

PRACTICE EXAM 11: ASE A7 SIMULATION

(50 QUESTIONS)

1. A vehicle's A/C system cools adequately at the center vent but the customer reports warm air from the far-left and far-right dashboard vents. The center vent reads 42°F while the outer vents read 55°F. This is a single-zone system with one evaporator and one blend door. What is the MOST likely cause?

- A. An evaporator that is cooling unevenly, with the center section performing better than the outer sections
- B. Normal temperature variation caused by the longer ductwork routing to the outer vents, which absorbs heat from surrounding dashboard components
- C. A blend door that is warped in the center, creating an uneven air split between the center and outer paths
- D. A low refrigerant charge that cannot sustain adequate cooling across all vent outlets simultaneously

2. A technician is inspecting a vehicle's A/C hoses during a routine service. The suction hose feels soft and spongy when squeezed, and the outer rubber cover shows fine surface cracking. The hose is original equipment on a 14-year-old vehicle. What should the technician recommend?

- A. Continue using the hose since surface cracking is cosmetic and does not affect internal barrier integrity
- B. Apply a rubber conditioner to the hose surface to restore flexibility and extend the service life by years
- C. Monitor the hose and replace it only if a measurable refrigerant leak is confirmed with a leak detector
- D. Replace the hose because internal deterioration produces particles that contaminate the system and permeation increases with age

3. A vehicle's A/C system has the following gauge readings at 90°F ambient: low side 20 psi, high side 150 psi. The vent temperature is 52°F. The technician adds refrigerant until the charge matches the manufacturer's specification by weight. After charging, the low side reads 34 psi, the high side reads 220 psi, and the vent temperature drops to 43°F. What was the original condition?

- A. The system was undercharged, and restoring the correct charge amount brought pressures and vent temperatures to normal
- B. The orifice tube was partially restricted but the additional refrigerant mass overcame the restriction pressure
- C. The condenser fan was operating at reduced speed but the additional charge compensated for poor heat rejection
- D. The compressor was bypassing internally but the higher charge volume masked the compression inefficiency

4. On a vehicle with electronic HVAC controls, the technician retrieves DTC B0229 — Blend Door Actuator Position Disagreement. The scan tool shows commanded position at 45% and actual feedback at 78%. What is the MOST likely cause of this position disagreement?

- A. A faulty HVAC control module that is sending an incorrect command signal to the actuator motor circuit
- B. A defective position feedback potentiometer that is sending false position data back to the module
- C. A mechanical failure inside the actuator — such as stripped gears — preventing the door from reaching the commanded position
- D. An open LIN bus wire between the module and actuator that is corrupting the position feedback signal

5. A technician is testing a vehicle's blower motor circuit. With the blower switch on HIGH and the engine running, the technician measures 14.2V at the blower motor positive terminal and 14.1V at the blower motor negative (ground) terminal, both referenced to chassis ground. The motor does not run. What does this indicate?

- A. The blower motor is receiving adequate voltage and the motor itself has failed with an internal open circuit
- B. The blower motor ground circuit is open — both terminals read near-battery voltage because no current flows
- C. The blower motor relay is stuck closed and is back-feeding voltage through the motor to the ground terminal
- D. The voltage readings are normal for a motor at rest and the technician should test with the motor under load

6. A vehicle's engine has been running for 25 minutes in 40°F ambient weather. The temperature gauge reads at the low end of normal — approximately 175°F. The heater output is lukewarm. The upper radiator hose is warm to the touch. What does the warm upper radiator hose indicate?

- A. The cooling system is operating normally because the thermostat should be open at 175°F engine temperature
- B. The water pump has failed and coolant is stagnating in the engine block without circulating properly
- C. The radiator is restricted internally and coolant is backing up into the upper hose without flowing through
- D. The thermostat is allowing coolant to flow to the radiator prematurely, preventing the engine from reaching full operating temperature

7. Technician A says that when replacing an evaporator in a vehicle with a fixed orifice tube system, the technician should also replace the orifice tube. Technician B says that the orifice tube should be inspected but only replaced if visible debris is found on the inlet screen. Who is correct?

- A. Technician B only, because a clean orifice tube with no screen contamination can be safely reused indefinitely
- B. Both Technician A and Technician B, because either approach is acceptable depending on shop preference
- C. Technician A only, because the orifice tube is an inexpensive component and replacing it eliminates a potential restriction
- D. Neither Technician A nor Technician B, because orifice tubes are permanent components that never need replacement

8. A vehicle's A/C system has a confirmed refrigerant leak at the condenser. The technician replaces the condenser and installs a new receiver-drier. During the repair, the technician notices a thick layer of oily grime covering the old condenser face between the condenser fins and the radiator. What effect would this grime have had on system performance before the condenser failed?

- A. The grime insulated the condenser surface and reduced heat rejection, causing elevated high-side pressure and reduced cooling
- B. The grime had no effect because heat rejection occurs through the tube walls, not the external fin surfaces

C. The grime improved heat rejection by filling the gaps between fins and creating a smoother airflow surface

D. The grime only affected the radiator behind it by blocking airflow and had no direct impact on condenser function

9. On a vehicle with electronic HVAC controls, the scan tool shows the A/C compressor clutch is commanded ON by the module. The clutch relay clicks audibly when commanded. However, the compressor clutch does not engage. The technician measures 12.1V at the clutch coil connector positive terminal and 11.8V at the ground terminal. What is the MOST likely cause?

A. The clutch coil has developed an internal open circuit that prevents current from flowing through the winding

B. The relay contacts are passing adequate voltage but the clutch air gap is too wide for the coil to overcome

C. The clutch coil power supply circuit has excessive voltage drop that is reducing the available current to the coil

D. The ground circuit is open — battery voltage appears at both terminals because no current path exists through the coil to ground

10. A vehicle's ATC system maintains the correct temperature in AUTO mode. However, the customer notices that the system occasionally switches from panel vent delivery to bi-level (panel and floor) delivery and back without any input from the driver. What does this behavior indicate?

A. A failing mode door actuator that is intermittently losing its commanded position and drifting between settings

B. A faulty HVAC control panel that is sending erratic mode commands due to an internal circuit board fault

C. Normal ATC operation where the module adjusts air distribution automatically based on cabin temperature and conditions

D. An intermittent CAN bus fault that is corrupting mode door commands between the module and the actuator

11. A vehicle's A/C system was charged with the specified 22 ounces of R-134a by weight. The vent temperature reaches 44°F at 88°F ambient. The technician measures superheat at the evaporator outlet and finds 4°F. The TXV system specification calls for 8–12°F of superheat. What does this low superheat reading indicate?

