PRACTICE EXAM 18: ASE A7 SIMULATION (50 QUESTIONS)

1. A vehicle's A/C system has the following readings at 90°F ambient: low side 42 psi, high side 290 psi, vent temperature 54°F. The condenser fan operates at high speed and the condenser face is clean. The subcooling measures 24°F and the superheat measures 4°F. What do these combined readings MOST likely indicate?

A. A restricted condenser with partially collapsed internal tubes that is limiting heat rejection capacity

B. A worn compressor that is generating excessive discharge pressure from internal valve plate distortion

C. A failing condenser fan motor that appears to run at high speed but is actually delivering reduced airflow

D. A refrigerant overcharge with excess liquid backing up in the condenser, producing high subcooling and low superheat

2. A technician removes the compressor from a vehicle for replacement. The old compressor oil is dark brown with visible metallic sparkle when held up to light. The oil drains to 2.5 ounces from the compressor body. The total system specification is 7 ounces. What TWO conclusions can the technician draw from these findings?

A. The oil is degraded from age only and the low volume is because the remaining oil is distributed in other components

B. The compressor experienced internal wear (metallic particles in oil) and oil was lost through the same leak that depleted the charge

C. The metallic sparkle indicates desiccant contamination and the low volume indicates a manufacturing deficiency

D. The dark color is normal for PAG oil over 50,000 miles and the 2.5 ounces represents the correct compressor-only amount

3. On a vehicle with electronic HVAC controls, all dashboard buttons for the climate control system are completely unresponsive. The display is blank. The scan tool CAN communicate with the HVAC module. The blower motor does not run. No actuators move. What should the technician check FIRST?

A. The HVAC control panel power supply and ground circuits, since the module communicates but the panel appears dead

B. The CAN bus wiring between the control panel and the HVAC module for an open or shorted communication wire

C. The HVAC control module itself for an internal failure that prevents it from processing any external input signals

D. The body control module for a failed ignition run signal that would prevent the HVAC system from powering up

4. A vehicle's engine reaches 200°F operating temperature. The heater produces excellent heat from the floor vents at 135°F. However, when the customer selects defrost mode, the windshield clears the driver side effectively but the far passenger corner remains fogged. The blower is on high. What is the MOST likely cause?

A. The heater core is not producing adequate heat on the passenger side due to internal corrosion and deposits

B. The mode door actuator is only partially opening the defrost pathway, reducing total airflow to the windshield

C. A blocked, kinked, or disconnected defrost duct on the far passenger side that prevents heated air from reaching that area

D. The windshield has a factory defect in the defroster grid pattern on the passenger side that prevents effective clearing

5. A technician is evacuating an A/C system after a compressor replacement. The vacuum pump runs for 45 minutes but the micron gauge reads 2,800 microns and is dropping very slowly. The pump oil level is adequate and the pump is operating normally. What is the MOST likely cause of the slow progress?

A. The system has a large leak that is allowing atmospheric air to enter faster than the pump can remove it

B. The new compressor was installed with excess oil that is outgassing vapors and maintaining high pressure

C. The manifold gauge hoses have internal restrictions from age that are limiting the pump's effective flow rate

D. Heavy moisture contamination inside the system that is continuously boiling off and maintaining high vapor pressure

6. A vehicle has an A/C performance complaint. The technician measures the liquid line temperature at three points between the condenser outlet and the orifice tube inlet: Point A (condenser outlet) reads 100°F, Point B (mid-line) reads 99°F, Point C (near the orifice tube) reads 68°F. The ambient temperature is 85°F. What does the sudden temperature drop between Points B and C indicate?

A. A restriction in the liquid line near Point C that is creating a localized pressure drop and corresponding temperature drop

B. Normal liquid line behavior because the refrigerant naturally cools as it approaches the metering device

C. The orifice tube's inlet screen is partially blocked and its restriction effect extends upstream into the liquid line

D. Condensation forming on the liquid line near the firewall is cooling the surface and producing a false temperature reading

7. Technician A says that when a TXV-equipped system has the correct charge, the suction line should feel cold and show light condensation (sweating) from the evaporator outlet to approximately 6–12 inches toward the compressor, with the remainder of the line gradually warming. Technician B says that frost on the suction line at any point always indicates a system malfunction requiring repair. Who is correct?

A. Technician A only, because any amount of suction line frost is always abnormal regardless of the operating conditions

B. Technician B only, because suction line sweating is actually a sign of undercharge and the line should be dry

C. Technician A only, because light sweating near the evaporator outlet is normal while frost indicates excessive liquid flooding

D. Both Technician A and Technician B, because sweating is normal near the evaporator but frost anywhere is abnormal

8. A vehicle's A/C system produces adequate cooling but the customer reports a rhythmic pulsation in the airflow from the center dashboard vent every 3–4 seconds. The pulsation feels like a brief decrease and increase in air volume. The blower motor runs smoothly and the compressor does not cycle during the pulsation. What is the MOST likely cause?

A. A TXV that is hunting between open and closed positions creating evaporator temperature oscillations felt as airflow changes

B. A blend door actuator that is oscillating between two positions due to a faulty feedback signal causing hunting behavior

C. The compressor's variable displacement control cycling between output levels creating refrigerant flow variations

D. Refrigerant pressure pulsations from the compressor that are transmitted through the evaporator causing air turbulence

9. On a vehicle with automatic temperature control, the scan tool shows all sensor readings accurate, all actuator positions matching commands, and the compressor running. The set temperature is 72°F and the in-car sensor reads 72°F. The customer's complaint is that the system switches from panel vent delivery to floor delivery and back approximately every 5 minutes without any input. What does this behavior indicate?

A. A faulty mode door actuator that is intermittently losing its position and drifting between panel and floor settings

B. An HVAC control module software error that is sending erratic mode commands due to corrupted programming

C. An intermittent CAN bus communication fault that is corrupting the mode door position commands periodically

D. Normal ATC operation where the module automatically adjusts air distribution based on cabin temperature stability and comfort algorithms

10. A vehicle's cooling system has a small external leak at the water pump weep hole. The leak produces a drip only when the engine is at full operating temperature and pressure. The drip stops within 2 minutes of engine shutdown. What does this specific leak pattern confirm?

A. The water pump bearing has failed and is allowing the shaft to wobble, breaking the seal intermittently

B. The cooling system is overpressurized from a faulty pressure cap that is exceeding the pump seal's design limit

C. The water pump's internal shaft seal has failed and allows coolant to pass under pressurized operating conditions

D. Condensation from the A/C evaporator drain is being redirected by airflow to drip near the water pump location

11. A vehicle's heater core was replaced six months ago. The customer now reports a gradual decrease in heat output. The technician finds the coolant is the correct type and concentration. Both heater hoses are hot. The engine temperature is 205°F. The blend door reaches full hot when commanded. What should the technician investigate as the MOST probable cause?

