangas. He is torn between buying a standard non-inverter unit (cheaper upfront cost) and an inverter unit (more expensive but has a high energy efficiency rating). He also does not know whether to just ask his handyman to install it or to hire a certified DomRAC technician.* *Task: Based on what you learned in this lesson, write a short dialogue or a persuasive paragraph (5-7 sentences) advising Mr. Reyes. In your response, you must:* 1. ***Recommend*** *which type of AC to buy and explain why (refer to the Green/Smart/Energy Efficiency trend).* 2. ***Explain*** *why hiring a certified technician is important (connect to safety, professionalism, or career pathways like Maintenance/Consulting).* 3. ***Use*** *the basic principle of heat transfer (moving heat from where it is not wanted to where it doesn't matter) in your explanation.* ***Rubric:*** • ***Content & Accuracy (10 pts):*** *Correctly applies trends, career concepts, and heat transfer principle.* • ***Clarity & Real-world Connection (5 pts):*** *Advice is practical, clear, and shows appreciation for the technician's role in Philippine society.* *(Alternative simpler task if the above is too advanced for the first lesson)*
VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**2**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and air-conditioning units.	
B. Performance Standard	The learner performs the installation of domestic refrigeration and air-conditioning units with safety precautions	
C. Learning Competencies	Discuss overview of Refrigeration and Air Conditioning servicing	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Refrigeration and Air Conditioning by Langley (Ch. 2-3); PEC 2017 **Materials:** Cutaway model of a refrigerator/window-type AC, actual components (compressor, condenser, evaporator, capillary tube), diagrams, magnifying glass	
III. CONTENT	Refrigeration Systems	
IV. OBJECTIVES	At the end of the lesson learners should be able to: 1. **Identify** the four major components of a vapor-compression refrigeration system. 2. **Describe** the function of each component using the acronym CCME. 3. **Differentiate** domestic, commercial and industrial refrigeration systems. 4. **Locate** each component on an actual window-type air conditioner.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Teacher Says:** Last time, we learned that refrigeration is moving heat. Today, we asked: *How* does it move? Let's start with a quick Organ Hunt. I will say a function. You raise your hand and name the part that does it.	**Facilitation:** Use a real opened window-type AC or large poster. Point to parts as students name them.

	Teacher functions: Makes the gas high pressure (Compressor). Releases heat outside (Condenser). Absorbs heat inside (Evaporator). Today, we will learn exactly what each part does. **2**. **Establishing the Purpose of the Lesson** **Teacher Says:** Imagine you are a doctor. A patient is sick. You cannot prescribe medicine if you don't know the organs. The same here. If a unit 'not cooling, you must know if the heart(compressor), lungs (condenser), or stomach (evaporator) is sick. Today, we learn the anatomy of a refrigeration system.	**Rationale:** Elicits prior knowledge about mechanical parts. Activates curiosity. Emphasizes diagnostic necessity.
B. Instituting New Knowledge	**3. Presenting Examples** **Teacher Says:** I will pass around three items: 1. a working compressor (small) 2. a piece of condenser coil 3. a capillary tube. Touch them (careful, edges are sharp!). *Teacher asks:* What do you notice about the compressor? (Heavy, sealed). The condenser? (Fins, metal). The capillary tube? (Very small opening). **4. Discussing New Concept** Open your notebook. Title: The Four Major Components - CCME. We will use this acronym forever.	**Facilitation:** Use a rotation system. Each group gets 2 minutes per component. **Rationale:** Structured, explicit lecture and **Rationale:** Tactile learning. Concrete experience before abstract theory. **Rationale:** Mnemonic CCME(Compressor, Condenser,

	Component 1: Compressor (The Heart) **Location:** At the back/bottom of a ref, or inside the outdoor unit of a split-type AC. **Function:** It receives low-pressure cold gas from the evaporator. It compresses it into high-pressure HOT gas. It pumps the refrigerant around the system. If the compressor is dead, the whole system is dead. **Types we use:** Reciprocating (piston), Rotary (common in window-type), Scroll (quiet, for inverter). **Component 2: Condenser (The 'Heat Releaser')** **Location:** The hot coils at the back of a refrigerator or the outdoor part of an AC. **Function:** The hot gas from compressor enters. Air (or water) passes over the coils. Heat is released to the outside. The gas turns into a high-pressure WARM LIQUID. *Analogy:* Parang pawis mo. When you sweat (gas), and wind blows (air over condenser), you feel cold because heat left your body. **Types:** Fin-and-tube (most common), microchannel (newer, lighter). **Component 3: Metering Device (The Gatekeeper)** **Location:** Between the condenser and evaporator. Usually a small copper tube called 'capillary tube' (cap tube) in domestic units. **Function:** It restricts flow. It causes a pressure drop. The high-pressure warm liquid becomes low-pressure COLD liquid (some flash gas). *This creates the cooling effect.* *Analogy:* Your thumb on a garden hose. When you cover the opening (restrict), water sprays out cold and fast. **Types for now:** Capillary tube (fixed), Thermal Expansion Valve (TXV - we see this in bigger units).	Metering, Evaporator) aids memorization. **Facilitation:** Fast-paced, buzzer system. First correct answer gets a plus.