- A. The system is undercharged and the TXV is opening wider to compensate for insufficient liquid supply
- B. The condenser is not rejecting adequate heat, causing excess liquid to reach the evaporator at higher volume
- C. The TXV is allowing too much refrigerant into the evaporator, which risks liquid reaching the compressor
- D. The evaporator is partially restricted on its air side, causing the refrigerant to supercool below normal levels

12. A technician removes a compressor from a vehicle and finds that the clutch hub spins freely by hand — there is no resistance when turning the shaft. The compressor should have moderate resistance from internal spring tension and oil viscosity. What does this free-spinning condition indicate?

- A. The compressor has likely suffered a catastrophic internal failure such as broken scrolls or a sheared shaft
- B. Normal condition for a compressor that has been sitting unused because oil drains away from contact surfaces
- C. The compressor is a variable displacement type at minimum displacement, which always spins freely by hand
- D. The clutch hub bearing has failed and the hub is spinning on the bearing without engaging the compressor shaft

13. A vehicle's engine runs at 210°F operating temperature. The heater produces adequate hot air at all speeds and conditions. However, the customer reports a constant sweet smell inside the cabin that is most noticeable when the heater is running. There is no visible coolant on the floorboard and no fogging on the windshield. What is the MOST likely cause?

- A. A cabin air filter that has absorbed sweet-smelling compounds from road chemicals or automotive fluids

- B. A blend door seal that has deteriorated and is releasing adhesive compounds when heated by the heater core
- C. An exhaust leak near the firewall that is allowing sweet-smelling catalytic converter gases into the fresh air inlet
- D. A very small heater core seep that is evaporating coolant vapor into the airstream before it can accumulate as liquid

14. A technician is diagnosing a vehicle where the blower motor works on all four speed settings, but the air volume from the vents is noticeably reduced compared to a known-good identical vehicle. The cabin air filter is new. The blower motor spins freely by hand. What should the technician check next?

- A. The blower motor voltage at each speed setting to determine if reduced voltage is limiting motor RPM
- B. Whether the evaporator core is blocked with debris or ice that is restricting airflow through the HVAC housing
- C. The blower motor resistor block for increased resistance values that may be limiting current at each speed
- D. The serpentine belt tension since a loose belt can reduce alternator output and lower blower motor voltage

15. A vehicle's A/C system uses R-1234yf. The technician has the following equipment available: an R-134a recovery machine, an R-1234yf recovery machine certified to SAE J2843, and a universal manifold gauge set. Which combination of equipment may be used to service this system?

- A. The manifold gauge set for diagnosis and the R-134a machine for recovery since the refrigerants have similar properties
- B. Only the R-1234yf machine for all service procedures since the manifold gauge set may cross-contaminate
- C. The R-1234yf machine for recovery, recycling, and charging, and the manifold gauge set for diagnostic readings
- D. Either recovery machine since both handle HFC-type refrigerants, plus the manifold gauge set for diagnostics

16. A vehicle has been driven through a severe dust storm. After the storm, the A/C cooling performance has decreased noticeably. Gauge readings show both the high-side and low-side pressures are elevated above normal. What should the technician inspect FIRST?

- A. The condenser face for heavy dust and debris accumulation that is blocking airflow and reducing heat rejection
- B. The cabin air filter for saturation with dust particles that is restricting total airflow through the evaporator
- C. The engine air filter since a restricted intake filter would reduce engine vacuum and affect compressor output
- D. The refrigerant charge level since dust contamination may have entered the system through the service ports

17. A vehicle has a TXV-equipped A/C system. The technician replaces the TXV during a repair. After installation, the sensing bulb is clamped tightly to the suction line with proper insulation. However, the new TXV was stored without its protective caps for approximately three weeks before installation. What potential problem could this storage condition create?

- A. The TXV's internal spring tension may have relaxed during storage, changing the valve's superheat setting
- B. The sensing bulb charge may have leaked through the open ports during the extended uncapped storage period
- C. The valve's internal surfaces may have been scored by airborne dust particles entering through the open ports
- D. Moisture may have entered the valve body through the uncapped ports, potentially causing freeze-up at the valve seat

18. A vehicle owner complains that the A/C system makes a loud clunk from the engine compartment each time the compressor clutch engages. The clunk is a single event at engagement, not a continuous noise during operation. The A/C system cools normally otherwise. What is the MOST likely cause?

- A. A failing compressor with damaged internal reed valves that produces a hydraulic shock at initial startup

- B. A loose or worn compressor mounting bracket or mount that allows the compressor body to shift during clutch engagement
- C. Normal clutch engagement behavior that all electromagnetic clutches produce when the hub contacts the pulley
- D. A worn engine mount that allows excessive engine movement when the compressor load is suddenly applied

19. On a vehicle with an ATC system, the technician reviews the following scan tool data: set temperature 74°F, in-car sensor 74°F, ambient sensor 88°F, evaporator temp 37°F, sun load 2.8V, blend door commanded 22%, blend door actual 22%, compressor ON. All sensor readings verified accurate with independent instruments. The customer's complaint is that the passenger-side panel vent blows slightly warmer than the driver side. This is a single-zone system. What is the MOST probable cause?

- A. A marginal refrigerant undercharge causing uneven cooling distribution across the evaporator face area
- B. The blend door has a slight warp that allows more heated air to reach the passenger side of the housing
- C. Differences in ductwork routing — the passenger-side ducts may pass closer to a heat source like the heater core
- D. A partially clogged passenger-side vent register that is restricting cold airflow and mixing in warm dashboard air

20. A technician is performing a nitrogen pressure test on an empty A/C system. The system is pressurized to 180 psi with dry nitrogen. After one hour, the pressure has dropped to 174 psi. The shop temperature has remained constant at 72°F. What should the technician conclude?

- A. A 6 psi drop over one hour in a temperature-stable environment confirms a leak that must be located and repaired
- B. A 6 psi drop is within the normal tolerance for nitrogen settling and molecular redistribution over one hour
- C. The nitrogen regulator is allowing slow bleed-back through its internal check valve into the supply cylinder
- D. The test duration was insufficient — a minimum of four hours is required to confirm a leak of this magnitude

21. A customer complains that the A/C in their vehicle cools the cabin adequately but produces an annoying whistling noise from the center dashboard vent. The noise increases with blower speed and disappears when the blower is on LOW. The A/C system pressures and temperatures are all within normal range. What is the MOST likely cause?