A. Whether the cooling system was properly flushed before the new core installation, since residual contamination may be clogging it

B. The cabin air filter for heavy dust accumulation that is restricting airflow through the evaporator and heater core

C. The thermostat for early opening that is reducing coolant temperature below the level needed for adequate heating

D. The water pump for progressive impeller erosion that is reducing coolant flow volume through the heater circuit

12. A vehicle has an orifice tube system where the compressor clutch cycles normally at 35-second intervals. The low-side pressure cycles between 24 psi (cutout) and 46 psi (cut-in) at 85°F ambient. The vent temperature during the on-cycle is 40°F and rises to 48°F during the off-cycle. Are these parameters within normal specification?

A. No — the vent temperature swing of 8°F between on and off cycles is excessive and indicates a charge problem

B. Yes — the cycling pressures, interval, and vent temperature variation are all within normal operating parameters

C. No — the cut-in pressure of 46 psi is too high and indicates the system is overcharged above specification

D. No — the cutout pressure of 24 psi is too low and the evaporator is at risk of freeze-up at this pressure

13. A vehicle's A/C system was working normally until the alternator was replaced. After the alternator installation, the A/C blows warm air. The compressor clutch does not engage. The scan tool shows the HVAC module is NOT commanding the relay. The ambient temperature is 85°F and the engine is at operating temperature. What should the technician check?

A. The serpentine belt routing to verify the new alternator did not require a different belt path that bypasses the compressor

B. The alternator output voltage for an overvoltage condition that may be triggering a module protective shutdown

C. The A/C relay for damage from voltage spikes during the alternator replacement procedure causing welded contacts

D. Whether a wiring connector near the alternator was accidentally left disconnected, such as the A/C pressure sensor

14. On a vehicle with electronic HVAC controls, the technician finds that the blower motor runs at full speed whenever the ignition is turned to RUN, regardless of any control panel setting including OFF. The scan tool shows the HVAC module commanding 0% blower output. What is the MOST likely cause?

A. A shorted electronic blower controller or a welded high-speed relay bypassing all module control of the motor

B. A failed HVAC control module that has lost control of its blower speed output driver circuit permanently

C. A blower motor with an internal short that causes it to self-energize from residual magnetism in the field windings

D. A ground circuit fault that creates a back-feed path through the motor winding from battery voltage to ground

15. A vehicle's A/C system has been properly charged with 22 ounces of R-134a by weight. The technician performs a complete performance test and records: low side 32 psi, high side 200 psi, vent temperature 43°F, subcooling 15°F, superheat 10°F at 84°F ambient. All readings are within manufacturer specifications. What is the MOST appropriate documentation step before returning the vehicle?

A. Photograph the manifold gauge readings and attach the photos to the customer's paper repair order

B. Print the performance data and attach to the repair order, but also recommend a follow-up recheck in 30 days

C. Record all performance test values on the repair order to establish a baseline for comparison during future service

D. No documentation is needed since the system is within specification and the customer will notice if cooling degrades

16. A vehicle's engine reaches operating temperature of 200°F. The heater supply hose at the firewall measures 198°F. The return hose measures 140°F. The floor vent temperature is only 100°F. The blend door is confirmed at full hot. What does the 58°F differential between the supply and return hoses specifically indicate?

A. Normal heat transfer with excellent coolant flow demonstrating the heater core is rejecting maximum heat to the air

B. The heater core has a partial restriction that is slowing coolant flow, causing the coolant to lose excessive heat during its extended transit time

C. The water pump is failing and cannot maintain adequate flow rate through the heater core's narrow passages

D. The thermostat is allowing too much flow through the heater core circuit, overwhelming the core's capacity

17. A vehicle has an A/C system where the compressor clutch engages normally. The gauge readings show low side 30 psi and high side 190 psi at 82°F ambient. The vent temperature is 43°F. The technician measures the condenser inlet temperature at 175°F and the condenser outlet temperature at 95°F. What does the 80°F temperature drop across the condenser indicate?

A. The condenser is oversized for the application and should be replaced with a correctly matched replacement unit

B. The condenser is partially restricted internally, causing some tubes to run hotter while others cool excessively

C. The temperature drop is too large and indicates the condenser fan is running at excessive speed overcooling the refrigerant

D. The condenser is performing effective heat rejection — the large temperature drop shows the refrigerant is being fully condensed and subcooled

18. A vehicle's heater control valve is vacuum-operated. When the temperature control is set to full hot, the valve should be fully open. The technician applies vacuum to the valve actuator and the valve closes (restricting coolant flow). When vacuum is removed, the valve opens (allowing full flow). On this vehicle, the temperature control cable pulls a vacuum switching valve that applies vacuum in the COLD position and removes vacuum in the HOT position. The customer complains the heater is always lukewarm. What is the MOST likely cause?

A. A vacuum leak in the heater control valve actuator circuit that allows partial vacuum to reach the valve at all settings, keeping it partially closed

B. A failed vacuum switching valve that applies full vacuum to the heater valve regardless of the temperature setting

C. A stretched temperature control cable that cannot fully close the vacuum switching valve in the hot position

D. A cracked heater control valve diaphragm that has lost its ability to close the valve when vacuum is applied

19. On a vehicle with ATC, the scan tool shows the following during A/C operation: evaporator temperature 37°F, compressor ON, blend door 20%, in-car sensor 74°F, set temperature 72°F. The customer reports the air feels adequately cool but excessively dry, causing discomfort. All readings are verified accurate. What should the technician explain?

A. The evaporator temperature is too cold and needs to be raised to 42°F to reduce moisture removal from the air

B. The blend door at 20% is mixing too much warm air and should be at 0% for maximum cooling with less dehumidification

C. Removing moisture from the air is a normal byproduct of A/C cooling — the cold evaporator surface condenses humidity as it cools the air

D. The recirculation door is stuck in the recirculation position, continuously drying the already-dehumidified cabin air

20. A vehicle's scan tool shows the HVAC module commanding the A/C compressor relay ON. The relay activates (confirmed by click). The technician measures 12.4V at relay terminal 87 (output). A cycling pressure switch is wired between the relay output and the clutch coil. The technician measures 12.3V on the relay side of the pressure switch and 0V on the clutch coil side. What has the technician identified?

A. A failed compressor clutch coil that has an internal open preventing current from flowing through the winding

B. A stuck-open relay contact that is not passing voltage despite the relay coil being energized by the module

C. An HVAC module fault where the relay command signal is being sent but the output driver has insufficient current

D. An open cycling pressure switch that is not passing voltage from the relay output through to the clutch coil circuit

21. 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 −8°F. The correct 50/50 mixture should read approximately −34°F. The coolant appears clean and the correct color. What should the technician recommend?