Component 4: Evaporator (The Heat Absorber)
Location: Inside the refrigerator or the indoor unit of an AC (the cold part).
Function: The cold liquid enters. Warm room air is blown across it. The liquid refrigerant absorbs heat and BOILS into a low-pressure COLD GAS. This is where your room gets cold.
Analogy: Ice on your skin. The ice absorbs heat from your body and melts (changes state). Same here, but refrigerant boils at -20°C

Component	What it does	State of refrigerant
Compressor	Pumps, increases pressure	Low pressure gas → High pressure HOT gas
Condenser	Releases heat	Hot gas → Warm liquid
Metering	Restricts flow	Warm liquid → Cold liquid + gas
Evaporator	Absorbs heat	Cold liquid + gas → Cold gas

5. Developing Mastery

Activity: "Line-Up Relay"

Teacher Says: In your group, arrange the components in the correct order of refrigerant flow. Then match each component to its function. First group to raise hands with correct arrangement wins.

Answer order: Compressor → Condenser → Metering → Evaporator (then back to compressor).

Rationale: Gamification increases dopamine and recall.

Facilitation: Divide class into 4 groups. Each group gets 4 cards (names of components) and 4 cards (functions).

Rationale: Kinesthetic and collaborative learning. Sequence understanding is critical.

C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** **Teacher Says:** Scenario: A customer says, My refrigerator is running but the freezer is not cold. The back coils are very hot. What could be wrong? Based on CCME which component should you check first? *Answer:* Condenser is hot = compressor okay. Problem is further downstream (metering device clogged, evaporator fan not working or low refrigerant). **2. Making Generalization** Complete this sentence: The four major components of a refrigeration system work like a relay team; if _____ fails then _____. *Example:* If the compressor fails, then no refrigerant moves and no cooling happens. **3. Evaluating Learning** **Multiple Choice (10 pts).** Encircle the letter of the correct answer. 1. Which component is considered the "heart" of the refrigeration system? a) Condenser b) Evaporator c) Compressor d) Capillary tube 2. Where does the refrigerant change from gas to liquid by releasing heat? a) Compressor b) Condenser c) Evaporator d) Metering device	**Facilitation:** Guide students to think: Hot coils (condenser) means compressor is working. Problem likely evaporator or metering device or refrigerant leak. **Rationale:** Diagnostic thinking. Links components to real troubleshooting. **Rationale:** Emphasizes interdependence of components.

	3. Which component creates the pressure drop that causes cooling? a) Compressor b) Condenser c) Evaporator d) Metering device 4. Which component absorbs heat from the room? a) Compressor b) Condenser c) Evaporator d) Metering device 5. What is the most common metering device in domestic refrigerators? a) TXV b) Capillary tube c) Orifice plate d) Float valve 6. The compressor receives refrigerant that is... a) High pressure hot gas b) Low pressure cold gas c) High pressure liquid d) Low pressure liquid 7. The condenser discharges... a) Cold air inside b) Hot air outside c) Refrigerant leak d) Water 8. Which component is located inside the refrigerated space? a) Compressor b) Condenser c) Evaporator d) Metering device 9. What happens to refrigerant in the evaporator? a) It condenses b) It boils/evaporates c) It freezes d) It compresses 10. The correct order of refrigerant flow is: a) Evap→Comp→Cond→Meter b) Comp→Cond→Meter→Evap c) Cond→Evap→Comp→Meter d) Meter→Evap→Comp→Cond **ANSWER KEY** 1-c, 2-b, 3-d, 4-c, 5-b, 6-b, 7-b, 8-c, 9-b, 10-b	

	4. Additional Activities Draw the CCME sequence on a short bond paper. Label each component and write one sentence about its function.	
VI. ASSESSMENT	***Performance Task:*** On a diagram of a window-type AC label the four major components and write one sentence explaining the function of each. **Scoring Guide:** • Correct label of Compressor: 2 pts • Correct label of Condenser: 2 pts • Correct label of Metering Device: 2 pts • Correct label of Evaporator: 2 pts • Accurate function sentence for each: 1 pt each (4 pts) • **Total: 12 pts** (Passing: 10)	
VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*	
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.	

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**3**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and air-conditioning units.	
B. Performance Standard	The learner performs the installation of domestic refrigeration and air-conditioning units with safety precautions	
C. Learning Competencies	Discuss the refrigeration cycle.	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Modern Refrigeration and Air Conditioning (Althouse); PEC 2017 **Materials:** Pressure-enthalpy (P-H) diagram poster, colored markers (red, blue, green, yellow), simulation software (PhET Refrigeration Cycle), dry ice demonstration materials (with safety gear)	
III. CONTENT	The Refrigeration Cycle	
IV. OBJECTIVES	At the end of the lesson learners should be able to: 1. **Sequence** the four stages of the refrigeration cycle correctly. 2. **Explain** what happens to refrigerant pressure and temperature at each stage. 3. **Trace** the cycle on a simple diagram using colored arrows. 4. **Predict** what happens to the cycle if one stage is interrupted.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Teacher Says:** Let's review our CCME. I will point to a component. You shout its function.	**Facilitation:** Fast-paced. Use a real unit or large poster

	Teacher points to compressors, condenser, capillary tube, and evaporator. **Teacher Says:** Now, these four components don't work alone. They work on a *cycle*. Today we followed the refrigerant's journey. **2. Establishing the Purpose of the Lesson** **Teacher Says:** Why do we need to learn the cycle? Because when a customer says, 'My AC is not cooling,' you need to find *where* in the cycle the problem is. Is it before the condenser? After the evaporator? The cycle is your map. No map = lost technician.	**Rationale:** Quick retrieval practice before building that knowledge. **Rationale:** Emphasizes diagnostic application of cycle knowledge.
B. Instituting New Knowledge	**3. Presenting Examples** **Teacher Says:** Watch this 2-minute animation of the refrigeration cycle. Watch the colors: RED = hot, BLUE = cold. *Play YouTube animation.* **Teacher Says:** What color was the gas leaving the compressor? (Red - hot). Leaving the evaporator? (Blue - cold). Now let's understand why. **4. Discussing New Concept** **Teacher Script:** We will trace the cycle stage by stage. Copy this diagram on your paper. Use four colors: RED, ORANGE, GREEN, BLUE.	**Facilitation:** Play animation twice. First time just watching. Second time, students draw the cycle in their notebooks. **Rationale:** Visual representation of an invisible process. Animation bridges abstract to concrete. **Rationale:** Multi-sensory learning (visual, auditory, kinesthetic - coloring).