- A. A refrigerant leak at the evaporator inlet fitting that produces a whistling sound amplified by the vent path
- B. The compressor is producing discharge pressure pulsations that travel through the refrigerant lines to the evaporator
- C. A failing blower motor bearing that resonates at specific frequencies and transmits noise through the ductwork
- D. Excessive airflow velocity through a partially obstructed vent register, duct connection, or cabin air filter housing

22. Technician A says that when the A/C system is low on charge, the compressor oil circulating through the system is also reduced proportionally. Technician B says that a system operating with a low charge for an extended period can suffer compressor damage from inadequate lubrication even if the charge is eventually restored. Who is correct?

- A. Technician A only, because restoring the full refrigerant charge automatically restores full oil circulation
- B. Both Technician A and Technician B are correct about the relationship between charge level and oil circulation
- C. Technician B only, because oil volume is independent of refrigerant charge and does not decrease with leaks
- D. Neither Technician A nor Technician B, because compressor oil is stored only in the compressor sump

23. A vehicle's cooling system was drained and refilled during a water pump replacement. The engine reaches 200°F operating temperature. The heater blows hot air from the driver-side floor vent but lukewarm air from the passenger-side floor vent. This is a dual-zone system with both sides set to 80°F. What is the MOST likely cause?

- A. An air pocket trapped in the passenger-side section of the heater core from the coolant refill, blocking flow on that side
- B. A failed passenger-side blend door actuator that is not reaching the full hot position after the battery disconnect
- C. A clogged passenger-side floor duct that is restricting the delivery of heated air to the passenger foot area
- D. An incorrectly installed water pump impeller that creates asymmetric coolant flow favoring the driver-side heater path

24. A vehicle's A/C system has the following scan tool data: the HVAC module commands the compressor clutch relay ON, the relay activates (confirmed by audible click), but the A/C pressure sensor shows no change from static pressure — the compressor is not compressing. The technician visually confirms the clutch hub is pulled against the pulley. What is the MOST likely cause?

- A. A failed A/C pressure sensor that is not detecting the actual pressure change occurring in the system
- B. A relay with burned contacts that is passing only enough voltage to engage the clutch but not enough to run the motor
- C. A stuck-open TXV that is equalizing pressures so quickly that the compressor cannot build a differential
- D. The compressor clutch is engaging but slipping — the hub contacts the pulley but does not transfer enough torque to turn the shaft

25. On a vehicle with vacuum-operated HVAC controls, the technician replaces a torn mode door actuator diaphragm. After the repair, the mode doors function correctly. However, the technician notices the engine idle speed has dropped by 150 RPM. What is the MOST likely explanation?

- A. The new diaphragm is stiffer than the original and requires more vacuum to operate, increasing the load
- B. The repaired actuator is now drawing vacuum properly, adding a vacuum load that was absent when the diaphragm was torn
- C. The replacement diaphragm material is porous and is slowly leaking vacuum that affects the intake manifold
- D. The new actuator has a larger diaphragm surface area that consumes more vacuum than the original design

26. A vehicle's A/C system produces a hissing sound from the evaporator area that begins approximately 2 minutes after the compressor engages and continues as long as the system operates. The hiss volume does not change with blower speed. System pressures and vent temperatures are within normal range. What is the MOST likely cause?

- A. A refrigerant leak at the evaporator outlet fitting that is producing an audible hiss as vapor escapes the joint
- B. Normal refrigerant flow noise through the metering device as liquid refrigerant expands into the evaporator
- C. A partially restricted evaporator passage that creates turbulence and noise as refrigerant forces through the blockage
- D. A failing compressor that is producing high-frequency discharge pulsations transmitted through the lines

27. Technician A says that when adding refrigerant to a system through the low-side port with the compressor running, the refrigerant should be added as vapor — not liquid — to prevent compressor damage. Technician B says that liquid refrigerant can be safely introduced through the high-side port only when the engine is off and the system is under vacuum. Who is correct?

- A. Both Technician A and Technician B are correct about proper refrigerant introduction techniques
- B. Technician A only, because liquid should never be introduced into any port under any circumstances
- C. Technician B only, because adding vapor through the low side is unnecessary since the compressor can handle liquid
- D. Neither Technician A nor Technician B, because liquid can safely be added through either port at any time

28. A vehicle's engine reaches full operating temperature of 205°F, and both heater hoses at the firewall are hot. The blend door actuator moves to full hot when commanded by the scan tool. The vent temperature from the floor outlets measures 135°F. The customer complains the heater does not produce enough warmth. What should the technician explain to the customer?

- A. The heater core is nearing the end of its service life and should be preemptively replaced before it fails

- B. The thermostat should be replaced with a higher-rated unit to increase the available coolant temperature
- C. A floor vent temperature of 135°F with engine coolant at 205°F is within normal operating range for this system
- D. The blower motor should be replaced since a stronger motor would push more heated air into the cabin

29. A vehicle has an intermittent A/C problem: the system cools normally for several days, then one morning the compressor will not engage. After sitting in the sun for a few hours, the compressor engages and the system works fine again. This pattern repeats approximately once per week. What is the MOST likely cause?

- A. An intermittent clutch coil winding that opens when the coil is cold and closes when warmed by ambient heat
- B. A cycling clutch pressure switch that is marginally calibrated near the cutout point for the current charge level
- C. A faulty HVAC control module that intermittently drops the compressor command due to a software glitch
- D. A very slow refrigerant leak that drops the charge below the low-pressure switch cutout overnight, then recovers above it as temperature rises and pressure increases

30. A technician is testing the resistance of a blower motor resistor block with an ohmmeter. The technician measures resistance between the input terminal and each speed output terminal. The readings are: speed 1 = 4.8Ω, speed 2 = 2.7Ω, speed 3 = OL (over limit), speed 4 (HIGH) = direct bypass. What do these readings indicate?

- A. All readings are within normal range since the OL reading on speed 3 represents the bypass circuit for that speed
- B. The resistor for speed 3 has failed open, and the blower motor will not operate on the speed 3 setting only
- C. The resistor block has a burned-open element for speed 3, meaning the blower will not work on speed 3
- D. The readings are inconclusive because resistor block testing requires measuring under powered conditions only

31. A vehicle's heater core was replaced three months ago. The customer returns complaining of a persistent antifreeze smell inside the cabin. No coolant is visible on the passenger floorboard and the windshield does not fog. The cooling system pressure test holds 16 psi for 20 minutes. What should the technician investigate?