A. The coolant has a weak concentration and should be drained, and the system refilled with correct 50/50 premix

B. The coolant concentration is acceptable for mild climates and only needs adjustment if the customer lives in a cold region

C. Add straight coolant concentrate to the reservoir until the refractometer reads −34°F and the concentration is corrected

D. The refractometer reading is unreliable and a hydrometer test should be performed for a second opinion before action

22. Technician A says that when replacing an evaporator, the technician should also replace the TXV or orifice tube because the metering device was exposed to whatever caused the evaporator to fail. Technician B says the metering device only needs replacement if the evaporator failure released debris into the system. Who is correct?

A. Technician B only, because a simple evaporator leak without debris release does not contaminate the metering device

B. Technician A only, because the metering device is always replaced as a matched set with the evaporator

C. Both Technician A and Technician B, because the decision depends on the nature of the evaporator failure

D. Neither Technician A nor Technician B, because the metering device never needs replacement during evaporator service

23. A vehicle's A/C system has the following condition: vent temperature starts at 42°F when the system is first turned on. Over the next 15 minutes, the temperature gradually rises to 48°F. If the technician turns the A/C off for 5 minutes and then back on, the vent temperature returns to 42°F and the gradual rise repeats. The compressor runs continuously in both periods. What is the MOST likely cause?

A. A marginal refrigerant charge that performs well initially but gradually starves the evaporator as heat load accumulates

B. A condenser that progressively heat-soaks during extended operation and gradually reduces its heat rejection capacity

C. A compressor with worn internals that gradually loses compression efficiency as internal components heat up

D. Progressive evaporator icing from a failed freeze protection device that gradually blocks airflow until the system is cycled off

24. On a vehicle with electronic HVAC controls, the technician performs a blend door actuator calibration after replacement. The scan tool reports "Calibration successful — range 0% to 100%." Two weeks later, the customer returns reporting that full-hot air temperature is 125°F instead of the expected 135°F. The engine reaches proper operating temperature. What should the technician investigate?

A. The HVAC module for a software calibration offset that needs to be reset after any actuator replacement procedure

B. Whether the actuator was installed one spline position off on the blend door shaft, slightly reducing the hot-end travel

C. The heater core for the beginning stages of internal restriction that reduces maximum heat output capacity

D. The engine thermostat for a rating that is 5°F lower than specification, which directly accounts for the 10°F deficit

25. A vehicle's A/C compressor clutch does not engage. The technician finds the clutch fuse blown. After replacing the fuse, the clutch engages for approximately 45 seconds before the new fuse blows. The technician replaces the fuse again and the same pattern repeats. What does the consistent 45-second timeline indicate?

A. The clutch coil develops a thermal short as it heats from current flow — resistance drops progressively until overcurrent blows the fuse

B. The compressor locks up intermittently after 45 seconds of operation, and the stalled motor draws locked-rotor current

C. A wire in the clutch circuit is chafing against a moving engine component that contacts it once per engine cycle

D. The relay contacts arc during initial engagement and gradually weld closed, creating a dead short after 45 seconds

26. A vehicle's cooling system repeatedly overflows from the reservoir during normal driving. The cap holds 16 psi during testing. The combustion gas test is negative. The engine does not overheat. The system holds pressure during a 30-minute static test. A recent coolant change was performed. What is the MOST likely cause?

A. Normal thermal expansion is not the issue — the system was not adequately bled of air pockets after the recent coolant change

B. The water pump has a worn impeller that creates excessive pressure pulses at specific RPM ranges during driving

C. The coolant level was filled above the cold MAX line, and normal thermal expansion overflows the excess during driving

D. A weak radiator hose that expands under pressure and displaces enough volume to push coolant into the reservoir

27. Technician A says that R-134a and R-1234yf have similar operating pressures and performance characteristics, which is why R-1234yf was chosen as the replacement for R-134a in new vehicles. Technician B says that despite their similar performance, R-1234yf requires completely separate, dedicated service equipment that cannot be shared with R-134a. Who is correct?

A. Technician A only, because R-1234yf equipment can service either refrigerant type with a simple adapter change

B. Technician B only, because R-134a and R-1234yf have dramatically different operating pressures requiring different gauges

C. Neither Technician A nor Technician B, because R-1234yf is being phased out in favor of CO2 refrigerant systems

D. Both Technician A and Technician B are correct about the similar performance and the need for separate equipment

28. A vehicle's heater produces hot air from the floor and defrost vents but the customer reports cold air from the panel (face) vents when BI-LEVEL mode is selected. The A/C compressor is OFF. The temperature control is set to full hot. The scan tool shows the mode door in the BI-LEVEL position. What is the MOST likely explanation?

A. A cracked HVAC housing that allows cold outside air to enter the panel vent ductwork pathway directly

B. Normal bi-level operation — the panel vents deliver cooler air directed over the heater core bypass while floor vents deliver heated air

C. A stuck panel-vent blend door that is preventing warm air from entering the upper dashboard duct pathway

D. The A/C compressor is actually engaging in bi-level mode without the technician noticing, cooling the panel vent air

29. On a vehicle with vacuum-operated HVAC controls, the mode selection works correctly in all positions while the engine is idling in the shop. However, the customer reports that the mode frequently changes to defrost during highway driving and returns to the selected mode when the vehicle decelerates. The engine is in good mechanical condition. What is the MOST likely cause?

A. A failing vacuum check valve that allows stored vacuum to bleed back to the manifold during highway cruise

B. An exhaust backpressure valve that reduces intake manifold vacuum at highway speed below the HVAC threshold

C. A small vacuum leak in one of the mode door actuator hoses that only manifests at sustained highway speeds

D. A cracked vacuum reservoir that maintains adequate vacuum at idle but depletes under the sustained load of driving

30. A vehicle's A/C system has been charged to specification. The technician performs a performance test at 80°F ambient and records: low side 30 psi, high side 190 psi, vent temperature 43°F, subcooling 14°F, superheat 10°F. The customer is satisfied. One year later, the customer returns with a vent temperature of 50°F. The technician recovers 19 ounces from the 22-ounce system. What is the proper diagnostic sequence?

A. Recharge the system to 22 ounces, verify 43°F vent temperature is restored, and release the vehicle

B. Add 3 ounces to bring the charge to specification and recheck the vent temperature before further diagnosis

C. Replace the accumulator and orifice tube since the system has been running low for an unknown period

D. Find and repair the leak, replace the accumulator/receiver-drier, evacuate to specification, then recharge

31. A vehicle's engine temperature gauge reads at the bottom of the normal range — approximately 170°F. The thermostat is rated at 195°F. The upper radiator hose is warm. The heater output is marginal. The vehicle is a 2018 model with 90,000 miles. What is the MOST likely cause of all three symptoms?