	Stage 1: Compression (Compressor) - COLOR: RED **Starting point:** Refrigerant enters compressor as a LOW PRESSURE, LOW TEMPERATURE GAS (around 10-20 psi, 10°C). **What happens inside:** The compressor squeezes the gas. The molecules are forced closer together. **Result:** The refrigerant becomes a HIGH PRESSURE, HIGH TEMPERATURE GAS (around 150-250 psi, 70-100°C). *Analogy:* Using a bike pump. When you push the pump (compress), the bottom of the pump gets very hot. **Draw on your diagram:** RED arrow from compressor to condenser. **Stage 2: Condensation (Condenser) - COLOR: ORANGE** **Starting point:** Hot gas enters the condenser coils. **What happens inside:** The condenser fan blows outside air (or water) across the coils. Heat moves FROM the hot refrigerant TO the cooler outside air. **Result:** The refrigerant RELEASES heat. It changes state from GAS to LIQUID. But it is still HIGH PRESSURE, now WARM LIQUID (around 35-45°C). *Analogy:* Steam from a kettle. When it hits a cold window, it turns into water droplets (condenses) and releases heat. **Draw:** ORANGE arrow from condenser to metering device. **Stage 3: Expansion (Metering Device) - COLOR: GREEN** **Starting point:** High pressure warm liquid enters the capillary tube (very small opening). **What happens inside:** The refrigerant is forced through a tiny hole. This creates a sudden pressure DROP. **Result:** The refrigerant becomes LOW PRESSURE, COLD LIQUID + some GAS (around 0-5°C, some even -5°C). The temperature drops dramatically.	**Facilitation:** Fast-paced, buzzer system. The first correct answer gets a plus. **Rationale:** Gamification increases dopamine and recall.

Analogy: Your thumb on a garden hose. When you cover the opening, the water comes out cold and fast because pressure drops.
Draw: GREEN arrow from metering device to evaporator.

Stage 4: Evaporation (Evaporator) - COLOR: BLUE

Starting point: Cold liquid gas mixture enters the evaporator coils inside the room/freezer.
What happens inside: The indoor fan blows warm room air across the cold evaporator coils. Heat moves FROM the warm room air TO the cold refrigerant.
Result: The refrigerant ABSORBS heat. It changes state from LIQUID to GAS (it boils/evaporates). It becomes LOW PRESSURE, COLD GAS (around 10°C, ready to go back to the compressor).
Analogy: Alcohol on your skin. It feels cold because it absorbs heat from your body to evaporate.
Draw: BLUE arrow from the evaporator back to the compressor (completing the circle).

Stage	Component	Pressure	Temp	State
Compression	Compressor	Low – High	Low – High	gas
Condensation	Condenser	High	High - Warm	Gas - Liquid
Expansion	Metering	High – Low	Warm – Cold	Liquid - Mix
Evaporation	Evaporator	Low	Cold – Colder	Mix - Gas

Teacher Says: The cycle never stops. It repeats as long as the compressor runs. That's why it's called a *cycle*.

	5. Developing Mastery **Activity: "Cycle Relay Race"** **Teacher Says:** In your group, arrange the cards in the correct order: Stage name, then its description. First group to finish with all correct win's a plus. Sample card: Stage 2 - Condensation: High pressure gas becomes warm liquid; heat is released.	**Facilitation:** Split class into 4 groups. Each group gets a set of 8 cards (4 stage names, 4 descriptions).
C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** **Teacher Says:** Scenario: You are called to a restaurant. Their walk-in freezer is not freezing. You feel the condenser and it is COLD (not warm). The compressor is running. Which stage of the cycle is most likely the problem? *Answer:* Compression stage (compressor not compressing) OR no refrigerant (nothing to compress). **2. Making Generalization** **Teacher Says:** Complete this analogy: The refrigeration cycle is like a water wheel because… *Sample answer: because* water (refrigerant) must flow continuously in a circle. If the wheel stops at any point, the whole system stops.	**Facilitation:** Guide to students: Cold condenser means no hot gas is reaching it. Compressor runs but no compression? Could be bad compressor valves or no refrigerant. **Rationale:** Diagnostic reasoning using cycle knowledge. **Rationale:** Forces deeper understanding through analogy construction.