- A. The heater core hose connections at the firewall for a very small seep that evaporates before dripping visibly
- B. The evaporator drain for coolant-tinted discharge that would indicate a leak inside the HVAC housing
- C. The cabin air filter for coolant contamination that may have absorbed liquid before the original core was replaced
- D. The engine oil for coolant contamination from a developing head gasket failure unrelated to the heater repair

32. On a vehicle with electronic HVAC controls, the technician notices that the A/C compressor engages and disengages at precisely 30-second intervals regardless of ambient temperature, refrigerant charge, or vent temperature. The gauges show normal pressures when the compressor is running. What is the MOST likely cause?

- A. Normal cycling clutch operation in an orifice tube system with the pressure switch correctly regulating the cycle
- B. A marginally low refrigerant charge that produces a cycling rate slightly faster than normal specifications
- C. A timed compressor cycling strategy programmed into the HVAC module, which is normal for some vehicle designs
- D. A failing compressor clutch coil that can only maintain the magnetic field for exactly 30 seconds before overheating

33. A vehicle's A/C system was recharged to specification two days ago. The customer returns reporting the vent temperature fluctuates between 40°F and 55°F in a rhythmic pattern every 20–30 seconds. The compressor runs continuously. The system has a TXV. What is the MOST likely cause?

- A. A variable displacement compressor that is cycling between maximum and minimum displacement
- B. A TXV with an improperly mounted or poorly insulated sensing bulb causing the valve to hunt

C. An intermittent blend door actuator that is oscillating between two positions due to a faulty feedback signal

D. A partially blocked condenser that causes periodic pressure buildup and relief in a rhythmic cycle

34. Technician A says that the pressure-temperature (P-T) relationship means that increasing the pressure on a refrigerant raises its boiling point. Technician B says that the compressor raises the refrigerant's pressure and boiling point high enough that the refrigerant will condense in the condenser by releasing heat to the outside air. Who is correct?

A. Both Technician A and Technician B are correct about the pressure-temperature relationship and compressor function

B. Technician A only, because the compressor lowers the refrigerant's boiling point to enable condensation

C. Technician B only, because increasing pressure actually lowers the boiling point of a refrigerant in a sealed system

D. Neither Technician A nor Technician B, because the boiling point of a refrigerant is fixed and does not change

35. A technician is diagnosing a vehicle where the A/C compressor clutch engages normally. The low-side pressure is 32 psi and the high-side pressure is 200 psi at 85°F ambient. The vent temperature is 44°F. The customer's complaint is that the A/C "cycles too often." In this cycling clutch orifice tube system, the compressor cycles off every 20 seconds and re-engages after 15 seconds. What should the technician conclude?

A. The cycling rate is abnormally fast and indicates a low refrigerant charge requiring leak detection and repair

B. The cycling clutch pressure switch is faulty and cutting out at too high a pressure, shortening the on-cycle

C. The system is overcharged, causing the low-side pressure to drop too quickly and trigger the cutout point

D. The cycling rate, pressures, and vent temperature are within normal range — the customer may simply be noticing normal cycling sounds

36. A vehicle's coolant recovery reservoir is consistently losing coolant — the level drops from the MAX mark to below MIN every two weeks. There are no visible external leaks, the oil is clean, there is no white exhaust smoke, and the cooling system holds 16 psi during a pressure test. The customer reports an occasional sweet smell from the dashboard vents. What is the MOST likely source of coolant loss?

- A. The radiator has internal micro-cracks that leak only when the system is at full operating temperature and pressure
- B. The head gasket has a small breach that only leaks under specific engine load conditions not replicated in the shop
- C. The heater core has a slow leak that is losing coolant into the HVAC housing where it evaporates before pooling
- D. The coolant reservoir itself has a hairline crack that seeps during thermal expansion and the fluid evaporates

37. A vehicle has an electronically controlled A/C system with no cooling output. The scan tool shows the module commanding the compressor ON. The technician measures 12.3V at relay terminal 30 and 12.1V at terminal 87 with the relay energized. There is 12.0V at the clutch coil positive terminal. But the clutch does not engage. What should the technician check next?

- A. The relay contacts for excessive voltage drop, since 0.2V drop from terminal 30 to 87 indicates failing contacts
- B. The clutch coil ground circuit and the coil itself for an open winding or excessive resistance preventing current flow
- C. The A/C pressure switch for an open circuit that would prevent voltage from passing to the clutch coil
- D. The HVAC control module output driver for insufficient ground signal to the relay coil winding terminal

38. A vehicle owner reports that the heater works well when driving but the heat output decreases significantly within 2–3 minutes of stopping at a red light. When the vehicle begins moving again, heat returns to full output within 30 seconds. The engine temperature gauge remains stable throughout. What is the MOST likely cause?

- A. A water pump with eroded impeller that provides adequate flow at higher RPM but marginal flow at idle speed
- B. A thermostat that partially opens at idle allowing coolant to bypass to the radiator and reducing heater supply temperature
- C. A partially blocked radiator that causes coolant to back up at idle but flows adequately when ram air assists at speed
- D. A blend door actuator that shifts slightly due to engine vibration changes between idle and driving conditions

39. A vehicle has a sub-cool condenser with an integrated receiver and desiccant. The system is being serviced for a compressor replacement after a non-catastrophic failure (bearing noise only — no internal debris released). Must the condenser assembly be replaced?

- A. Yes, because the integrated receiver desiccant is always exhausted when the compressor fails regardless of failure type
- B. No, because non-catastrophic compressor failures do not produce debris that would require condenser replacement
- C. Yes, because anytime the system is opened for major service, the desiccant in the integrated receiver must be fresh
- D. No, because the sub-cool section of the condenser can be independently isolated and the desiccant recharged

40. A technician is diagnosing a vehicle with ATC where the blower motor runs at full speed continuously in AUTO mode. The scan tool shows the HVAC module commanding 30% blower speed. The blower motor connector has 14.2V (full battery voltage) present. What has MOST likely failed?

- A. The HVAC control module's blower speed output driver, which is stuck at maximum output regardless of command
- B. The blower motor itself, which has an internal short causing it to draw maximum current at any voltage level
- C. A welded high-speed relay that is bypassing the electronic controller and supplying full battery voltage directly
- D. The electronic blower motor controller, which is not reducing voltage in response to the module's 30% command

41. A vehicle's A/C was serviced at a quick-lube facility where the technician "topped off" the system with R-134a from a retail can without first recovering and measuring the existing charge. After the service, the A/C performance is worse than before. The gauges show both-sides-high pressures. What is the MOST likely cause?