A. A failing water pump that is circulating coolant too slowly, allowing the engine to run cool and limiting heater output

B. A restricted radiator that creates back-pressure forcing coolant through the heater core instead of the radiator

C. A thermostat that has failed partially open, allowing premature coolant flow to the radiator and preventing the engine from reaching 195°F

D. A faulty engine coolant temperature sensor that reads lower than actual, causing the fan to overcool the engine

32. On a vehicle with electronic HVAC controls, the technician uses the scan tool to command the blend door actuator through its full range. At 0% (full cold), the center vent temperature is 40°F. At 50%, the vent temperature is 85°F. At 100% (full hot), the vent temperature is 135°F. What do these temperature readings confirm?

A. The blend door, actuator, heater core, and evaporator are all functioning correctly through the full temperature range

B. The blend door reaches only 95% of its travel because full hot should produce 140°F or higher at 100% position

C. The evaporator is undercooling at 40°F and the heater core is overheating at 135°F, indicating charge imbalance

D. The mid-range temperature of 85°F is too cool and indicates the blend door is not reaching true 50% position

33. A vehicle has an A/C system where the compressor clutch engages and the gauges show normal pressures. The center vent temperature reads 43°F. However, the customer reports that the air volume from all vents seems significantly reduced compared to when the vehicle was new. The blower motor runs at all speeds and sounds normal. The cabin air filter was replaced 3 months ago. What should the technician check?

A. The cabin air filter installation to verify the filter was seated correctly and the housing was fully closed after replacement

B. The evaporator face for debris accumulation or ice buildup that is restricting airflow through the HVAC housing

C. The blower motor current draw on high speed to verify the motor is producing adequate torque for full airflow

D. The condenser for external debris that could be reducing the total system cooling output and simulating reduced flow

34. Technician A says that the R-134a pressure-temperature chart shows that at a measured low-side pressure of 30 psi, the corresponding saturation temperature is approximately 33°F. Technician B says

that if the actual suction line temperature at the evaporator outlet measures 43°F, the superheat is approximately 10°F. Who is correct?

A. Technician A only, because superheat cannot be determined from pressure and temperature alone

B. Both Technician A and Technician B, but the superheat should be measured at the compressor inlet not evaporator outlet

C. Technician B only, because the P-T chart correlation between 30 psi and 33°F is incorrect for R-134a

D. Both Technician A and Technician B are correct about the P-T relationship and the superheat calculation method

35. On a vehicle with electronic HVAC, the customer reports that the A/C compressor runs continuously without ever cycling off. The system is an orifice tube design with a cycling clutch switch. The low-side pressure is steady at 38 psi and the vent temperature is 41°F at 84°F ambient. The technician inspects the cycling pressure switch and finds it has been bypassed with a jumper wire by a previous technician. What risk does this bypass create?

A. No risk — the bypass simply ensures continuous maximum cooling output which is preferable for customer comfort

B. The compressor will overheat from continuous operation without the rest periods the cycling switch provides

C. The evaporator could freeze solid because the cycling switch is the primary freeze protection device on this system

D. The compressor clutch will wear prematurely because it never disengages to allow the bearing to cool between cycles

36. A vehicle has an engine coolant temperature of 200°F. The heater supply hose measures 198°F and the return hose measures 185°F. The floor vent temperature is 130°F at full hot. The customer wants warmer heat. Is the heater system performing within normal expectations?

A. Yes — a 13°F differential between supply and return hoses with a 130°F vent temperature indicates normal operation

B. No — the 13°F differential is too small and indicates excessive flow that doesn't allow adequate heat transfer

C. No — the 130°F vent temperature is below the 140°F minimum standard for all automotive heater systems

D. Yes — but installing a thermostat with a 210°F rating would safely increase the maximum vent temperature

37. A vehicle's HVAC system has the following complaint: the mode doors respond correctly to panel, floor, and defrost button presses. However, when the driver presses the defrost button, there is a 4-second delay before the mode actually changes. All other mode transitions are instantaneous. What is the MOST likely cause?

A. The HVAC module has a programmed delay specifically for the defrost mode to allow the compressor to stabilize before changing airflow

B. The defrost mode requires the mode door to travel the farthest mechanical distance from the current position, producing a longer transit time

C. The A/C compressor engagement that automatically accompanies defrost selection creates a momentary electrical load that delays the actuator

D. The defrost actuator's motor is slower than the mode door actuator because it drives a larger, heavier defrost flap mechanism

38. A vehicle's A/C system has a confirmed slow leak at the evaporator. The technician recovers the refrigerant and finds the oil is milky white and cloudy. What does this oil condition indicate about the system beyond the evaporator leak?

A. The milky oil simply confirms the evaporator leak, since refrigerant mixing with humidity causes the discoloration

B. The oil appears normal for a system that has been running with a low charge for an extended period of operation

C. Moisture has contaminated the system — atmospheric air and water entered through the leak and emulsified with the oil

D. An incompatible refrigerant was used in a previous service, creating a chemical reaction that discolored the oil

39. Technician A says that when checking A/C system performance, the technician should measure vent temperature at the center dashboard vent with a thermometer probe inserted at least 3 inches into the vent. Technician B says that the probe should be placed at the vent opening surface for the most accurate reading of what the customer actually feels. Who is correct?

A. Technician A only, because inserting the probe deep into the vent reduces the influence of ambient air on the reading

B. Technician B only, because the surface temperature matches the customer's experience better than a deep reading

C. Both Technician A and Technician B, because either measurement location provides an acceptable performance result

D. Neither Technician A nor Technician B, because vent temperature should only be measured with a scan tool sensor

40. On a vehicle with ATC, the scan tool shows the A/C pressure sensor reading 4.8V. The sensor's normal operating range is 0.5V–4.5V. The compressor does not engage. What can the technician determine from this reading?

A. The system pressure is at the maximum measurable value and the system is dangerously overcharged with refrigerant

B. The A/C pressure sensor is functioning correctly at the upper end of its range and the module is protecting the system

C. The HVAC module is over-supplying the sensor's reference voltage, which is inflating the pressure reading artificially

D. The sensor signal exceeds the valid operating range — the module interprets this as a circuit fault and disables the compressor

41. A vehicle's A/C system was recently serviced with a compressor replacement. The system cools well but the customer reports a squealing noise from the engine compartment that occurs only when the A/C is engaged. The noise increases with engine RPM. The belt is new and properly tensioned. What should the technician check FIRST?