	3. Evaluating Learning **Multiple Choice (10 pts).** Encircle the letter with the correct answer. 1. In which stage does the refrigerant change from gas to liquid? a) Compression b) Condensation c) Expansion d) Evaporation 2. In which stage does the refrigerant absorb heat? a) Compression b) Condensation c) Expansion d) Evaporation 3. What happens to pressure in the expansion stage? a) Increases greatly b) Decreases suddenly c) Stays the same d) Fluctuates randomly 4. The refrigerant leaving the compressor is… a) Low pressure cold gas b) High pressure hot gas c) High pressure warm liquid d) Low pressure cold liquid 5. Which component is associated with the evaporation stage? a) Compressor b) Condenser c) Metering device d) Evaporator 6. What color arrow represents the condensation stage in our lesson? a) Red b) Orange c) Green d) Blue 7. The refrigerant entering the evaporator is… a) High pressure hot gas b) High pressure warm liquid c) Low pressure cold liquid+gas d) Low pressure cold gas 8. Which stage is responsible for releasing heat to the outside? a) Compression b) Condensation c) Expansion d) Evaporation	

	9. If the metering device is clogged, which stage is directly affected? a) Compression b) Condensation c) Expansion d) Evaporation 10. The correct sequence of the refrigeration cycle is a) Evap→Comp→Cond→Exp b) Comp→Cond→Exp→Evap c) Cond→Exp→Evap→Comp d) Exp→Evap→Comp→Cond **ANSWER KEY** 1-b, 2-d, 3-b, 4-b, 5-d, 6-b, 7-c, 8-b, 9-c, 10-b **4. Additional Activities** Draw the four-stage cycle on a short bond paper. Use colored arrows (Red, Orange, Green, Blue). Label each stage and write the state of refrigerant.	
VI. ASSESSMENT	**Performance Task Component:** On a diagram of a refrigeration system, use colored arrows (Red, Orange, Green, Blue) to trace the cycle. Write one sentence explaining what happens at each stage. **Scoring Guide:** • Correct color sequence: 4 pts • Correct arrow direction: 4 pts • Accurate description for each stage: 2 pts each (8 pts) • **Total: 16 pts** (Passing: 13)	

VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**4**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and air-conditioning units.	
B. Performance Standard	The learner performs the installation of domestic refrigeration and air-conditioning units with safety precautions	
C. Learning Competencies	Discuss states of matter, units of heat, heat transfer, sensible heat, latent heat, superheat, and subcooling.	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Principles of Refrigeration by Dossat; PEC 2017 **Materials:** Ice cubes, beaker, thermometer, hot plate, water, digital thermometer, stopwatch, candle, metal rod	
III. CONTENT	States of Matter and Heat Principles	
IV. OBJECTIVES	At the end of the lesson learners should be able to: 1. **Identify** the three states of matter and their changes. 2. **Differentiate** sensible heat from latent heat using examples. 3. **Explain** the three methods of heat transfer. 4. **Define** superheat and subcooling in the context of the refrigeration cycle. 5. **Calculate** simple sensible heat problems.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Demonstration: "Melting Ice"**	**Facilitation:** Do this at the front where all can see. Use a clear container.

	Teacher Says: I have an ice cube. I will heat it up. Watch the thermometer. *The teacher heats ice until it melts, then until the water boils.* **Teacher Asks:** What did you observe? Did the temperature stay the same while melting? (Yes). Why? We will answer that today. **2. Establishing the Purpose of the Lesson** **Teacher Says:** Why do we study this? Because in DomRAC, we don't just say it's cold. We measure how much heat is removed. We calculate BTU. We check superheat and subcooling. These are the numbers that separate a professional from a barabara	**Rationale:** Concrete observation of state change. Establishes a baseline for latent/sensible heat discussion. **Rationale:** Emphasizes diagnostic application of cycle knowledge.
B. Instituting New Knowledge	**3. Presenting Examples** **Demonstration 1: Heat Transfer by Conduction** The teacher heats one end of a metal rod. Students feel the other end is getting hot. **Demonstration 2: Convection** The teacher lights an incense stick above a candle flame. Smoke rises.	**Facilitation:** Use a metal rod and a candle. Heat one end. Students touch the other end. **Rationale:** Direct sensory experience of conduction. **Rationale:** Visual demonstration of convection currents.

	Demonstration 3: Radiation The teacher holds a hand near (but not touching) a hot light bulb. **Teacher Says:** Three different ways of heat moves. Everything happens in your AC unit. **4. Discussing New Concept** We have five key concepts today. **Topic A: States of Matter and Changes** **Three states:** Solid (ice), Liquid (water), Gas (steam/water vapor). **Changes of state:** Melting (solid→liquid), Freezing (liquid→solid), Evaporation/Boiling (liquid→gas), Condensation (gas→liquid). **KEY POINT for DRAC:** In the evaporator refrigerant LIQUID BOILS into GAS even at -20°C. In the condenser refrigerant GAS CONDENSES into LIQUID even at 40°C. The refrigerant changes state at temperatures different from water! **Topic B: Units of Heat** Heat is energy. We measure it in: - **Joule (J)** - scientific unit - **Calorie (cal)** - heat to raise 1g water by 1°C - **BTU (British Thermal Unit)** - heat to raise 1 lb water by 1°F. This is what we use in HVAC. Conversion: 1 BTU = 1055 Joules ≈ 252 calories.	**Rationale:** Structured, sequential, with real-world connections.

	Topic C: Methods of Heat Transfer **Conduction:** Heat moves through solid materials. Example: Copper tube gets hot along its length. AC uses copper because it conducts well. **Convection:** Heat moves through fluids (liquids/gases) by circulation. Example: Hot air rises. AC uses fans to force convection. **Radiation:** Heat moves as electromagnetic waves. Example: Sun warms your face. AC does not use radiation primarily, but we consider solar radiation in heat load calculation. **Topic D: Sensible vs. Latent Heat** **Sensible Heat:** Heat that you can *feel* or *sense*. It changes temperature but NOT state. Example: Heating water from 10°C to 30°C. You feel it getting warmer. It's still water. **Latent Heat:** Hidden heat. It changes STATE but NOT the temperature. Example: Ice melts at 0°C. Add heat; it melts, but temperature stays 0°C until all ice is melted. The heat is 'hidden' in a state of change. *Why this matters in AC:* - In the **evaporator**: Refrigerant absorbs LATENT heat as it boils from liquid to gas. This is where the cooling happens! - In the **condenser**: Refrigerant releases LATENT heat as it condenses from gas to liquid.	