- A. The system was already adequately charged, and adding more refrigerant created an overcharge condition
- B. The quick-lube technician's service was properly performed but a separate coincidental failure has occurred
- C. The retail R-134a can contained contaminants that have degraded the existing refrigerant's properties
- D. The additional refrigerant compensated for the leak but the elevated pressures indicate a condenser restriction

42. On a vehicle with dual-zone ATC, the driver side maintains 72°F correctly. The passenger side maintains 72°F correctly. However, the rear seat passengers complain that the rear cabin area is significantly warmer than the front. The vehicle does not have a rear auxiliary A/C system. What should the technician explain?

- A. The rear seat area is warmer because the driver and passenger sensors only measure front cabin temperature
- B. A failed mode door is preventing air from reaching the rear passenger area through the floor ducts
- C. Without rear auxiliary A/C, the single front HVAC system has limited ability to condition the rear cabin area equally
- D. The rear windows allow excessive solar heat gain that overwhelms the front system's ability to cool the full cabin

43. A vehicle has an A/C system where the compressor runs continuously without ever cycling off. The system is an orifice tube design with a cycling clutch pressure switch. Low-side pressure is steady at 38 psi and the vent temperature is 40°F at 85°F ambient. What is the MOST likely cause of the continuous compressor operation?

- A. The system is slightly overcharged, preventing the low-side pressure from ever dropping to the cycling switch cutout point

- B. The cycling clutch pressure switch contacts have welded closed, keeping the clutch circuit complete permanently
- C. A failed evaporator temperature sensor is reading too warm and preventing the module from cycling the clutch
- D. The orifice tube is oversized, allowing too much refrigerant into the evaporator and keeping the low side elevated

44. Technician A says that latent heat is the energy absorbed or released during a change of state — such as liquid to vapor — without a temperature change. Technician B says that sensible heat is the energy that causes a temperature change without a change of state. Who is correct?

- A. Both Technician A and Technician B are correct about the definitions of latent heat and sensible heat
- B. Technician A only, because sensible heat also involves a change of state but at a different rate than latent heat
- C. Technician B only, because latent heat always produces a measurable temperature change during the phase transition
- D. Neither Technician A nor Technician B, because both terms describe the same thermodynamic phenomenon

45. A vehicle's A/C compressor makes a high-pitched whining noise that increases with engine RPM. The noise is present only when the A/C is engaged. The gauge readings are normal and the system cools properly. The compressor is two years old. What is the MOST likely cause?

- A. A refrigerant overcharge that is creating excessive internal compressor pressure and noise during compression
- B. A failing compressor bearing that has not yet progressed to the point of affecting compression performance
- C. A developing internal bearing or wear issue in the compressor that will likely worsen over time if not addressed
- D. Normal compressor operation noise that is simply more audible on this particular compressor model and design

46. A vehicle has been parked with the engine off on a 100°F day. The technician checks the A/C system static pressure and reads 110 psi on both gauges. The expected static pressure for R-134a at 100°F is approximately 115–120 psi. What does this slightly lower-than-expected static reading indicate?

- A. The system may have a slightly low charge, though the reading is close enough that further testing while running is needed
- B. The reading confirms a severe undercharge that requires immediate leak detection before operating the system
- C. The pressure reading is within normal tolerance and confirms the system is properly charged with adequate refrigerant
- D. The manifold gauge set is reading low and should be recalibrated before any further diagnostic conclusions are drawn

47. A vehicle with electronic HVAC controls has DTCs stored for both the blend door actuator and the mode door actuator — both indicate "circuit open." The technician inspects the actuator connectors and finds them properly seated. What single fault could explain both codes simultaneously?

- A. Both actuators failed at the same time due to a power surge from a faulty charging system voltage spike
- B. The HVAC control module has a failed output driver stage that supplies both actuator circuits from the same output
- C. Corrosion at the HVAC module connector has affected both actuator output terminals simultaneously
- D. A shared power supply or ground wire that feeds both actuators has an open circuit or broken connection

48. A vehicle's cooling system uses a 50/50 coolant mixture. The technician tests the coolant with a refractometer and reads a freeze point of -20°F . A proper 50/50 mix should read approximately -34°F . What does this warmer-than-expected freeze point indicate?

- A. The refractometer is malfunctioning and should be recalibrated using a known reference coolant sample
- B. The mixture has too much water relative to coolant concentrate, reducing freeze protection below specification

C. The coolant inhibitors have depleted to the point that the freeze point has risen despite correct concentration

D. The coolant type is incompatible with the refractometer's scale and a different testing method should be used

49. Technician A says that conduction is the transfer of heat through direct physical contact between materials. Technician B says that in an automotive A/C system, heat conducts through the evaporator tube walls from the warm cabin air to the cold refrigerant inside. Who is correct?

A. Technician A only, because heat transfer at the evaporator occurs through radiation rather than conduction

B. Technician B only, because conduction requires the two materials to be the same type of metal to function

C. Both Technician A and Technician B are correct about conduction and its role in evaporator heat transfer

D. Neither Technician A nor Technician B, because all automotive HVAC heat transfer occurs through convection only

50. A vehicle has an A/C performance complaint. The technician's performance test shows: ambient 82°F, low side 30 psi, high side 195 psi, vent temperature 44°F, subcooling 14°F, superheat 10°F. The compressor engages smoothly, the condenser fan operates, and the blower runs at full speed. The customer states the system "just doesn't seem right." What should the technician conclude?

A. All measured parameters are within normal specifications — the system is functioning correctly and no repair is needed