A. The compressor for internal mechanical failure that is creating a high-pitched noise transmitted through the body

B. The compressor clutch pulley alignment relative to the other pulleys in the serpentine drive system

C. The new belt material for incompatibility with the compressor pulley surface creating a friction noise

D. The compressor mounting brackets for loose bolts that allow the compressor to vibrate under A/C operational load

42. On a vehicle with ATC, the customer reports the system blows maximum cold air regardless of the temperature setting. The set temperature is 80°F. The scan tool shows the blend door commanded to 0% (full cold). The in-car sensor reads 58°F. The ambient temperature is 35°F. What is the MOST likely cause of the module commanding full cold despite the cabin being colder than the set point?

A. A failed blend door actuator stuck at full cold that is not responding to the module's commands for heat

B. A shorted sun load sensor that is sending a maximum signal, overriding the temperature control with cooling demand

C. A faulty in-car temperature sensor reading lower than actual, causing the module to incorrectly calculate cooling is needed

D. A failed ambient sensor reading much warmer than actual, causing the module to command cooling for a perceived hot day

43. A vehicle's A/C system has the following readings at 78°F ambient: low side 28 psi, high side 175 psi, vent temperature 42°F. The customer asks the technician to verify the system is in good condition for an upcoming summer road trip. What additional measurements should the technician take to provide a thorough assessment?

A. Subcooling at the condenser outlet and superheat at the evaporator outlet to confirm proper charge and metering device function

B. The temperature at each individual vent outlet to map the cooling distribution across the entire dashboard surface

C. The compressor clutch air gap and coil resistance to verify the clutch assembly is within service specification

D. The high-side and low-side hose surface temperatures to calculate the total system heat rejection efficiency

44. Technician A says that EPA regulations require any person who purchases R-134a in containers larger than 2 pounds to be Section 609 certified. Technician B says that small cans of R-134a sold at retail auto parts stores do not require certification to purchase because they contain less than 2 pounds. Who is correct?

A. Technician A only, because Section 609 certification is required for purchases of any size container of refrigerant

B. Technician B only, because Section 609 only applies to commercial purchases by shops, not individual consumers

C. Neither Technician A nor Technician B, because EPA certification is only required for refrigerant disposal not purchase

D. Both Technician A and Technician B are correct about the 2-pound threshold for certification requirements

45. On a vehicle with electronic HVAC controls, the blend door actuator has been replaced three times in two years. Each replacement fails within 3–4 months with stripped gears. What underlying condition is MOST likely causing the repeat actuator failures?

A. An incorrect replacement actuator part number that has weaker gear material than the original equipment design

B. A binding or seized blend door pivot point that forces the actuator to work against excessive mechanical resistance

C. Excessive blower motor vibration being transmitted through the HVAC housing and causing gear tooth fatigue

D. A corroded LIN bus connection that causes erratic commands and forces the motor to reverse direction repeatedly

46. A vehicle's cooling system has the following condition: the engine runs at 200°F. When the A/C compressor engages, the engine temperature rises to 215°F within 5 minutes and the cooling fan activates at high speed. When the A/C is turned off, the engine temperature drops back to 200°F within 3 minutes. This occurs consistently. What is the MOST likely cause?

A. Normal operation — the A/C condenser adds significant heat to the airflow through the radiator, and the fan compensates

B. An overcharged A/C system that creates abnormally high condenser temperatures, overwhelming the cooling system

C. The condenser is adding heat load that the cooling system can handle but only with the high-speed fan assistance

D. A failing water pump that cannot maintain adequate flow under the combined engine and A/C heat load at 215°F

47. A vehicle has an A/C system where the technician measures the following at 85°F ambient with the system operating: compressor discharge line temperature 190°F, condenser inlet 188°F, condenser outlet 98°F, liquid line at firewall 100°F. The technician calculates that the high-side pressure of 210 psi corresponds to 122°F on the P-T chart. What is the subcooling at the condenser outlet?

A. 24°F — calculated by subtracting the condenser outlet temperature (98°F) from the P-T saturation temperature (122°F)

B. 90°F — calculated by subtracting the condenser outlet temperature from the discharge line temperature

C. 13°F — calculated by subtracting the ambient temperature from the condenser outlet temperature

D. 122°F — using the P-T chart value directly as the subcooling measurement without further calculation

48. A vehicle has an A/C performance complaint. The system has been charged to specification. At 92°F ambient, the gauge readings are: low side 22 psi, high side 250 psi. The vent temperature is 50°F. The suction line at the evaporator outlet is cold but the suction line near the compressor inlet is warm. What does this pattern indicate?

A. The compressor has worn seals that are allowing hot discharge gas to leak into the suction port internally

B. The condenser fan is running at reduced speed, causing the elevated high-side pressure and warm suction line

C. A restriction in the suction line between the evaporator and compressor that is creating a secondary pressure drop

D. The low-side pressure of 22 psi combined with the high-side of 250 psi indicates a restricted liquid line or metering device

49. Technician A says that when performing a leak test with nitrogen, the technician should always use dry nitrogen with a pressure regulator to control the test pressure. Technician B says that oxygen or compressed air can be safely substituted for nitrogen when performing A/C system leak testing. Who is correct?

A. Both Technician A and Technician B, because any pressurized gas can safely be used for leak detection purposes

B. Technician A only, because oxygen or compressed air mixed with refrigerant oil can create a combustible mixture

C. Technician B only, because nitrogen's inert properties provide no safety advantage over compressed air for this purpose

D. Neither Technician A nor Technician B, because leak testing should only be performed with the system's refrigerant charge

50. A vehicle's A/C system was serviced one month ago. The customer returns reporting that the system cools adequately but produces a noticeable chemical smell from the vents during the first 2 minutes of A/C operation. The smell disappears after the system runs for a few minutes. The system was flushed during the previous service. What is the MOST likely cause?

A. A slow evaporator leak that is releasing refrigerant vapor into the cabin during the initial A/C startup period

B. Microbial growth on the evaporator surface that releases volatile compounds when the blower first disturbs it

C. Residual flushing solvent trapped in the system that was not fully purged with nitrogen before reassembly and charging

D. The new compressor oil is chemically different from the original type and produces a detectable odor when circulating

Practice Exam 18: Answer Key and Explanations

1. D — High subcooling (24°F — above the normal 10°F–20°F range) indicates excess liquid refrigerant backing up in the condenser, cooling well below its condensation temperature. Low superheat (4°F — below the normal 8°F–12°F TXV range) indicates the evaporator is receiving more refrigerant than it can fully evaporate. Both elevated pressures, high subcooling, and low superheat together form the signature pattern of a refrigerant overcharge — excess mass in the system overwhelms the condenser's capacity and floods the evaporator.