	- **Sensible heat** changes the temperature of the refrigerant (superheat, subcooling). **Topic E: Superheat and Subcooling** **Superheat:** The amount of sensible heat added to a GAS *after* it has completely evaporated. Measured as: Actual gas temperature - Saturation temperature. *Example:* Refrigerant boils at 10°C. You measure the gas leaving evaporator at 20°C. Superheat = 10°C. *Why check?* Low superheat = liquid may enter compressor (BAD - damages compressor). Too high = not enough refrigerant. **Subcooling:** The amount of sensible heat REMOVED from a LIQUID *after* it has completely condensed. Measured as: Saturation temperature - Actual liquid temperature. Example: Refrigerant condenses at 40°C. You measure liquid leaving condenser at 35°C. Subcooling = 5°C. Why check? Subcooling ensures that only liquid (not gas) enters the metering device. More subcooling = more cooling capacity.	

Term	Changes state?	Changes temperature?	Measured by?
Sensible Heat	No	Yes	Thermometer
Latent Heat	Yes	No	No change during state change
Superheat	No (already gas)	Yes (gas heating)	Thermometer - Saturation temp
Subcooling	No (already liquid)	Yes (liquid cooling)	Saturation temp - Thermometer

5. Developing Mastery

Activity: "Heat Transfer Sorting"

Sort these scenarios into Sensible Heat, Latent Heat, Superheat, or Subcooling.

Facilitation: Give each group a set of cards with scenarios
onstruction.
Rationale: Application of definitions to concrete examples.

	Sample cards: 1. Water boiling at 100°C (temp constant)" = Latent 2. Copper pipe feels warm" = Sensible 3. Gas leaving evaporator is 15°C hotter than boiling point" = Superheat 4. Liquid leaving condenser is 8°C cooler than condensing point" = Subcooling	
C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** Scenario: You check the refrigerator. The suction line (evaporator outlet) is sweating heavily and has frost. Your thermometer shows that the gas temperature is only 1°C above the boiling point. Is superheating too high or too low? What problem does this indicate? Answer: Superheat is too low. Liquid is not fully evaporating. Possible causes: overcharge of refrigerant, metering device too open, or evaporator fan failure. **2. Making Generalization** Complete this sentence: Without latent heat absorption in the evaporator there would be no _____; superheat tells me if the evaporator is _____. Sample answer: cooling; completely evaporating the refrigerant before it reaches the compressor.	**Facilitation:** Frost on suction line = liquid refrigerant entering the compressor (floodback). Superheat is too low **Rationale:** Direct application of superheat concept to real troubleshooting **Rationale:** Forces connection between abstract heat concepts and system performance.

	3. Evaluating Learning **Multiple Choice (10 pts).** Encircle the letter of the correct answer. 1. Which type of heat changes the temperature of a substance without changing its state? a) Latent heat b) Sensible heat c) Superheat d) Subcooling 2. The heat absorbed when ice melts at 0°C is an example of... a) Sensible heat b) Latent heat c) Conduction d) Superheat 3. Which unit of heat is commonly used in HVAC in the Philippines? a) Joule b) Calorie c) BTU d) Watt 4. Heat transfer through a solid material (like a copper tube) is called... a) Conduction b) Convection c) Radiation d) Sublimation 5. Superheat is measured... a) At the condenser outlet b) At the evaporator outlet c) At the compressor inlet d) Both B and C 6. Subcooling ensures that... a) Only gas enters the compressor b) Only liquid enters the metering device c) Only gas enters the evaporator d) Only liquid enters the condenser 7. Which statement about latent heat is TRUE? a) It changes temperature b) It changes state while temperature is constant c) It cannot be measured d) It only happens with water 8. The method of heat transfer that occurs when warm air rises and cool air sinks is... a) Conduction b) Convection c) Radiation d) Insulation	

	9. If the measured superheat is too high (above target), the system likely has... a) Overcharge of refrigerant b) Undercharge of refrigerant c) Clogged condenser d) Too much airflow 10. One BTU is approximately equal to... a) 1 Joule b) 100 Joules c) 1055 Joules d) 1 million Joules **ANSWER KEY** 1-b, 2-b, 3-c, 4-a, 5-d, 6-b, 7-b, 8-b, 9-b, 10-c **4. Additional Activities** Draw a simple graph showing temperature vs. heat added for ice becoming steam. Label the sensible heat regions (slanted lines) and latent heat regions (flat lines).	
VI. ASSESSMENT	**Performance Task Component:** Using a temperature-pressure chart for R-32 (provided by teacher), calculate the superheat and subcooling from given measurements. **Given measurements:** • Evaporator boiling temperature (from pressure): 5°C • Suction line temperature (at evaporator outlet): 18°C • Condensing temperature (from pressure): 45°C • Liquid line temperature (at condenser outlet): 38°C **Calculate:** 1. Superheat = _____ °C 2. Subcooling = _____ °C	

	Answer Key: Superheat = 13°C; Subcooling = 7°C **Scoring:** 5 pts each = 10 pts total (Passing: 8)
VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**5**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and air-conditioning units.	
B. Performance Standard	The learner performs the installation of domestic refrigeration and air-conditioning units with safety precautions.	
C. Learning Competencies	Perform pre-installation procedure for domestic air-conditioning unit (Survey site).	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; ASHRAE Handbook - HVAC Systems and Equipment; PEC 2017 Part 1; Philippine Building Code **Materials:** Sample pre-installation checklist forms, tape measure, laser distance measurer, clipboard, inspection flashlight, sample heat load calculation sheet, tablet/laptop for digital forms	
III. CONTENT	Pre-Installation Procedure - Site Survey	
IV. OBJECTIVES	At the end of the lesson learners should be able to: 1. **Identify** the nine factors to check during a site survey. 2. **Explain** how each factor affects air conditioning performance. 3. **Perform** a mock site survey of a classroom using a checklist. 4. **Compute** a basic heat load estimate using a simplified formula. 5. **Document** survey findings in a standard pre-installation form.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Teacher Says:** Think of a room that is always hot even with an AC running. What could be wrong?	**Facilitation:** Do this at the front where all can see. Use a clear container.