B. The subcooling of 14°F is at the upper limit and suggests the system may be slightly overcharged with refrigerant

C. The vent temperature of 44°F is marginally warm for 82°F ambient and additional refrigerant should be added

D. The superheat of 10°F indicates the TXV is beginning to restrict and should be replaced as a preventive measure

Practice Exam 11: Answer Key and Explanations

1. B — In a single-zone system with one evaporator and one blend door, all air exits the HVAC housing at the same temperature. The outer dashboard vents receive air through longer duct runs that pass near heat-producing components — the heater core, engine firewall, steering column, and dashboard electronics. These longer paths absorb radiant and conducted heat from surrounding components, warming the air by 10°F–15°F before it reaches the outer vent outlets. The center vent has the shortest, most direct path from the evaporator.
2. D — A 14-year-old hose that feels soft and spongy with surface cracking has deteriorated internally as well as externally. The inner rubber liner breaks down over time, releasing small particles into the refrigerant stream that can clog orifice tube screens and TXV inlet filters. Additionally, aged hoses — particularly non-barrier types — have significantly increased refrigerant permeation rates. Replacement eliminates both the contamination risk and the permeation loss.
3. A — The initial both-sides-low readings (20 psi low / 150 psi high) with a warm vent temperature of 52°F improved to normal readings (34 psi low / 220 psi high / 43°F vent) after adding refrigerant to the correct specification by weight. This confirms the original condition was simply an undercharged system. The charge was depleted by a leak, and restoring the correct amount brought all parameters back to normal operating range.
4. C — DTC B0229 indicates the blend door's actual position (78%) does not match the commanded position (45%). The module sends the correct command, but the door cannot reach it. The most common mechanical cause is stripped gears inside the actuator — the motor receives the command and runs, but the broken gear teeth cannot transmit torque to the output shaft, so the door remains at or near whatever position it was in when the gears failed. The actuator must be replaced and calibrated.
5. B — When both the positive terminal and the negative (ground) terminal of a motor read near-battery voltage relative to chassis ground, no current is flowing through the motor circuit. In a functioning circuit, the ground terminal should read near 0V. The fact that battery voltage appears at the ground terminal means the ground path is open — voltage passes through the motor winding (which acts as a conductor when no current flows) and sits at the ground terminal with no path to chassis. Repairing the open ground restores motor operation.
6. D — At 175°F — below the specified 195°F thermostat opening temperature — the thermostat should be fully closed, blocking all coolant flow to the radiator. A warm upper radiator hose proves coolant is flowing to the radiator when it should not be, confirming the thermostat is opening prematurely (failed

partially open or stuck open). This premature opening prevents the engine from reaching full operating temperature, directly reducing the heat available to the heater core.

7. C — Technician A is correct that the orifice tube should be replaced during evaporator service. The orifice tube is an inexpensive component (typically under \$10) that is readily accessible during evaporator work. Replacing it eliminates a potential source of restriction from debris accumulation on its screens and ensures optimal metering function. Technician B's approach of inspecting and conditionally replacing is not wrong, but given the low cost and easy access, routine replacement is the better practice.

8. A — The condenser's primary heat rejection occurs through its external fin surfaces — warm air passes over the fins and carries heat away through convection, while heat conducts from the tubes through the fins. A thick layer of oily grime between the condenser fins acts as an insulating blanket that blocks airflow and reduces the conductive and convective heat transfer area. This insulation effect elevates high-side pressure, reduces subcooling, and degrades cooling performance — the same effect as a physically blocked condenser.

9. D — With 12.1V at the clutch coil positive terminal and 11.8V at the ground terminal, virtually no voltage difference exists across the coil — only 0.3V. For current to flow through the coil and generate a magnetic field, the ground terminal must be near 0V, creating a full 12V potential across the coil. Battery voltage appearing at the ground terminal confirms the ground path is open — there is no return path for current to flow through the coil winding to chassis ground.

10. C — Many ATC systems are programmed to automatically adjust air distribution mode based on conditions — switching between panel, bi-level, and floor delivery as the cabin temperature and heating/cooling demand change. The module may select bi-level mode when the upper cabin is approaching the set temperature but the lower cabin needs additional conditioning, then switch back to panel when conditions change. This automatic mode adjustment without driver input is a designed feature of full-AUTO ATC operation, not a fault.

11. C — Superheat of 4°F is below the 8°F–12°F TXV specification, meaning the refrigerant leaving the evaporator has barely vaporized above its boiling point. This low superheat indicates the TXV is feeding too much liquid refrigerant into the evaporator — the excess liquid does not fully boil off before reaching the evaporator outlet. If superheat drops further toward 0°F, liquid refrigerant will enter the compressor suction line, risking liquid slugging damage to the compressor.

12. A — A compressor shaft that spins freely with zero resistance — no spring tension, no oil drag, no mechanical feedback — indicates the internal mechanism has disconnected from the shaft. This typically

means broken scroll elements in a scroll compressor, a sheared drive shaft coupling, or completely disintegrated internal components. Normal compressors always have noticeable resistance from compression springs, oil viscosity, and mechanical engagement when turned by hand.

13. D — A persistent sweet antifreeze smell inside the cabin — strongest when the heater is running — without visible coolant on the floor or windshield fogging indicates a very small heater core seep. The tiny amount of leaking coolant evaporates on the hot core surface before it can accumulate as liquid drops. The ethylene glycol vapor is carried into the cabin airstream and detected by the occupants as a sweet odor. This is an early-stage heater core leak that will likely worsen over time.

14. B — The blower motor operates at all speeds (confirming the motor, resistor block, and electrical circuits are functional), the cabin air filter is new (eliminating filter restriction), and the motor spins freely (eliminating mechanical drag). Reduced air volume from all vents despite correct blower function points to a restriction inside the HVAC housing itself. A debris-blocked or ice-covered evaporator face restricts the air path regardless of how fast the blower spins, reducing the total volume of air that can pass through to the vents.

15. C — R-1234yf requires dedicated SAE J2843-certified equipment for recovery, recycling, and charging — the R-134a machine cannot be used for any of these functions. However, a standard manifold gauge set can be used for diagnostic pressure readings on R-1234yf systems as long as the gauge hoses have the correct R-1234yf couplers. The gauges only read pressure — they do not recover or introduce refrigerant — so cross-contamination risk from gauge use alone is minimal.

16. A — Both-sides-high pressures after a dust storm — with the system previously working normally — point directly to the condenser. Heavy dust and debris accumulation on the condenser face blocks airflow through the fins, dramatically reducing the condenser's ability to reject heat. Without adequate heat rejection, the refrigerant does not fully condense, high-side pressure climbs, and the elevated back-pressure pushes the low side up as well. Cleaning the condenser face should restore normal pressures.

17. D — A TXV stored for three weeks without protective caps on its ports was exposed to atmospheric moisture for an extended period. Moisture that entered the valve body and settled on internal surfaces can freeze at the valve seat during operation when cold refrigerant flows through, creating an intermittent freeze-up restriction similar to moisture contamination anywhere else in the system. The valve should have been stored capped, and thorough evacuation after installation is critical to remove any absorbed moisture.

18. B — A single loud clunk at clutch engagement — not a continuous noise during operation — indicates a mechanical shock event at the moment the clutch hub contacts the spinning pulley. A loose or worn compressor mounting bracket allows the compressor body to shift position when the sudden rotational torque is applied through the clutch. This movement produces a clunk that stops once the compressor is firmly loaded. Tightening or replacing the mounting bracket or its hardware resolves the noise.