2. B — Dark brown oil with visible metallic sparkle confirms two problems simultaneously. The metallic particles indicate the compressor experienced internal mechanical wear — bearing surfaces, piston shoes, or reed valves have been shedding material. The low oil volume of 2.5 ounces (from a 7-ounce total specification) confirms oil was lost from the system — since oil travels with the refrigerant, oil escapes through any refrigerant leak proportionally with the charge loss.

3. A — The scan tool communicates with the HVAC module (confirming the module's processor and CAN bus connection are functional), but the control panel display is blank and no buttons respond. Since the module itself is alive on the network, the fault is most likely at the control panel — its power supply, ground circuit, or internal electronics have failed. Checking the panel's power and ground is the logical first step because a dead panel cannot send any commands to the functional module.

4. C — The heater produces 135°F floor vent air (confirming the heater core, coolant, blend door, and blower are functional). The driver side defrosts effectively (confirming the defrost system produces adequate heated air). Only the far passenger corner remains fogged — a localized delivery failure. A blocked, kinked, or disconnected defrost duct specifically serving the far passenger corner of the windshield would prevent heated air from reaching that area while all other zones clear normally.

5. D — After 45 minutes of pump operation with adequate oil and normal pump function, a micron gauge reading of 2,800 microns dropping very slowly indicates the pump is fighting against a continuous source of vapor pressure inside the system. Heavy moisture contamination produces a large volume of water vapor as the lowering pressure causes the trapped water to boil. This continuous evaporation maintains high vapor pressure that the pump must overcome, dramatically slowing the evacuation progress. Extended pump time is required.

6. A — The liquid line temperature is stable from the condenser outlet (100°F) through the midpoint (99°F) — only a 1°F normal drop. Then it drops suddenly to 68°F near the orifice tube — a 31°F drop at a specific location. This abrupt localized temperature decrease indicates a restriction at that point in the line. When high-pressure liquid forces through a restriction, the pressure drops and the refrigerant partially flashes to vapor, producing a dramatic temperature decrease at the restriction location.

7. C — Technician A correctly describes normal suction line behavior: light condensation (sweating) near the evaporator outlet that gradually transitions to a dry, warmer line toward the compressor is the expected pattern for a properly charged TXV system. Technician B is incorrect because frost — not sweating — on the suction line indicates excessive liquid refrigerant flooding beyond the evaporator, which is abnormal. The distinction between normal sweating and abnormal frost is a critical diagnostic observation.

8. B — A rhythmic pulsation in airflow volume every 3–4 seconds — felt as a brief volume decrease and increase — without compressor cycling or blower speed changes points to a moving component in the air path. A blend door actuator with a faulty feedback signal hunts between two adjacent positions as the module tries to maintain a precise temperature. Each position shift momentarily redirects a portion of the airflow, producing the rhythmic pulsation the customer feels at the vent.

9. D — All sensor readings are accurate, all actuator positions match commands, and the system maintains the set temperature correctly. The automatic mode switching between panel and floor delivery without driver input is a programmed ATC feature — the module adjusts air distribution based on cabin conditions to optimize comfort. When the upper cabin is at temperature, the module may shift to floor delivery to stratify the air (warm feet, cool head), then switch back as conditions change.

10. C — The water pump weep hole is specifically designed as an early warning indicator of internal shaft seal failure. The drip appearing only when the engine is at full operating temperature and system pressure (16 psi) confirms the seal fails under pressurized operating conditions but reseals when the engine cools and pressure drops. This temperature and pressure-dependent pattern definitively identifies a failed internal shaft seal rather than condensation or external contamination.

11. A — Every other potential cause has been systematically eliminated: correct coolant, hot hoses (adequate supply), proper engine temperature, full-hot blend door position, and recent core replacement. A heater core that loses heat output within six months of installation — despite a clean coolant supply — most commonly suffers from contamination left in the system during the replacement. If the cooling system was not thoroughly flushed before installing the new core, residual deposits progressively migrate to and clog the new core's passages.

12. B — The cycling pressures fall within normal ranges: cutout at 24 psi is within the typical 23–28 psi range, and cut-in at 46 psi is within the typical 40–48 psi range. The 35-second cycle interval is within normal parameters for 85°F ambient. The 8°F vent temperature swing (40°F to 48°F) between on and off cycles is the expected result of the compressor cycling — the evaporator cools during the on-cycle and warms slightly during the off-cycle. All parameters confirm normal system operation.

13. D — The A/C worked normally before the alternator replacement and failed immediately after — directly correlating the fault to the service procedure. When replacing the alternator, the technician works in close proximity to several A/C-related wiring connectors. The most likely cause is a connector that was accidentally left disconnected — particularly the A/C pressure sensor connector, which would send an out-of-range signal causing the module to withhold the compressor engagement command.

14. A — The scan tool confirms the HVAC module commands 0% blower output (OFF), yet the blower runs at maximum speed. The module is not driving the motor — something else is. A shorted electronic blower motor controller (power transistor failed short) passes full battery voltage to the motor regardless of the module's command. Alternatively, a welded high-speed relay stuck closed bypasses the controller entirely and delivers full battery voltage directly to the motor whenever the ignition is on.

15. C — Recording all performance test values on the repair order creates a documented baseline of the system's verified performance at this specific service date. During any future A/C complaint or service, the technician can compare current readings against this baseline to identify exactly what has changed. This documentation practice is the most valuable long-term step — it transforms a single service visit into a reference point for all future diagnostic work on this vehicle.

16. B — A 58°F differential between the supply hose (198°F) and the return hose (140°F) is significantly larger than the normal 20°F–40°F range. This excessive temperature drop means the coolant is spending too long inside the heater core — it enters hot but exits dramatically cooler because the reduced flow rate gives each unit of coolant more time to release heat. A partial internal restriction slows the flow, producing this large differential combined with the low 100°F vent temperature despite adequate inlet temperature.

17. D — An 80°F temperature drop across the condenser (175°F inlet to 95°F outlet) demonstrates effective heat rejection. The hot refrigerant vapor enters the condenser at 175°F, releases its latent heat as it condenses from vapor to liquid, and exits as subcooled liquid at 95°F (only 13°F above the 82°F ambient). This large temperature drop with normal gauge pressures and excellent vent temperature confirms the condenser is performing its designed function — fully condensing and subcooling the refrigerant efficiently.

18. A — In this system, vacuum applied equals cold (valve closes) and vacuum removed equals hot (valve opens). If a vacuum leak exists in the heater control valve circuit, partial vacuum reaches the valve at all temperature settings — including full hot where vacuum should be completely absent. The partial vacuum keeps the valve partially closed at all times, restricting coolant flow to the heater core and producing perpetually lukewarm output regardless of the temperature knob position.

19. C — The system is functioning correctly — all sensor readings are within specification and the cabin temperature matches the set point. The "excessively dry" air the customer perceives is a normal and unavoidable byproduct of the A/C cooling process. The cold evaporator surface (37°F) continuously condenses moisture from the cabin air as it passes over the fins. This dehumidification is actually beneficial (it helps defrost and reduces interior fog) but some occupants are more sensitive to low humidity than others.

20. D — The diagnostic path is clear: 12.3V arrives at the relay side of the cycling pressure switch, but 0V exits the switch on the clutch coil side. The switch is wired in series between the relay output and the clutch coil — it must pass voltage through its closed contacts for the clutch to engage. With voltage present on one side and absent on the other, the switch contacts are open. The switch has either tripped due to low system pressure or has failed in the open position.

21. A — A freeze point of −8°F instead of the expected −34°F for a 50/50 mixture indicates the coolant is significantly diluted — too much water relative to glycol concentrate. This weak mixture provides inadequate freeze protection (risking engine damage in cold climates), reduced boiling point elevation (lower overheating margin), and potentially diminished corrosion protection. The entire coolant volume should be drained and replaced with a properly mixed 50/50 solution to restore all protective properties.

22. A — Technician B correctly states that the metering device only requires replacement when the evaporator failure produced debris that could contaminate the system. A simple evaporator leak (such as a pinhole from external corrosion) does not release debris into the refrigerant circuit — the refrigerant escapes outward, not inward. Without contamination, the metering device's screens and internal passages remain clean and the device can be reused. Replacing it unnecessarily adds cost without benefit.

23. D — Vent temperature starting at 42°F and gradually rising over 15 minutes with continuous compressor operation — then resetting when the system is cycled off — is the classic pattern of progressive evaporator icing. A failed freeze protection device (sensor reading too warm, stuck cycling switch) allows the evaporator to cool below 32°F. Ice gradually builds on the fins, progressively blocking airflow. Turning the system off for 5 minutes allows the ice to melt, resetting the cycle.

24. B — The calibration completed successfully showing 0%–100% range, but the full-hot vent temperature is 125°F instead of the expected 135°F. The calibration sees both electrical endpoints — but if the actuator was installed one spline position off on the blend door shaft, those endpoints are shifted relative to the door's actual mechanical stops. The door reaches full cold correctly but falls 10°F short of full hot because one spline offset reduces the hot-end travel by approximately one tooth's worth of rotation.

25. A — The consistent 45-second timeline — working initially then failing as the coil heats — is characteristic of a thermal short in the clutch coil winding. When cold, the partially damaged insulation between adjacent windings maintains adequate separation. As current flows and the coil heats over 45 seconds, the insulation softens or the wire expands, closing the gap between windings. The resulting partial short progressively increases current draw until it exceeds the fuse rating and blows it.

26. C — The pressure cap tests correctly at 16 psi, the combustion gas test is negative, the engine does not overheat, and the system holds pressure during a 30-minute static test. The recent coolant change is the key detail — if the coolant level was filled above the cold MAX line, normal thermal expansion during engine warm-up and driving increases the coolant volume beyond the reservoir's capacity. The excess overflows through the cap's relief valve, and the level drops after each drive cycle.

27. D — Both technicians state correct facts. Technician A is right that R-134a and R-1234yf have similar operating pressures and thermodynamic performance characteristics — this similarity is precisely why R-1234yf was chosen as R-134a's replacement, as it requires minimal system redesign. Technician B is right that despite their similar performance, R-1234yf's A2L flammability classification mandates completely separate, dedicated SAE J2843-certified equipment that cannot be shared with R-134a service.

28. B — In bi-level mode, the HVAC system is designed to deliver cooler air from the panel (face) vents and warmer air from the floor vents — this split creates the "cool head, warm feet" comfort strategy. The panel vent air is directed through or around the heater core bypass, receiving less heat, while the floor vent air passes through more of the heater core for warming. The A/C is OFF, so the panel air is simply unheated ambient air from the evaporator bypass path, which feels cool relative to the heated floor air.

29. A — The mode doors work correctly at idle (adequate vacuum) but default to defrost at sustained highway speeds. During highway cruise, the engine operates at moderate manifold vacuum. A failing vacuum check valve allows stored reservoir vacuum to bleed back to the manifold during sustained cruise, gradually depleting the vacuum available to the HVAC actuators. When vacuum drops below the actuator holding threshold, the spring-loaded mode doors default to defrost position. Decelerating increases manifold vacuum, recharges the system, and restores the selected mode.

30. D — A 3-ounce charge loss over one year confirms a leak exists — this exceeds normal permeation. The proper diagnostic sequence is: find the leak first (electronic detection, UV dye), repair the leak, replace the accumulator/receiver-drier (the system was running with reduced charge and the desiccant may be saturated from moisture entry through the leak), evacuate to specification to remove air and moisture, and then recharge with the full specified amount. Simply adding refrigerant without fixing the leak guarantees a repeat visit.

31. C — Three symptoms correlate to a single root cause: engine running at 170°F (below the 195°F thermostat specification), warm upper radiator hose (coolant flowing to the radiator prematurely), and marginal heater output (insufficient coolant temperature for adequate heat). A thermostat that has failed partially open allows coolant to reach the radiator before the engine warms to its designed operating temperature, keeping the coolant perpetually below 195°F. Replacing the thermostat resolves all three symptoms.

32. A — The blend door sweep through its full range produces appropriate temperatures at all three test points: 40°F at full cold (excellent evaporator cooling), 85°F at mid-range (proper blending of cold and hot air), and 135°F at full hot (adequate heater core heat delivery). These temperatures confirm the evaporator is cooling properly, the heater core is delivering adequate heat, and the blend door travels through its complete mechanical range with the actuator controlling position accurately throughout.

33. B — The A/C system produces excellent 43°F vent temperatures (confirming the refrigeration system is functional), the blower runs normally at all speeds (eliminating motor and electrical faults), and the cabin air filter is relatively new (eliminating filter restriction). Reduced total air volume despite normal blower operation points to a restriction inside the HVAC housing itself. The evaporator face is the most common accumulation point for dust, debris, and ice that blocks the air path regardless of blower speed.

34. D — Both technicians correctly apply the superheat calculation method. Technician A is right that the R-134a P-T chart shows approximately 33°F saturation temperature at 30 psi low-side pressure. Technician B is right that superheat equals the actual measured suction line temperature (43°F) minus

the P-T chart saturation temperature (33°F), which equals 10°F — within the normal 8°F–12°F TXV specification. Both the P-T reference value and the calculation method are correct.

35. C — In a cycling clutch orifice tube system, the cycling pressure switch is the primary freeze protection device. It disengages the compressor when the low-side pressure drops to a temperature-equivalent near 32°F, preventing ice formation on the evaporator. Bypassing this switch with a jumper wire allows the compressor to run continuously without any freeze protection — the evaporator can cool below 32°F, ice builds on the fins, eventually blocking airflow completely, and liquid refrigerant can flood into the compressor causing slugging damage.

36. A — A 13°F differential between supply (198°F) and return (185°F) hoses falls within the normal 10°F–30°F range, indicating adequate coolant flow through the heater core. A floor vent temperature of 130°F with 200°F engine coolant represents substantial heat delivery — normal heater cores produce outlet air 40°F–70°F below coolant temperature. The system is performing within its design parameters. Automotive heater output varies by vehicle design and there is no universal "minimum standard."

37. B — The 4-second delay occurs only when selecting defrost — all other mode transitions are instantaneous. This is not a programmed delay or electrical issue — it is simply a matter of mechanical travel distance. When the mode door must travel from its current position (panel or floor) to the defrost position at the opposite extreme of its travel range, the actuator motor takes longer to physically drive the door through the full distance. Closer mode transitions require less travel and appear instantaneous.

38. C — Milky white, cloudy oil is the definitive indicator of moisture contamination — water has emulsified with the PAG oil, creating the characteristic milky appearance. Over the period of the slow evaporator leak, atmospheric air and moisture continuously entered the system through the leak point. The system's desiccant eventually saturated, and the excess moisture contaminated the oil throughout the circuit. The system requires complete flushing, new drier, extended evacuation, and fresh oil.

39. A — Technician A correctly describes the proper vent temperature measurement technique: inserting the probe at least 3 inches into the center vent ensures the thermometer reads the actual conditioned air temperature from inside the duct, not air that has mixed with ambient cabin air at the vent opening. A surface measurement at the vent opening is influenced by the warm ambient cabin air surrounding the vent, producing a warmer and less accurate reading than the true system output.

40. D — The A/C pressure sensor's normal operating range is 0.5V–4.5V. A reading of 4.8V exceeds this range — the module recognizes the out-of-range signal as a circuit fault rather than a valid pressure reading. Because the module cannot determine actual system pressure from an invalid signal, it disables

the compressor as a protective measure to prevent operation under unknown and potentially unsafe pressure conditions. The sensor or its circuit must be repaired.

41. B — A squealing noise present only when the A/C is engaged that increases with RPM — with a new, properly tensioned belt — points to a pulley alignment issue. When the new compressor was installed, its clutch pulley may not align perfectly with the other pulleys in the serpentine drive system. Misalignment causes the belt to track at an angle across the compressor pulley, producing a squeal that is amplified under the load of A/C engagement. Checking and correcting pulley alignment resolves the noise.

42. C — The scan tool displays the in-car sensor reading as 58°F, but if the sensor is faulty, this reading does not represent what the module's control algorithm is actually using for its calculations. A malfunctioning NTC sensor with an intermittent fault may produce a signal that the module's raw processing interprets differently than the scan tool's displayed value. The module commanding full cold despite a cold cabin and warm set point indicates the temperature input it uses for blend calculation is corrupted, and the in-car sensor fault is the most likely source of the erroneous command.

43. A — Gauge pressures and vent temperature provide a good snapshot of system performance, but subcooling and superheat provide the deepest insight into charge accuracy and metering device function. Subcooling at the condenser outlet confirms whether the condenser is producing adequate fully condensed liquid (normal 10°F–20°F). Superheat at the evaporator outlet confirms whether the metering device is feeding the correct amount of refrigerant (normal 8°F–12°F for TXV). Together, these four measurements — pressures, vent temperature, subcooling, and superheat — provide a complete system health assessment.

44. D — Both technicians correctly describe the EPA's refrigerant purchase certification threshold. Technician A is right that any person purchasing R-134a in containers larger than 2 pounds must hold EPA Section 609 certification. Technician B is right that small retail cans containing less than 2 pounds (the common 12-ounce DIY cans sold at auto parts stores) are exempt from the certification requirement, allowing uncertified consumers to purchase them for personal vehicle use.

45. B — Three actuator replacements failing with the identical stripped-gear failure mode within 3–4 months each points to a chronic excessive mechanical load that destroys the gears. A binding or seized blend door pivot forces every replacement actuator to work against resistance far exceeding its gear design capacity. The motor generates enough torque to slowly strip the teeth over weeks of continuous effort against the bound door. Freeing or replacing the door pivot mechanism eliminates the excessive load and prevents future actuator gear failures.

46. C — With the A/C off, the engine runs at 200°F with the cooling fan at normal speed — the cooling system handles the engine's heat load without issue. When the A/C engages, the condenser — mounted in front of the radiator — adds its rejected heat to the air flowing through to the radiator. This additional heat load raises the engine temperature from 200°F to 215°F, which triggers the high-speed cooling fan. The high-speed fan provides enough additional airflow to manage the combined heat load and bring the temperature back down.

47. A — Subcooling is calculated by subtracting the actual measured condenser outlet temperature from the P-T chart saturation temperature at the measured high-side pressure: 122°F (saturation at 210 psi) minus 98°F (measured outlet) equals 24°F subcooling. This 24°F value is slightly above the normal 10°F–20°F range, which may indicate a mild overcharge — excess liquid refrigerant is backing up in the condenser and subcooling further below the condensation temperature than normal.

48. D — A low-side pressure of 22 psi with a high-side of 250 psi creates an extreme pressure differential across the system. The cold suction line at the evaporator outlet (confirming some refrigerant reaches the evaporator) transitioning to a warm suction line near the compressor could suggest heat absorption, but the extreme pressure spread is the key finding. The very low low-side and very high high-side indicate a restriction in the liquid line or metering device that traps refrigerant on the high side while starving the low side.

49. B — Technician A correctly states that dry nitrogen with a pressure regulator should always be used for A/C leak testing. Technician B is dangerously incorrect — oxygen or compressed air must NEVER be introduced into an A/C system. Refrigerant oil is flammable, and mixing oxygen or compressed air with oil under pressure creates a potentially explosive mixture. If any ignition source is present (electrical arc, hot surface), the mixture can detonate. Nitrogen is inert and creates no combustion risk.

50. C — A chemical smell from the vents during the first 2 minutes of A/C operation — on a system that was recently flushed — is most commonly caused by residual flushing solvent that was not fully purged from the system with dry nitrogen before reassembly and charging. The trapped solvent slowly evaporates from internal surfaces where it has pooled, and the initial burst of blower airflow carries the concentrated vapor into the cabin. The smell diminishes as the solvent disperses, but the underlying contamination should be addressed.