	Likely answers: Too big room, too small AC, poor insulation, sun hitting directly, open windows, dirty filter, etc. Today we will learn to fix problems before installing the AC. We call this SITE SURVEY. **2. Establishing the Purpose of the Lesson** **Teacher Says:** Imagine you install a 1 HP AC in a 50 sqm room facing the afternoon sun. The customer complains that your AC is defective, but the AC is fine. The problem is your pre-installation assessment. A site survey protects you from callbacks, unhappy customers and wasted money.	**Rationale:** Connects pre-installation to professional liability, customer satisfaction, and business reputation.
B. Instituting New Knowledge	**3. Presenting Examples** **Teacher Says:** I will show two rooms. *Room A:* Small (12 sqm), shaded, 1 person, no appliances, insulated ceiling. *Room B:* Large (30 sqm), afternoon sun, 5 people, 2 computers, 4 lights, thin walls. **Teacher Asks:** Which room needs a larger AC? Why? List the differences. *Students list factors.* **Teacher Says:** Those differences are what we survey. **4. Discussing New Concept** **Teacher Script:** We use the acronym R-H-A-D-I-S-P-M-C to remember the nine factors. Copy this.	**Facilitation:** Use photos or video walkthroughs. **Comparative analysis** helps students identify factors.

	Factor 1: Room size and layout - Measure length, width, height. Compute floor area (sqm). Ceiling height matters: high ceilings = more volume to cool. **Factor 2: Heat load** Sources of heat: - **People:** Each person adds ~200-250 BTU/hr **- Appliances:** Computer (~300 BTU), TV (~200 BTU), refrigerator (~400 BTU) **- Lighting:** Each fluorescent tube ~40-80 BTU **- Solar radiation:** Windows facing west (afternoon sun) add huge heat **- Infiltration:** Doors/windows that leak air Simplified rule: For residential, 1 HP (8000-9000 BTU) per 15-20 sqm of normal room. For high heat load rooms, use 1 HP per 10-12 sqm. **Factor 3: Airflow and ventilation** Check: Is there space for air to enter and exit the condenser? Window types need outdoor space. Split type needs clearance around outdoor unit. *Minimum clearance:* 1-2 feet from wall, 5 feet from obstruction above, no blockage in front. **Factor 4: Drainage** Where will condensate water go? Window-type: Slopes slightly downward outside Split type: Needs drain hose to a drainage point or container **Factor 5: Insulation** Check ceiling, walls, windows. Poor insulation = high heat load. **Factor 6: Power supply** Voltage: 220V or 110V? Check outlet. **Factor 7: Structural and architectural** Can the wall/ceiling support the AC?	**Rationale:** Mnemonic aids memorization of nine factors.

	Window-type: Needs strong windowsill or bracket. Split type: Indoor unit needs strong wall. Outdoors need mounting brackets on concrete wall (not hollow blocks alone). **Factor 8: Maintenance access** Can you reach the unit to clean filters, check compressors, and clean coils? **Factor 9: Codes and permits** PEC requirements: Proper wire sizing, grounding, circuit protection. **Pre-Installation Checklist (Teacher distributes sample form): This** is your tool. Mark each factor as Acceptable, Needs Adjustment, or Reject. If Needs Adjustment, note what must be fixed before installation. **5. Developing Mastery** **Activity: "Classroom Site Survey"** **Teacher Says:** We will survey this classroom as if we are installing a 1.5 HP window-type AC. Use your checklist. Report findings after 10 minutes. *Groups report:* Room size (measure), windows (facing? shading?), power supply (outlet type, voltage), drainage (possible outlet), maintenance access	**Facilitation:** Divide class into 5 groups. Assign each group of 2-3 factors to survey in the classroom. **Rationale:** Hands-on, authentic application. Students practice measurement and documentation.
C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** **Teacher Says:** Scenario: You survey a 25 sqm bedroom. West-facing window (no curtain). 2 people. 1 computer. 4 LED lights. Ceiling is galvanized iron (no insulation). What AC capacity would you recommend and why? *Answer:* Recommend 2.0 HP, OR advise customers to install blackout curtains and ceiling insulation then use 1.5 HP.	**Facilitation:** Guide calculation: 25 sqm normal = 1.5 HP. But west sun + no insulation + computer = high heat load. Recommend 2.0 HP or suggest adding insulation/curtains first. **Rationale:** Professional ethics - honest recommendation, not just selling bigger

	2. Making Generalization Complete this sentence: A proper site survey prevents _____ by identifying _____ before installation Sample answer: ...customer complaints; problems like insufficient power, poor drainage and wrong AC sizing. **3. Evaluating Learning** **Multiple Choice (10 pts).** Encircle the letter with the correct answer. 1. Which factor refers to the ability of the wall to hold the AC unit? a) Power supply b) Structural integrity c) Airflow d) Drainage 2. How many BTU per hour does an average person add to heat load? a) 50 BTU b) 200-250 BTU c) 1000 BTU d) 5000 BTU 3. Which window orientation adds the MOST heat load in the Philippines? a) North b) East c) South d) West 4. What is the minimum clearance typically recommended for a condenser unit? a) 0 feet b) 1-2 feet c) 5 feet d) 10 feet 5. Which factor checks if water from the AC has a place to go? a) Insulation b) Power supply c) Drainage d) Codes and permits 6. For a normal residential room, 1 HP of cooling is typically sufficient for how many square meters? a) 5-10 sqm b) 15-20 sqm c) 30-40 sqm d) 50-60 sqm	**Rationale:** Emphasizes the preventative nature of site surveys.