19. C — In a single-zone system with verified sensor accuracy and correct actuator positioning, a slight temperature difference between left and right panel vents indicates the air is being heated during its transit through the ductwork. The passenger-side ducts may route closer to the heater core, the exhaust tunnel, or other heat-producing components inside the dashboard structure. This proximity allows conducted and radiated heat to warm the air slightly more than on the driver side.

20. A — A 6 psi pressure drop over one hour in a temperature-stable environment cannot be explained by gas settling or thermal effects — nitrogen in a sealed system at constant temperature should maintain constant pressure indefinitely. The 6 psi loss (from 180 to 174 psi) confirms a leak exists somewhere in the system. The technician must locate the leak using soap solution at all fittings, an ultrasonic detector, or by listening for hissing before proceeding with evacuation and charging.

21. D — A whistling noise from a specific vent that increases with blower speed — while all A/C pressures and temperatures are normal — is an airflow velocity problem, not a refrigerant problem. Excessive air velocity through a partially obstructed or restricted pathway creates turbulence noise. Common causes include a partially blocked vent register, a disconnected or misaligned duct connection, or a restriction in the cabin air filter housing that accelerates air through a narrow gap.

22. B — Both technicians are correct. Technician A is right that oil circulates with the refrigerant — when charge level drops, less refrigerant flows through the compressor, carrying less oil with it. Technician B is right that extended operation with depleted oil causes progressive internal wear to bearings, seals, and precision surfaces. Even if the charge is eventually restored to full, the mechanical damage from the low-oil period is permanent and may manifest as noise, reduced efficiency, or eventual failure.

23. A — Hot air from the driver-side floor vent but lukewarm from the passenger side — immediately after a cooling system drain and refill for water pump replacement — is the classic symptom of an air pocket trapped in the passenger section of the heater core. The refill procedure did not fully purge air from the heater circuit, and the bubble blocks coolant flow on the passenger side while the driver side flows normally. Properly bleeding the cooling system should eliminate the air pocket and restore even heating.

24. D — The module commands the clutch ON, the relay energizes (audible click), voltage reaches the clutch coil (12.0V at the positive terminal), and the clutch hub visually contacts the pulley. Yet the pressure sensor shows no change — the compressor is not actually pumping. The hub is engaging the pulley surface but is not gripping firmly enough to transfer rotational torque to the compressor shaft. A glazed, oily, or excessively worn friction surface on the hub or pulley allows physical contact without mechanical coupling.

25. B — When the original actuator diaphragm was torn, the actuator drew no vacuum — the tear allowed atmospheric air to bleed through, so the vacuum source was not loaded. After the repair, the actuator now draws vacuum properly through its sealed diaphragm, adding a vacuum load to the intake manifold that was previously absent. This additional load slightly reduces the manifold vacuum available to the engine, which the idle control system compensates for by adjusting idle speed downward slightly.

26. B — A steady hissing sound from the evaporator area that begins shortly after compressor engagement and continues during operation — without any performance issues — is normal refrigerant flow noise through the metering device. As high-pressure liquid refrigerant passes through the orifice tube or TXV restriction, the sudden pressure drop and partial flash to vapor creates turbulence that produces an audible hiss. The sound is transmitted through the evaporator into the HVAC housing and is heard from inside the cabin.

27. A — Both technicians describe correct refrigerant introduction practices. Technician A is right that when adding refrigerant through the low-side port with the compressor running, the refrigerant must enter as vapor — introducing liquid directly into the low side risks liquid slugging the compressor. Technician B is right that liquid can safely enter the high-side port when the engine is off and the system is under vacuum, because the liquid flows into the condenser and liquid line where it belongs.

28. C — A floor vent temperature of 135°F with engine coolant at 205°F represents a substantial heat output that is within normal operating range. The heater core cannot deliver air at coolant temperature — heat transfer through the core always produces outlet air that is 40°F–70°F below coolant temperature. A 135°F floor vent temperature on a cold day provides significant cabin warming. The customer's expectation may exceed the system's actual design capability.

29. D — The intermittent pattern — works most days, occasionally fails to engage in the morning, recovers after sitting in the sun — correlates with temperature-dependent pressure changes. A very slow leak gradually depletes the charge. On cold mornings, the reduced refrigerant mass produces lower static pressure that drops below the low-pressure switch cutout threshold, preventing engagement. As the sun

heats the vehicle, the remaining refrigerant's pressure rises above the cutout point, allowing engagement. The leak needs to be found and repaired.

30. C — An OL (over limit / infinite resistance) reading between the input terminal and the speed 3 output terminal indicates the resistor element for speed 3 has burned open — there is no current path through that resistor. The blower will not operate on speed 3 because no circuit exists to deliver voltage to the motor at that particular resistance level. Speeds 1, 2, and HIGH (direct bypass) will function normally since their respective elements are intact.

31. A — A persistent antifreeze smell after heater core replacement — without visible coolant on the floor, windshield fogging, or pressure test failure — suggests a very small seep at one of the heater hose connections at the firewall. The tiny amount of leaking coolant evaporates on the hot hose or fitting surface before it can drip and accumulate visibly. The standard 16 psi pressure test may not produce enough sustained pressure at the connection point to create a visible drip during the test window.

32. C — Some vehicle HVAC systems use a timed compressor cycling strategy where the module cycles the compressor on and off at fixed intervals regardless of refrigerant pressure or evaporator temperature. This programmed cycling strategy — common in certain European and Asian vehicles — is designed to optimize fuel economy and compressor longevity while maintaining acceptable cooling. The precisely consistent 30-second interval is the key indicator of a programmed strategy rather than a pressure-driven cycle.

33. B — A rhythmic vent temperature oscillation every 20–30 seconds with the compressor running continuously and normal gauge pressures in a TXV system is the classic signature of a hunting TXV. The sensing bulb is not in proper thermal contact with the suction line — either poorly positioned, inadequately insulated, or improperly clamped. The bulb alternately reads warmer (opening the valve wider) and cooler (closing the valve) in a cycle that never reaches equilibrium, producing the pulsating temperature pattern.

34. A — Both technicians correctly describe fundamental refrigeration principles. Technician A is right that increasing pressure on a refrigerant raises its boiling point — this is the core of the pressure-temperature relationship. Technician B is right that the compressor's function is to raise the refrigerant's pressure (and therefore its condensation temperature) high enough above ambient air temperature that the refrigerant condenses in the condenser by releasing heat to the cooler outside air.

35. D — The gauge readings (32 psi low / 200 psi high), vent temperature (44°F), and cycling behavior (20 seconds on, 15 seconds off) all fall within normal operating parameters for a cycling clutch orifice

tube system at 85°F ambient. Normal cycling intervals range from approximately 15–90 seconds depending on conditions. The customer may simply be noticing the normal clutch engagement click and RPM dip that occurs with each cycle. Documenting the measurements and explaining normal operation is appropriate.

36. C — A consistently dropping coolant level with no visible external leaks, clean oil, no white exhaust smoke, a pressure test that holds, and a sweet smell from the dashboard vents specifically points to a heater core leak. The small leak loses coolant into the HVAC housing where the hot evaporator and heater core environment causes the fluid to evaporate before it can pool on the floorboard. The ethylene glycol vapor enters the airstream and produces the sweet smell the customer reports.

37. B — Voltage is confirmed present at the clutch coil positive terminal (12.0V) — the power supply path through the fuse, relay, and any pressure switches is intact. The clutch does not engage despite receiving voltage, which means current is not flowing through the coil. The two remaining components are the coil winding itself (which may be open internally) and the ground circuit (which must provide a return path for current). Testing the coil resistance and the ground circuit voltage drop will identify which one is preventing current flow.

38. A — Hot air that decreases at idle but returns within seconds of driving — with a stable temperature gauge — points to a water pump with an eroded impeller. At idle RPM, the damaged impeller cannot push enough coolant volume through the heater core to maintain full heat transfer. At driving RPM, the faster pump speed compensates for the reduced impeller efficiency and restores adequate flow. The stable temperature gauge indicates the engine is not overheating because the thermostat and radiator manage engine temperature independently.

39. C — A sub-cool condenser with an integrated receiver contains desiccant inside the receiver section. Anytime the system is opened for major service — including compressor replacement — the desiccant is exposed to atmospheric moisture and begins absorbing it immediately. Because the receiver is integrated into the condenser body and cannot be independently serviced, the entire condenser assembly must be replaced to provide fresh desiccant. This applies regardless of whether the compressor failure produced debris.

40. D — The scan tool confirms the HVAC module commands 30% blower speed (module logic and command are correct), but the blower motor receives full 14.2V (battery voltage) and runs at maximum speed. The electronic blower motor controller sits between the module's command and the motor — it should reduce voltage to approximately 30% of battery voltage. The controller's power transistor has shorted internally, passing full voltage regardless of the command. The controller must be replaced.

41. B — "Topping off" an A/C system without first recovering and measuring the existing charge is the most common cause of overcharge in the field. The system likely had an adequate or near-adequate charge before the quick-lube service. Adding refrigerant from a retail can on top of the existing charge pushed the total well above specification, flooding the condenser with excess liquid, reducing effective heat transfer area, and elevating both high-side and low-side pressures — producing worse cooling than before the service.

42. C — Without a rear auxiliary A/C system, the single front-mounted HVAC unit must condition the entire cabin volume. The front system's evaporator, blower, and ductwork are designed to deliver conditioned air primarily to the front seat area. Rear seat areas receive conditioned air only indirectly — through general cabin air circulation — which is significantly less effective than direct duct delivery. This temperature gradient from front to back is an inherent limitation of single-zone front HVAC systems.

43. D — The system cools well (40°F vent temperature) with normal low-side pressure (38 psi) at 85°F ambient — all performance indicators are within specification. The compressor runs continuously because the low-side pressure never drops to the cycling switch cutout point (typically 23–28 psi). The question is why the pressure stays elevated at 38 psi. The most likely explanation is that the system is slightly overcharged — the excess refrigerant mass maintains the low-side pressure above the switch's cutout threshold at all times.

44. A — Both technicians correctly define these fundamental thermodynamic concepts. Technician A is right that latent heat is the energy involved in a phase change (liquid to vapor or vapor to liquid) that occurs without any temperature change — this is the mechanism that makes the refrigeration cycle so effective. Technician B is right that sensible heat is the energy that causes a measurable temperature change without a phase change — simply heating or cooling a substance without changing its state.

45. C — A high-pitched whining noise from the compressor that is present only when the A/C is engaged (the internal mechanism is turning) and increases with RPM indicates a developing internal wear issue — most likely a bearing that is beginning to degrade. The noise is present only under load when the internal components are rotating. Since the system still cools properly with normal pressures, the wear has not yet progressed to the point of affecting performance — but it will likely worsen over time if not addressed.

46. A — A static pressure of 110 psi at 100°F ambient when the P-T chart indicates 115–120 psi is slightly below the expected value. This small deficit could represent a marginally low charge — perhaps 1–3 ounces below specification. However, the difference is small enough that it could also fall within normal gauge tolerance or reflect minor temperature variations. The technician should operate the

system and perform a full performance test with operating pressures, vent temperature, subcooling, and superheat to determine if the charge is truly low.

47. D — Two separate actuators both reporting "circuit open" simultaneously is unlikely to be two independent actuator failures occurring at the same time. A more probable single-point failure that would affect both circuits is a shared power supply wire or ground wire that feeds both actuators. If both actuators receive power or ground through a common wire that has broken or a common connector that has corroded, both circuits would appear open to the module simultaneously, generating matching DTCs.

48. B — A freeze point of -20°F is significantly warmer than the -34°F expected from a proper 50/50 mixture, indicating the coolant concentration has been diluted — there is too much water relative to ethylene glycol concentrate. This diluted mixture provides less freeze protection (risking engine damage in cold climates), less boiling point elevation (reducing the cooling system's heat rejection margin), and potentially less corrosion protection than the specified concentration.

49. C — Both technicians correctly describe conduction and its role in evaporator operation. Technician A is right that conduction is heat transfer through direct physical contact between materials — molecular vibration transfers energy from warmer to cooler substances touching each other. Technician B is right that in the evaporator, heat conducts from the warmer cabin air through the aluminum tube walls and fins into the colder refrigerant flowing inside — this conductive path is the primary mechanism of evaporator heat absorption.

50. A — Every measured parameter falls within normal specifications: low-side 30 psi and high-side 195 psi are textbook for 82°F ambient, vent temperature of 44°F represents excellent cooling, subcooling of 14°F confirms adequate liquid production, and superheat of 10°F confirms proper TXV operation within the 8°F – 12°F specification. The system is operating at its designed capability with no measurable deficiency. The customer's subjective feeling that something is wrong is not supported by the objective measurements.