	7. Which appliance adds significant heat to a room? a) LED light b) Ceiling fan c) Desktop computer d) Wooden chair 8. A west-facing window without curtains is a problem for which factor? a) Power supply b) Heat load (solar radiation) c) Maintenance access d) Codes 9. Why is a dedicated electrical line recommended for AC units? a) Saves electricity b) Prevents circuit overloading c) Makes AC colder d) Required by barangay 10. Which of the following is a code requirement? a) AC must be 2 HP b) Proper grounding of AC c) AC must be split-type d) Drainage to street Answers: 1-b, 2-b, 3-d, 4-b, 5-c, 6-b, 7-c, 8-b, 9-b, 10-b 11-False, 12-True, 13-False, 14-False, 15-True **4. Additional Activities** Draw a simple site survey checklist with 9 factors. Write one question you would ask the customer for each factor.	
VI. ASSESSMENT	**Performance Task:** Complete a **Pre-Installation Survey Form** for a room of your choice (at home or in school). Include: 1. Drawing/ sketch of room layout with dimensions 2. Checklist of 9 factors with findings (Acceptable/Needs Adjustment/Reject) 3. Heat load estimate (list all sources) 4. Recommended AC capacity (HP or BTU) 5. Recommendations for any needed corrections	

	Rubric:			
	Criteria	Excellent (5)	Satisfactory (3)	Needs Improvement (1)
	Complete dimensions	All 3 (L, W, H) measured	2 measured	1 or none
	Nine factors addressed	All 9 with specific notes	6-8 factors	Below 6
	Heat load calculation	All sources listed, computed	Some sources	No calculation
	Recommendation	Specific HP, with justification	HP only	No recommendation
	Professional documentation	Neat, organized, readable	Some organization	Unclear
	Total: 25 pts (Passing: 20)			
VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*			
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.			

LESSON EXEMPLAR			
Learning Area	DOMESTIC REFRIGERATION AND AIR-CONDITIONING SERVICING	**Grade Level**	**11**
Term	FIRST	**Lesson Exemplar**	**6**

I. OBJECTIVES		
A. Content Standard	The learner understands the concepts and principles of installing domestic refrigeration and AC units.	
B. Performance Standard	The learner performs installation with safety precautions.	
C. Learning Competencies	Perform procedures installing a window-type air-conditioning unit (Cavity works, mounting support, positioning, electrical, insulation, condensate drain).	
II. REFERENCES and MATERIALS	**References:** TESDA TR - DRAC NC II; Manufacturer installation manuals (e.g., Carrier, Kolin, LG) **Materials:** Actual window-type AC (for demo), bracket, level, drill, screwdriver, insulation foam, PVC drain hose, electrical tools, safety gear (gloves, goggles)	
III. CONTENT	Window-Type Air Conditioning Unit Installation Procedure	
IV. OBJECTIVES	At the end of the lesson learners should be able to: 1. **Sequence** the 6 major steps of window-type AC installation. 2. **Demonstrate** proper leveling of an AC unit. 3. **Explain** why the unit must slope slightly downward outside. 4. **Install** a condensate drain line correctly. 5. **Perform** a complete window-type AC installation simulation following OHS.	
V. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	**1. Activating Prior Knowledge** **Teacher Says:** Look at this photo. A customer window-type AC is dripping water inside the room, and the wall has black mold. What went wrong? Students answer: No slope outward, no drain hose, no insulation.	***Facilitation:*** *Show a clear photo or drawing of an incorrectly installed unit – sloping inward, no sealant, cord dangling.*

	Teacher Says: Today we learn the correct sequence, so you never cause these problems. **2. Establishing the Purpose of the Lesson** **Teacher Says:** This is not just screw and plug. A wrong installation can: (1) make the unit fall and injure someone, (2) cause electrical fire, (3) flood the room, (4) waste electricity, and (5) destroy your reputation. Follow the sequence. Skip one step = liable for damages.	***Rationale:*** *Engages error analysis and diagnostic thinking before instruction.* ***Rationale:*** *High-stakes framing emphasizes professionalism, safety, and legal responsibility.*
B. Instituting New Knowledge	**3. Presenting Examples** Teacher Says: I will show two 30-second clips. Clip A: A professional installer measuring the cavity, installing a bracket, leveling, and sealing. Clip B: A kanto installer using no bracket, no level, no sealant. Write two differences you see. *Students share observations.* Teacher Says: We will follow Clip A's method exactly. **4. Discussing New Concept** **Teacher Script:** Copy this six-step procedure. I will demonstrate each step while you take notes. **Step 1: Cavity Preparation** Measure the opening (width x height. Standard window-type chassis needs opening ½" to 1" larger than unit dimensions.	**Facilitation:** Pause after each clip. Ask: Which one will last longer? Which one is safer? **Rationale:** Step-by-step demonstration with physical unit maximizes retention.

	Example: If the unit is 500mm wide, the opening should be 525mm. Clean debris, remove obstacles. Check for pests or old wiring. **Step 2: Mounting Support** Install a heavy-duty bracket or support frame. Must be rated for 3x the unit weight (safety factor). Use concrete anchors – not ordinary wood screws. Check with spirit level: LEVEL side-to-side. If the bracket is tilted, the unit will be tilted. **Step 3: Positioning** Slide the unit into the cavity. Crucial: The unit must slope 5 to 10 degrees DOWNWARD toward the outside – about ¼" drop for every 12" of depth. Why? So, condensate water flows out, not inside. Use shims if needed. Re-check level. **Step 4: Electrical** Plug into a dedicated outlet. If no outlet exists, install a new circuit per Lesson 6 (PEC). No extension cords – they overheat and cause fire. Ensure grounding: three-prong plug with functional ground. Test voltage before turning on. **Step 5: Insulation** Apply foam sealant or pre-cut insulation strips around all gaps between the unit and the wall/window frame. Prevents: (a) hot air infiltration, (b) insects/rodents, (c) rain leaks, (d) noise.	**Rationale:** Safety factor and anchor selection directly affect structural integrity. *Demonstration: Place a small bubble level on top of the unit. Show the tilt.* ***Rationale:*** *Direct link to previous lesson reinforces PEC compliance.* ***Facilitation:*** *Show before/after photos of sealed vs. unsealed units.*

	Step 6: Condensate Drain Some units have a rubber drain plug at the rear bottom. Attach a PVC or rubber hose (½" or ¾"). Route the hose downward continuously – no dips or kinks – to a drainage point or container. Test by pouring water into the base pan; verify it flows out. **5. Developing Mastery** **Activity: "Installation Sequence Relay"** Teacher Says: Arrange the cards in the correct order. Then, for each step, one group member must act out or explain the most critical safety check. First group with correct order and clear explanation wins.	***Rationale:*** *Prevents "dripping on sidewalk" violations and customer complaints.* ***Facilitation:*** *Divide class into 4 groups. Give each group 6 large cards with step names (jumbled).* ***Rationale:*** *Kinesthetic + verbal rehearsal strengthens memory.*
C. Demonstrating Knowledge and Skills	**1. Finding Practical Application** Scenario: You arrive at a customer's house. The wall opening is 2 inches wider than the AC. No bracket is available. The customer says, 'Just stuff rags in the gaps and prop it with wood.' What do you do? *Answer:* Refuse unsafe installation. Explain that rags are fire hazards, and wood can shift. Recommend proper bracket and proper filler (foam sealant + L-bracket extender or frame modification).	**Facilitation:** Guide calculation: 25 sqm normal = 1.5 HP. But west sun + no insulation + computer = high heat load. Recommend 2.0 HP or suggest adding insulation/curtains first. **Rationale:** Professional ethics - honest recommendation, not just selling bigger

	2. Making Generalization **Teacher Says:** Complete this sentence: The difference between a professional window-type AC installation and a temporary one is _____. *Sample answers:* -following all six steps without skipping. -using the right bracket, slope and sealant. -documenting the work. **3. Evaluating Learning** **Multiple Choice (10 pts).** Encircle the letter with the correct answer. 11. What is the correct slope direction for a window-type AC? a) Level (no slope) b) Downward inside c) Downward outside d) Upward outside 12. The support bracket must be rated for at least how many times the unit weighs? a) 1x b) 2x c) 3x d) 5x 13. Why are extension cords prohibited for window-type AC? a) They are expensive b) They cause voltage drop and fire hazard c) They are short d) The customer might trip	**Rationale:** Synthesis of quality, safety, and durability.

	14. Which tool is used to check if the bracket is level side-to-side? a) Tape measure b) Clamp meter c) Spirit level d) Thermometer 15. What material is typically used to seal gaps around the AC unit? a) Duct tape b) Foam sealant or insulation strips c) Cardboard d) Plastic bag 16. Where should condensate water flow? a) Inside the room b) Into a bucket inside c) Outside or into a proper drain d) Into the electrical panel 17. If the AC slopes inward, what happens? a) Better cooling b) Water drips inside c) Compressor runs faster d) Filter cleans itself 18. Before sliding the unit into the cavity, you must: a) Plug it in first b) Clean debris and measure c) Turn it on high cool d) Remove the compressor 19. Insufficient insulation around the AC leads to: a) Higher electricity bill b) Insect entry c) Hot air infiltration d) All of the above 20. After installation, you should test the drain by: a) Blowing into the hose b) Pouring water into the base pan c) Ignoring it d) Taping the drain closed Answers: 1-c, 2-c, 3-b, 4-c, 5-b, 6-c, 7-b, 8-b, 9-d, 10-b **4. Additional Activities** Draw a simple flowchart of the 6 steps. Besides each step, write ONE possible mistake and their consequences.	

VI. ASSESSMENT	**Performance Task:** Each student will install a window-type AC (or simulator) following a Practical Exam Checklist. Drawing/ sketch of room layout with dimensions Step Task Pass/Fail 1 Measures opening correctly (within ½–1" tolerance) 2 Installs bracket level and secure with proper anchors 3 Positions unit with correct outward slope (5–10°) 4 Makes proper electrical connection (grounded, no extension cord) 5 Seals gaps with insulation foam or strips 6 Installs drain line without kinks, tests with water 7 Follows OHS (gloves, goggles, ladder safety, no loose wires) **Passing:** All 7 steps PASS.
VII. REFLECTION	*This section presents the key highlights and challenges encountered by both teachers and learners during the teaching-learning process throughout the unit. It also includes the adjustments made by the teacher to improve instruction*
VIII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE.