

PRACTICE EXAM 9: RED SEAL AUTOMOTIVE SERVICE TECHNICIAN SIMULATION (125 QUESTIONS)

1. A shop receives a bulk delivery of engine oil in 205-liter (45-gallon) drums. A technician needs to move a full drum from the storage area to the service bay. What is the safest method?

- A. Roll the drum on its bottom edge by tilting it and walking it across the shop floor to the service bay, maintaining full control of the drum's direction at all times
- B. Two technicians can carry the drum between them using the drum's rim handles, with one technician at each end to share the approximately 180 kg load equally
- C. Use a forklift to transport the drum only if the drum is placed inside a spill containment pallet, since the forklift tines cannot safely grip the round drum surface
- D. Use a drum dolly, hand truck, or drum cart specifically designed for moving full drums, which provides stable support and controlled mobility for the heavy load

2. A technician is working on a vehicle's electrical system and needs to disconnect the battery. What is the correct sequence for disconnecting and the reason for that sequence?

- A. Disconnect the negative cable first to eliminate the ground path, preventing accidental short circuits if the positive terminal or wrench contacts any grounded metal surface
- B. Disconnect the positive cable first to eliminate the voltage source, preventing current flow through any circuit while the ground path through the negative cable remains intact
- C. Either cable can be disconnected first since the circuit is interrupted as soon as one cable is removed, and the sequence does not affect the risk of short circuits during service
- D. Disconnect both cables simultaneously using two wrenches operated by two technicians, ensuring the circuit is interrupted at both terminals at the same instant for maximum safety

3. A shop's ventilation system has failed during business hours. Vehicles are being serviced in the enclosed shop. What immediate action is required regarding running engines?

A. Continue normal operations but open the overhead doors halfway to provide natural ventilation while the mechanical ventilation system is being repaired during the business day

B. Engines can continue running if each vehicle has its exhaust extraction hose connected, since the extraction system operates independently of the shop's general ventilation system

C. No engines should be started or run inside the shop until the ventilation system is repaired or adequate alternative ventilation is established to prevent toxic gas accumulation

D. Only diesel engines should be restricted from running inside the shop, since gasoline engines produce significantly less carbon monoxide and are safe in an unventilated enclosed space

4. A technician observes a co-worker using a box-end wrench with a cheater bar (pipe extension) to increase leverage on a stubborn bolt. What is the safety concern?

A. The cheater bar reduces the wrench's grip on the bolt head, increasing the likelihood that the wrench will slip off and the technician's knuckles will strike the surrounding components

B. The additional leverage from the cheater bar can exceed the wrench's rated capacity, potentially causing the wrench to fracture or the bolt to shear suddenly, resulting in injury

C. The cheater bar changes the wrench's leverage angle from perpendicular to angled, reducing the wrench's mechanical advantage and requiring even more force to break the bolt free

D. The cheater bar is only unsafe when used on metric wrenches, since SAE wrenches are manufactured from a stronger alloy that is rated for the additional stress of cheater bar leverage

5. A vehicle in the shop has a cracked windshield. During a repair involving welding near the dashboard, sparks land on the cracked windshield. What is the specific hazard?

A. The sparks will melt the windshield's PVB laminate layer, releasing toxic fumes that the technician will inhale while working in close proximity to the dashboard weld area

B. The heat from the sparks will cause the tinted window film to shrink and peel from the glass surface, requiring complete removal and reapplication of the tinting material

C. The sparks will etch permanent burn marks into the glass surface that cannot be polished out, requiring windshield replacement even if the cracks were previously considered repairable

D. The sparks can cause the existing cracks to propagate rapidly across the glass from thermal shock, potentially causing the windshield to shatter or requiring replacement of repairable glass

6. What is the minimum PPE required when handling concentrated battery acid (sulfuric acid) during battery service?

A. Standard safety glasses and nitrile shop gloves provide adequate protection for all battery acid handling operations during normal automotive battery service procedures

B. Only chemical splash goggles are required, since the technician's shop uniform provides adequate skin protection against incidental acid splashes during battery handling operations

C. Chemical splash goggles, acid-resistant gloves, and a face shield are required to protect the eyes, hands, and face from acid splashes, mist, and fumes during handling operations

D. A full-body chemical protection suit with self-contained breathing apparatus is required for any battery acid handling, regardless of the quantity or concentration being transferred

7. A customer's vehicle has an aftermarket trailer wiring harness installed. During a safety inspection, the technician notices the harness uses scotch-lock connectors tapped into the vehicle's CAN bus wiring. What is the concern?

A. Scotch-lock connectors on CAN bus wires can damage the wire insulation, alter the circuit impedance, and introduce signal noise that causes intermittent communication faults across the entire network

B. Scotch-lock connectors are approved only for trailer lighting circuits and using them on CAN bus wiring voids the trailer wiring warranty but does not affect the vehicle's electronic systems

C. Scotch-lock connectors on any vehicle wiring are an approved industry practice as long as the connectors are the correct gauge size for the wire being tapped and are properly crimped during installation

D. Scotch-lock connectors on CAN bus wiring only affect the modules directly connected to the tapped circuit and cannot influence other modules on the same CAN bus network segment

8. A technician is using a scan tool that is plugged into the OBD II DLC while performing a road test. The scan tool falls from the seat and lands on the floor, pulling the DLC connector at an angle. What potential damage should be inspected?

A. The scan tool's internal battery may have been dislodged during the impact, causing the tool to lose its stored diagnostic data and vehicle communication history from the current session

B. The OBD II DLC pins may have been bent or the connector housing may have cracked from the angular force, which could prevent future scan tool connections or damage the CAN bus circuit

C. The vehicle's ECM may have been damaged by the electrical surge created when the scan tool's connection was momentarily interrupted during the fall from the seat to the floor

D. The scan tool's software may have been corrupted by the impact and requires a factory reset before it can communicate reliably with any vehicle's OBD II system during future diagnostic sessions

9. A shop stores flammable liquids in a dedicated flammable storage cabinet. The cabinet's self-closing doors have been propped open with a wooden wedge for convenience. What is the violation?

A. Propping the doors open reduces the cabinet's fire resistance rating by half, but the remaining resistance is still adequate for the volumes of flammable liquids typically stored in an automotive shop

B. Propping the doors open is acceptable during business hours when the shop is occupied, as long as the doors are closed and latched at the end of each business day before the shop is vacated

C. Propping the doors open is only a violation if the cabinet contains more than 20 liters of flammable liquid, since smaller volumes do not generate sufficient vapor to create an ignition hazard

D. The self-closing doors are a critical safety feature that contains fire and vapor in an emergency — propping them open defeats the cabinet's fire protection function and violates fire safety regulations

10. A technician is diagnosing an engine with a consistent misfire on cylinder 1. The coil, plug, and injector have been swapped to other cylinders without the misfire following. Compression is 150 psi on

all four cylinders. What fault could cause a misfire on cylinder 1 with normal compression and proven-good ignition and fuel components?

A. An intake manifold runner flap stuck partially closed on the cylinder 1 runner, restricting airflow into that cylinder enough to cause incomplete combustion and a detectable misfire at idle and light load

B. A faulty upstream oxygen sensor that sends incorrect data to the ECM, causing it to miscalculate the fuel delivery specifically for cylinder 1 while the other cylinders receive correct fuel amounts

C. A worn camshaft lobe on cylinder 1's intake cam that has lost enough lift to reduce the intake charge, but not enough to show as low compression on the relatively insensitive static compression test

D. A clogged catalytic converter that creates backpressure affecting only cylinder 1 because its exhaust port is closest to the converter inlet, while the other cylinders vent through ports further from the restriction

11. A V8 engine has a ticking noise from the valve train area that appears at 3,000 RPM and above but is absent at idle and low RPM. Oil pressure is normal at all speeds. What is the most likely cause?

A. Hydraulic lash adjusters that are bleeding down at high RPM because the oil supply volume to the lifter gallery is insufficient to maintain all sixteen lifters at the faster pump-up rate required at high speed

B. Valve springs with insufficient tension that allows the valves to float at high RPM, creating the ticking sound as the cam follower briefly loses contact with the cam lobe during each valve event

C. A collapsed lifter on one cylinder that produces a constant tick at all RPM but is only audible at higher RPM when the engine noise drops below the ticking frequency and the sound becomes distinguishable

D. Worn rocker arm pivot balls that develop enough clearance at high RPM to allow the rocker to shift position on each valve event, producing the ticking as the rocker snaps between its contact points

12. A vehicle has been sitting unused for eight months. Upon startup, the engine runs rough with white smoke from the exhaust. After 10 minutes of idling, the rough running and smoke clear completely. What caused the initial symptoms?

- A. The fuel injectors developed deposits during the extended storage that temporarily blocked their spray patterns, and the deposits were dissolved by the fuel flow once the engine ran for several minutes
- B. Moisture condensation accumulated in the exhaust system and combustion chambers during the long storage period, and the engine burned off this moisture during the initial warmup running period
- C. The engine oil drained from the valve stems during storage, temporarily allowing oil to seep past the dry seals into the combustion chambers, burning off as blue-white smoke during the first minutes of operation
- D. The catalytic converter cooled below its light-off temperature during storage and required 10 minutes of engine operation to reach the activation temperature needed to process the exhaust gases cleanly

13. A diesel engine has excessive black smoke under all operating conditions — idle, acceleration, and cruise. The air filter has been replaced and the turbocharger boost is within specification. What should be investigated next?

- A. The exhaust gas recirculation system for a stuck-open valve that is recirculating too much inert exhaust into the intake, diluting the oxygen available for combustion at all operating conditions
- B. The diesel particulate filter for excessive soot loading that is creating backpressure and reducing the engine's ability to expel exhaust gases efficiently across the entire operating range
- C. The fuel return system for a restriction that is increasing rail pressure above the specified maximum, causing all injectors to deliver more fuel than commanded at every operating condition
- D. The fuel injectors for excessive fuel delivery — worn nozzle seats, incorrect opening pressure, or damaged tips that dribble fuel — since over-fueling at all conditions produces the constant black smoke

14. An engine has a P0171 (System Too Lean Bank 1) code. The LTFT on bank 1 is +22%. The technician performs a propane enrichment test — when propane is introduced at the intake, the RPM increases and the STFT drops toward zero. What does this confirm?

- A. The engine is genuinely lean on bank 1 and the propane provided the additional fuel needed to bring the mixture to stoichiometric, confirming a real fuel deficit or unmetered air entry on that bank
- B. The upstream oxygen sensor on bank 1 is faulty and responding to the propane rather than the actual exhaust composition, proving the sensor is the cause of the false lean indication to the ECM

C. The catalytic converter on bank 1 is storing excess oxygen that is being detected by the downstream sensor and fed back to the upstream fuel trim calculation, creating the lean code artificially

D. The propane enrichment caused a temporary rich condition that would have occurred regardless of the original lean condition, proving the test is inconclusive and additional diagnostics are needed

15. A GDI engine at 120,000 km has an intake valve cleaning service performed. Within 5,000 km, the misfire codes return and a borescope inspection shows carbon has reaccumulated on the intake valves. What is the underlying cause of the rapid reaccumulation?

A. The engine's compression ratio is higher than the factory specification from carbon buildup in the combustion chambers, producing more blowby gas volume that overwhelms the PCV system capacity

B. The PCV system is circulating excessive crankcase vapors past the intake valves, and until the source of the excessive vapor production is addressed, the carbon will continue to accumulate rapidly

C. The intake valve cleaning service used an incorrect chemical agent that left a residue on the valve surfaces, and this residue acts as an adhesion promoter that accelerates carbon accumulation

D. The fuel injector spray pattern has shifted from high-pressure operation over 120,000 km, and the altered spray is impinging on the piston crown and creating more carbon precursors in the exhaust

16. An engine has a random misfire code (P0300) that occurs only during the first 60 seconds after a cold start on mornings when the ambient temperature is below -15°C . The misfire clears completely after warmup. What is the most likely cause?

A. The mass airflow sensor reads inaccurately at extremely cold ambient temperatures because the cold air density exceeds the sensor's calibration range, causing fuel calculation errors during cold start

B. The engine oil is too viscous at -15°C , creating excessive cranking resistance that reduces the cranking speed below the minimum needed for consistent ignition during the first minute of operation

C. The fuel injectors' spray patterns are degraded by the cold temperature, producing poor atomization that creates inconsistent combustion across all cylinders until the intake manifold warms sufficiently

D. The spark plugs have worn electrodes that fire adequately at normal temperatures but cannot overcome the increased resistance of the denser cold air charge in the combustion chambers at -15°C

17. A vehicle's engine has a consistent P0442 code (EVAP System Small Leak Detected) that has been present for three months. The fuel cap, EVAP purge valve, and canister vent valve have all been replaced. A smoke test shows no visible smoke escaping from any EVAP component. What should the technician try next?

A. Replace the charcoal canister, since internal canister cracks are a known source of small leaks that are too minor to produce visible smoke during a standard smoke test pressure and duration

B. Increase the smoke machine pressure above the standard test specification to force smoke through the small leak that is too tight to detect at normal test pressure, making it visible for identification

C. Inspect the fuel tank itself for rust pinholes, seam cracks, or a faulty fuel tank pressure sensor, since the tank is the largest component and the most likely source of a leak not found elsewhere

D. The EVAP system integrity monitor uses a more sensitive test than the smoke machine — run the onboard monitor using the scan tool and monitor the system pressure decay rate for a more precise leak measurement

18. A common rail diesel engine has a DTC for fuel rail pressure below commanded value during cranking. The engine starts after extended cranking. Once running, fuel pressure meets specification at all RPM and loads. What is the most likely cause?

A. The high-pressure fuel pump's internal check valve is leaking, allowing rail pressure to bleed down during key-off periods and requiring extended cranking to rebuild the pressure from zero before the engine fires

B. The fuel filter has a partial restriction that limits fuel flow during the high-demand cranking period but provides adequate flow once the engine is running at idle and the pump can maintain a steady supply

C. The crankshaft position sensor signal is erratic at the slow cranking RPM and stabilizes once the engine fires, causing the ECM to miscalculate injection timing during cranking but not during running

D. The glow plug control module is activating the glow plugs late, requiring additional cranking time for the combustion chambers to reach adequate temperature for diesel autoignition in the cold cylinders

19. A turbocharged engine has a whistle or high-pitched whine from the intake area that increases with boost pressure. No DTCs are stored and boost pressure meets specification. What is the most likely cause?

- A. The turbocharger compressor wheel has minor blade damage that creates turbulent airflow at higher boost pressures, producing the whistle as air passes the damaged blade at high velocity
- B. The intercooler has a small internal leak that only becomes audible when the intercooler is pressurized above a certain boost level, with the pressurized air escaping through the leak as a whistle
- C. A small boost leak at a charge pipe connection, intercooler hose clamp, or throttle body gasket is allowing pressurized air to escape, producing the whistle that increases with boost pressure
- D. The wastegate actuator diaphragm has a pinhole that creates a whistling sound as boost pressure acts on the diaphragm, but the hole is too small to affect the actuator's ability to control boost

20. An engine has a P0016 code (Crankshaft Position — Camshaft Position Correlation Bank 1 Sensor A). The engine runs but has reduced power. The technician inspects the timing chain and finds it has 12 mm of deflection on the slack side. The specification is a maximum of 6 mm. What does the excessive chain slack confirm?

- A. The chain tensioner has reached its maximum extension and can no longer take up the chain slack, but the chain itself has not stretched and can be reused with a new tensioner and guide set
- B. The timing chain has stretched beyond the tensioner's compensation range, allowing the camshaft to retard from its designed position relative to the crankshaft and triggering the correlation code
- C. The crankshaft position sensor is detecting the chain slack as a crankshaft speed variation that it reports as a correlation error, but the actual cam-to-crank timing is still within the acceptable window
- D. The camshaft position sensor is reading inaccurately because the chain's excessive slack is vibrating the sensor trigger wheel, generating a noisy signal that the ECM interprets as a timing deviation

21. A vehicle has a P0401 (EGR Insufficient Flow) code. The EGR valve opens when commanded and the passages are clear. The DPFE sensor reads 0.5V at both idle and 2,500 RPM when the EGR is commanded open. What does the unchanged DPFE sensor reading indicate?

- A. The EGR valve is opening but no exhaust gas is flowing through the passage, likely because the exhaust backpressure is too low from an exhaust leak upstream of the EGR takeoff point
- B. The engine is running too lean for the EGR system to function because there is not enough fuel being burned to produce adequate exhaust volume for the EGR circuit to detect a pressure differential

C. The DPFE sensor is correctly reading zero flow because the catalytic converter has completely plugged the exhaust, preventing any exhaust pressure from reaching the EGR system pickup port

D. The DPFE sensor itself or its pressure sampling hoses are faulty — either the sensor has failed at a fixed voltage or the hoses are clogged, disconnected, or switched, preventing it from detecting the pressure change when EGR flows

22. A vehicle's engine oil is changed at the manufacturer's recommended interval but the oil analysis consistently shows elevated fuel dilution. The engine has no misfire codes and runs normally. What is the most likely cause of the chronic fuel dilution?

A. Short-trip driving patterns where the engine never reaches full operating temperature for an extended period, preventing the oil temperature from rising enough to evaporate the accumulated fuel from the crankcase

B. The oil filter is not removing fuel molecules from the oil because its micron rating is too coarse for the fuel particle size, and a finer-filtration aftermarket filter would reduce the fuel dilution readings

C. The engine's fuel injectors are all leaking a small amount of fuel past their pintle seats during the key-off period, and the accumulated fuel drains into the crankcase through the cylinder walls each shutdown

D. The engine oil specification is too light for the engine's operating temperature range, and the thin oil is absorbing fuel vapors from the crankcase ventilation system more readily than a heavier viscosity would

23. A four-cylinder engine has compression readings of 145, 150, 148, and 75 psi. A wet test on cylinder 4 raises the reading to 135 psi. A leak-down test on cylinder 4 shows 45% leakage with air audible at the oil fill cap. What is the definitive diagnosis?

A. A burned exhaust valve on cylinder 4, since the air escaping from the oil fill cap indicates the leakage path is past the piston rings into the crankcase ventilation system through the valve train area

B. The cylinder 4 piston rings are the failure, confirmed by three consistent findings: low dry compression, significant improvement with the wet test, and air escaping into the crankcase during leak-down

C. A head gasket failure between cylinder 4 and the oil gallery, since the air at the oil fill cap could travel from the combustion chamber through the breached gasket into the oil passages and up to the cap

D. The cylinder 4 piston has a crack through the ring land area, since the wet test improvement confirms the ring area as the leak path and the cracked piston prevents the rings from sealing properly

24. An engine's oil pressure warning light flickers at hot idle but the light turns off immediately when RPM is raised above 1,000. The oil level is correct and the oil is clean. What is the most likely cause?

A. The oil pressure sender unit is faulty and produces an erratic signal at the low pressure of hot idle that stabilizes when the pressure increases at higher RPM, even though the actual pressure is normal

B. The oil pump pickup screen is partially restricted with sludge, limiting the pump's suction volume at idle, but the pump compensates at higher RPM by generating enough suction to pull through the restriction

C. The oil pressure relief valve spring has weakened and is allowing the valve to open at a lower pressure than specified, reducing the effective pressure at hot idle where pump output is at its minimum

D. Worn engine bearings with excessive clearance allow oil to leak from the bearing journals faster than the pump can supply at idle output, but the increased pump output at higher RPM overcomes the leak rate

25. A V6 engine has a P0305 misfire code that occurs only during deceleration (throttle closed, high manifold vacuum). The misfire is absent at idle, cruise, and acceleration. What is the most likely cause?

A. An intake valve on cylinder 5 that does not seal completely under the high vacuum conditions of deceleration, allowing the vacuum to pull air and oil past the valve seal and disrupt combustion

B. A fuel injector on cylinder 5 that drips fuel during the deceleration fuel-cut period, flooding that cylinder and causing a misfire when fueling resumes at the return-to-idle transition point

C. An ignition coil on cylinder 5 that fires correctly under the lower cylinder pressures of idle and cruise but fails under the brief pressure spikes that occur during deceleration backfire events

D. A crankshaft position sensor reluctor wheel with a damaged tooth at cylinder 5's position that produces a signal glitch interpreted as a misfire, but only at the specific deceleration RPM range

26. A diesel engine equipped with a selective catalytic reduction (SCR) system has a NO_x efficiency below threshold DTC. The DEF fluid quality and level have been verified as correct. What should be investigated?

- A. The EGR system for a stuck-open valve that is recirculating excessive exhaust and reducing combustion temperature below the minimum needed for the SCR catalyst to reach its operating efficiency range
- B. The DPF for excessive soot loading that is creating backpressure and preventing adequate exhaust flow through the SCR catalyst, reducing its conversion efficiency below the monitored threshold level
- C. The engine coolant temperature sensor for a reading error that causes the ECM to calculate incorrect exhaust temperature values and miscommand the DEF injection dosing rate for the actual conditions
- D. The DEF injector for a clogged nozzle or failed heater element, the SCR catalyst for degradation, or the NO_x sensors for calibration drift — since any component in the aftertreatment chain could cause the efficiency code

27. A vehicle's engine has an intermittent surge at steady cruise — the RPM fluctuates ± 100 RPM cyclically every 3-4 seconds. Fuel trims are within $\pm 5\%$ and no DTCs are stored. What is the most likely cause?

- A. The oxygen sensor is switching between rich and lean too slowly, causing the ECM to overcorrect in each direction as the closed-loop fuel control hunts for the stoichiometric balance point at cruise
- B. The EVAP purge valve is opening and closing cyclically as the ECM modulates the purge rate, and the fuel vapor entering the intake is rich enough to cause a measurable RPM fluctuation with each purge cycle
- C. The EGR valve position is oscillating from a sticky actuator or faulty position sensor, and the varying exhaust gas dilution causes the cyclical RPM fluctuation as the engine's effective displacement changes
- D. The throttle position sensor has electrical noise in its signal at the specific voltage corresponding to the cruise throttle opening, causing the ECM to modulate the electronic throttle position cyclically

28. An engine coolant temperature sensor has been replaced, but the new sensor reads 15°C when the ambient temperature is 25°C and the engine is cold. What effect does this -10°C offset have on engine operation?

A. The ECM will command slightly leaner fueling than optimal at cold start because it perceives the engine as warmer than actual, reducing the cold-start enrichment duration and potentially causing hesitation

B. The -10°C offset is within the normal manufacturing tolerance for automotive ECT sensors and will not produce any detectable effect on engine operation or emissions at any operating temperature

C. The ECM will command slightly richer fueling and extended cold-start enrichment because it perceives the engine as colder than actual, increasing fuel consumption and emissions during warmup

D. The -10°C offset only affects the dashboard temperature gauge display and does not influence the ECM's fuel or ignition calculations since the ECM uses the MAP sensor for primary load calculation

29. A vehicle's oxygen sensor heater circuit has a DTC (P0031 — HO₂S Heater Circuit Low Voltage Bank 1 Sensor 1). The sensor has been replaced but the code returns. What should be checked next?

A. The wiring harness and connector for the heater circuit between the ECM and the sensor, since a damaged wire, corroded connector, or open circuit prevents voltage from reaching the heater element

B. The catalytic converter temperature, since an overheated converter can backfeed heat into the sensor housing and trigger the heater circuit code by overloading the heater's thermal management circuit

C. The ECM's internal heater driver circuit, since the ECM provides the ground path for the heater element, and a faulty driver transistor cannot supply the ground current needed for the heater to operate

D. The upstream oxygen sensor on bank 2, since some vehicles share a common heater control circuit between the bank 1 and bank 2 upstream sensors, and a fault on bank 2 can affect bank 1's heater

30. A turbocharged diesel engine has an intermittent loss of power that occurs unpredictably during driving. When the power loss occurs, boost pressure drops to near zero. Shutting the engine off and restarting immediately restores normal power. What is the most likely cause?

A. The turbocharger's oil supply line has an intermittent restriction that causes the turbo bearings to momentarily seize, stopping the turbine until the oil flow resumes after the restart clears the restriction

B. The wastegate actuator vacuum line has an intermittent leak that causes the wastegate to open fully during certain operating conditions, bypassing all exhaust around the turbine and eliminating boost

C. The ECM has an intermittent processing fault that drops the boost control command, causing the turbo to default to a zero-boost condition until the ECM is reset by the ignition off-on cycle

D. The variable-geometry turbocharger vanes are intermittently sticking from carbon buildup and defaulting to the fully open (no boost) position, with the restart cycling the actuator through its range and freeing the vanes

31. An engine has a consistent misfire at cold idle that smooths out after 30 seconds. During the misfire period, the scan tool shows short-term fuel trim oscillating between +35% and -10%. What does this severe fuel trim swing indicate?

A. The oxygen sensor is heating up during the first 30 seconds and the ECM's open-loop to closed-loop transition creates the fuel trim oscillation until the sensor reaches its operating temperature and stabilizes

B. A severe air-fuel ratio imbalance during cold idle that the ECM is struggling to correct — the large positive corrections indicate lean compensation while the brief negative swings represent momentary overcorrection

C. The ECM's closed-loop control algorithm has a software fault that causes excessive fuel trim oscillation during cold start until the coolant temperature reaches the threshold where the algorithm switches to its normal gain setting

D. The fuel pressure regulator is not reaching stable operating pressure during the first 30 seconds after startup, and the pressure fluctuations cause the ECM to chase the changing fuel delivery with corresponding fuel trim corrections

32. A vehicle's scan tool can communicate with the ECM but receives "Communication Error" when attempting to access the TCM. All other modules communicate normally. The ECM has no U-codes for the TCM. What does the absence of a U-code in the ECM suggest?

A. The TCM is communicating normally on the bus (which is why the ECM has no U-code), but the scan tool lacks the correct software protocol to access the TCM's diagnostic functions on this vehicle

B. The ECM has a faulty DTC storage circuit that is unable to record U-codes even when modules are missing from the bus, so the absence of U-codes is not diagnostically meaningful

C. The TCM is still communicating its data on the CAN bus (which is why the ECM receives TCM data and stores no U-code), but the TCM's diagnostic service function has a fault that prevents it from responding to scan tool requests

D. The CAN bus has a physical break between the scan tool's DLC connection and the TCM, but the ECM and TCM are on the same side of the break and can communicate with each other while isolated from the DLC

33. A vehicle's key fob will not program to the vehicle using the standard customer key programming procedure. The procedure requires cycling the ignition and pressing the fob button within a specific time window. What is the most common reason the procedure fails?

A. The programming procedure requires exact timing and sequence, and the most common failure is the operator not completing the steps within the specified time window or performing them in the incorrect order

B. The key fob's battery is too weak to transmit the programming signal at the higher power level required during the initial programming handshake, even though it has sufficient power for normal lock-unlock operation

C. The vehicle's immobilizer module has reached its maximum programmed key limit and cannot accept an additional fob until one of the existing programmed keys is removed from the system's memory

D. The ambient temperature is too cold for the key fob's radio frequency transmitter to operate at the correct frequency, causing the programming signal to be shifted outside the receiver's acceptance bandwidth

34. A vehicle has a DTC for "CAN Bus Communication Fault — Bus Off" stored in the ECM. The ECM went into a temporary bus-off state but has since recovered. What does the "bus off" condition indicate?

A. The ECM detected excessive errors on the CAN bus — either from a faulty transceiver, bus noise, or signal corruption — and temporarily disconnected itself from the bus to protect the network from its own erroneous transmissions

B. The ECM's internal clock drifted out of synchronization with the other modules during a specific operating condition, and the ECM removed itself from the bus until the clock was recalibrated automatically

C. The ignition switch sent a shutdown command to the ECM that was misinterpreted as a bus-off command due to a software error, temporarily removing the ECM from the network before the error self-corrected

D. Another module on the CAN bus transmitted a priority message that forced all lower-priority modules including the ECM to go silent, and the ECM interpreted this as a bus-off condition and stored the DTC

35. A vehicle with a factory-installed remote start system has a new concern — the remote start activates the engine but the engine shuts off after 2 seconds. The remote start worked correctly until last week. What is the most likely cause?

A. The key fob battery has weakened to the point where it can transmit the initial start command but cannot maintain the continuous confirmation signal required to keep the engine running during remote start

B. The remote start module detects a vehicle condition that triggers an immediate safety shutdown — such as a check engine light, low oil pressure, hood ajar signal, or vehicle-in-gear indication

C. The factory remote start system has a software timer that limits each remote start session to 2 seconds until the system is reset by the dealer using the manufacturer's programming tool

D. The engine's idle speed drops below the remote start module's minimum RPM threshold within 2 seconds of starting, and the module interprets the low RPM as an engine stall condition and shuts down

36. A vehicle's instrument cluster displays erratic speedometer readings — the speed jumps between zero and 180 km/h randomly while driving at a steady 80 km/h. All other cluster functions are correct. What is the most likely cause?

A. The instrument cluster has a faulty stepper motor for the speedometer needle that is receiving the correct speed data from the CAN bus but cannot position the needle accurately due to internal motor failure

B. The speedometer calibration data in the instrument cluster has been corrupted by a voltage spike, causing the cluster to misinterpret the correct speed data from the CAN bus and display random values

C. The vehicle speed signal on the CAN bus is corrupted by an intermittent fault at the ABS module (which generates the speed data from wheel speed sensors), causing erratic data to be displayed by the cluster

D. The tire size has been changed to a significantly different rolling circumference, and the ABS module is calculating an incorrect speed from the wheel speed sensor pulse rate that does not match the tire calibration

37. What diagnostic information can be obtained by monitoring the CAN bus with a dual-channel oscilloscope that cannot be obtained with a scan tool alone?

A. The exact DTC numbers stored in each module on the network, since the oscilloscope can decode the CAN bus data frames directly without requiring the scan tool's protocol translation software

B. The physical layer quality of the CAN bus signal — voltage levels, rise times, signal symmetry between CAN-H and CAN-L, noise, reflections, and intermittent signal disruptions that a scan tool cannot detect

C. The module software version numbers, since the oscilloscope can read the module identification data directly from the CAN bus data stream without the scan tool's menu navigation requirements

D. The order in which modules were installed on the vehicle during manufacturing, since each module transmits a timestamp in its CAN bus header that identifies its factory installation sequence number

38. A vehicle's BCM has a DTC for "Low Battery Voltage Detected." The battery and charging system test good. The vehicle has an aftermarket dashcam hardwired to the battery that runs 24/7. What is the relationship between the dashcam and the BCM code?

A. The dashcam is generating electromagnetic interference that is being detected by the BCM's voltage monitoring circuit as voltage fluctuations, triggering the low voltage code despite actual voltage being normal

B. The dashcam's 24/7 operation is drawing current from the battery continuously, and the cumulative parasitic draw from the dashcam plus normal vehicle modules drops the voltage below the BCM's threshold during sleep

C. The dashcam's power supply circuit has a voltage regulation fault that feeds back a low-voltage signal onto the vehicle's 12V bus, causing the BCM to read the dashcam's regulated voltage instead of the battery voltage

D. The BCM code is unrelated to the dashcam and is caused by a normal voltage dip during engine cranking that the BCM recorded, since all vehicles experience a brief low-voltage event during every start cycle

39. A vehicle's TPMS system uses indirect monitoring (no physical sensors in the wheels). After a tire rotation, the TPMS light illuminates. What must be performed to resolve the light?

A. Each tire must be inflated to a specific reset pressure (typically 3 psi above the placard recommendation) to trigger the indirect system's re-baseline calibration, then reduced to normal pressure after the reset

B. The vehicle must be driven at highway speed for exactly 30 minutes without stopping to allow the ABS module to recalibrate the wheel speed comparison algorithm for the rotated tire positions on the vehicle

C. The TPMS reset procedure must be performed (typically through the vehicle's menu or a reset button) to re-baseline the system, since indirect TPMS uses wheel speed comparisons that change when tires are rotated

D. No action is required — indirect TPMS systems automatically recalibrate within 24 hours of driving and the light will turn off on its own without any technician intervention or reset procedure being needed

40. A scan tool is connected to a vehicle and the technician selects "Module Identification." The scan tool lists 35 modules but the repair information indicates the vehicle should have 37 modules. What is the significance of the two missing modules?

A. The two missing modules are on a LIN sub-bus that the scan tool cannot access through the OBD II DLC, and a dedicated LIN bus adapter is required to communicate with those specific sub-bus modules

B. Two modules are either unpowered (blown fuse, no ground), disconnected from the CAN bus (damaged spur wiring, unplugged connector), or have failed internally and cannot respond to the scan tool's identification request

C. The vehicle was built without those two optional modules because the customer did not order the associated features, and the repair information lists all possible modules for the model regardless of installed options

D. The scan tool software is outdated and does not include the communication protocol for those two modules, which were added in a mid-year production change after the scan tool software was released

41. A vehicle's adaptive cruise control loses its set speed and disengages when driving over a large bridge expansion joint. The system re-engages immediately after passing the joint with no DTCs stored. What caused the momentary disengagement?

A. The expansion joint creates a brief radio frequency interference burst that disrupts the radar sensor's signal processing, causing the ACC module to temporarily lose its forward target tracking

B. The vehicle's suspension movement over the expansion joint momentarily changes the radar sensor's aim angle beyond its operating tolerance, causing the system to lose its tracking reference point

C. The steering angle sensor registers a sudden input from the steering correction needed to maintain lane position over the joint, and the ACC interprets this as an intentional steering maneuver that cancels cruise

D. The vibration from crossing the expansion joint causes a brief wheel speed sensor signal disruption that the ACC module interprets as an abrupt speed change, triggering a protective disengagement

42. A technician needs to perform a module software update on a vehicle with stop-start technology. The battery support tool is connected. Why is battery support especially critical during programming on stop-start equipped vehicles?

A. Stop-start vehicles use an AGM or EFB battery with a narrower acceptable voltage range during programming, and a voltage drop below 12.4V during the flash will permanently brick the module being updated

B. The stop-start system's battery management module will detect the sustained current draw of the programming session and command the engine to start automatically to charge the battery, corrupting the programming

C. Stop-start vehicles have higher parasitic draw from their more complex module network, and the battery support tool compensates for the draw that the non-running engine's charging system cannot provide during programming

D. Stop-start vehicles' battery management systems may interpret the sustained discharge during programming as a battery fault and enter a protective mode that reduces available voltage below the programming threshold

43. A vehicle has an intermittent "Service Park Assist" warning. The parking sensors work correctly during testing. The warning appears only when the ambient temperature drops below 0°C. What is the most likely cause?

A. The parking sensor membranes contract in cold temperatures, changing the sensor's ultrasonic frequency output to a range that the control module cannot process correctly for distance calculation

B. The parking sensor wiring harness has a marginal connection that contracts and loses contact at cold temperatures, temporarily interrupting the signal between the sensor and the control module

C. The parking assist module's internal crystal oscillator shifts frequency in extreme cold, causing the module to mistime the ultrasonic pulse return and generate a self-diagnostic fault from the timing error

D. Ice or condensation forms on one or more parking sensor faces at cold temperatures, blocking the ultrasonic signal and triggering the service warning until the ice melts from engine heat during driving

44. A front-wheel-drive vehicle has a vibration that occurs at exactly 40 km/h and exactly 80 km/h but is absent at all other speeds. The vibration is felt through the floor and seat. What does this double-frequency pattern suggest?

A. The transmission has a faulty output shaft bearing that resonates at a harmonic frequency corresponding to both 40 and 80 km/h due to the bearing's specific defect geometry and roller count

B. A half-shaft has a balance issue at a specific rotational speed, and the two vibration speeds correspond to the first and second harmonic of that rotational frequency as the shaft speed doubles

C. The engine has a misfire that is RPM-dependent rather than speed-dependent, and the two speeds happen to correspond to the RPM points where the misfire produces its strongest vibration in two different gears

D. The torque converter has an internal balance issue that produces vibration at a specific turbine speed, and the two vehicle speeds correspond to the same turbine speed achieved in two different gear ratios

45. A rear-wheel-drive vehicle has a vibration at highway speed that is present only under power (acceleration and cruise) and disappears completely on deceleration (coast). What component is the most likely source?

A. A worn transmission output shaft bearing that produces vibration only when the output shaft is loaded by the engine's torque and becomes silent when the load reverses during coast deceleration

B. An unbalanced drive shaft that produces vibration at all times when rotating at highway speed regardless of whether the vehicle is under power or coasting, since the shaft always rotates at the same speed

C. A worn rear axle bearing that produces vibration proportional to wheel speed regardless of the load direction, since the bearing supports the axle shaft weight and rotational loads in both drive and coast

D. A worn U-joint with a tight bearing cap that binds when the joint is loaded under drive torque but frees when the load reverses on deceleration, producing vibration only under the power loading condition

46. A vehicle's automatic transmission has a firm, consistent shift quality in all gears — the shifts are not harsh but are noticeably firmer than normal. No DTCs are stored. The ATF level and condition are correct. What is the most likely cause?

A. The transmission line pressure is above the normal calibration due to a sticking pressure control solenoid, a stuck regulator valve, or an incorrect adaptive pressure correction, causing all shifts to feel firmer than designed

B. The torque converter clutch is partially engaging during every shift, adding a mechanical coupling component to the normally hydraulic-cushioned shift feel across all gear transitions simultaneously

C. The transmission fluid has been recently changed with the correct type but is still cold, and the higher viscosity of the cold fluid produces a firmer shift feel that will normalize once the fluid reaches operating temperature

D. The engine mounts have stiffened from age, transmitting more of the normal shift impulse into the vehicle body than the original softer mounts would have absorbed and dampened during each gear change

47. A manual transmission has a growling noise in neutral that disappears when the clutch pedal is depressed. The noise returns when the pedal is released. What is the likely source of the noise?

A. The countershaft bearings are worn and produce the growling noise from the constant mesh gear train spinning at idle, and the noise stops when the clutch disconnects the input shaft and the gears coast to a halt

B. The input shaft bearing is worn and produces noise when the shaft is spinning at idle speed, and pressing the clutch disconnects the shaft from the engine, allowing it to stop spinning and silencing the bearing

C. The pilot bearing is worn and produces noise when the input shaft and crankshaft are rotating at the same speed in neutral, and pressing the clutch separates their speeds and changes the bearing loading

D. The release bearing is worn and produces noise when it is in its rest position not touching the pressure plate fingers, and pressing the clutch loads it against the fingers which stabilizes it and stops the noise

48. An AWD vehicle's center coupling engages with a noticeable shudder when the front wheels slip on wet pavement. The coupling fluid was changed recently. What is the most likely cause of the shudder during engagement?

A. The AWD coupling's internal clutch pack is worn beyond its service limit and cannot engage progressively, grabbing abruptly when the front-to-rear speed difference triggers engagement on the wet surface

B. The rear drive shaft U-joints are dry and binding, creating a resistance to rotation that the coupling must overcome, producing the shudder as the coupling alternately overcomes and is resisted by the joint

C. The incorrect coupling fluid was installed during the recent service — AWD couplings require a specific fluid with friction modifier properties that prevent shudder during the progressive clutch engagement

D. The front tires have significantly more tread than the rear tires, creating a rolling circumference mismatch that produces a speed difference the coupling interprets as wheel slip, engaging aggressively

49. A customer reports that their vehicle's clutch pedal slowly sinks to the floor over a period of minutes when held at the engagement point. The pedal returns to its full height when released and repumped. What does this symptom indicate?

A. The clutch master cylinder has an internal piston seal bypass that allows fluid to leak past the piston under sustained pressure, causing the pedal to creep toward the floor until the pressure is released

B. The clutch slave cylinder return spring has weakened from fatigue and heat exposure, allowing the piston to slowly extend under the residual system pressure that exists during the sustained pedal hold

C. The clutch disc friction material is compressing under the sustained clamping pressure of the engagement point hold, and the pedal sinks as the disc material gradually yields under the constant load

D. The clutch hydraulic line has a minor air pocket that gradually compresses under the sustained pressure of the engagement hold, and the pedal returns when released because the air re-expands to its original volume

50. A four-wheel-drive vehicle's front differential makes a clunking noise when the steering is turned to full lock at low speed during parking maneuvers. The noise occurs in both 2WD and 4WD modes. What is the most likely cause?

A. The front CV joints are worn and produce the clunking at full lock due to the extreme articulation angle, and the noise is present in 2WD because the front wheels still drive the CV joints through the wheel bearings

B. The front differential's spider gears are worn and produce a clunk when the left and right wheels rotate at maximum speed difference during full-lock turns, which occurs regardless of the drive mode selection

C. The steering stops are not limiting the steering angle before the CV joints reach their maximum articulation, allowing the joints to exceed their designed angle and produce the clunk at both steering extremes

D. The front differential has excessive ring and pinion backlash that produces a clunk during the torque reversal that occurs when the steering changes from one direction to the other at full lock during parking turns

51. A vehicle with a dual-clutch transmission has a hesitation from a stop that the dealer has attempted to address with a software update. The update improved the hesitation but did not eliminate it entirely. The customer asks if this is normal. What is the accurate response?

A. The hesitation indicates a hardware fault in the dual-clutch mechanism that the software update is masking rather than fixing, and the clutch pack should be inspected for wear or contamination

B. Some degree of launch hesitation is an inherent characteristic of dry dual-clutch transmissions during low-speed modulation, and software updates optimize but cannot completely eliminate the trait

C. The hesitation is caused by the dual-clutch transmission's turbo lag interaction, where the transmission waits for boost pressure to build before engaging the clutch to prevent drivetrain shock loading

D. The software update was the wrong version for this vehicle and a newer version is available that completely eliminates the hesitation by adjusting the clutch engagement point and pressure ramp rate

52. A vehicle's automatic transmission has a P0715 code (Input/Turbine Speed Sensor Circuit). The vehicle drives normally in all gears. What does the ECM use the input speed sensor for, and what is affected by its loss?

A. The input speed sensor measures engine RPM for the TCM's shift calculations, and without it the TCM uses the crankshaft position sensor as a backup, which provides adequate but less precise shift timing

B. The input speed sensor monitors the transmission oil pump speed, and its loss prevents the TCM from detecting pump wear that would reduce line pressure below the minimum for reliable clutch engagement

C. The input speed sensor measures the turbine shaft speed, which the TCM compares to the output speed to calculate gear ratio, torque converter slip, and shift timing — its loss affects shift quality and TCC control

D. The input speed sensor measures the torque converter stator speed, and its loss prevents the TCM from commanding the stator clutch release that is required for efficient highway cruising above 100 km/h

53. A rear-wheel-drive vehicle produces a single loud bang from the driveline when the engine is started. The noise occurs only at the initial start — never during driving. What is the most likely cause?

A. Excessive backlash in the ring and pinion gear set combined with the initial torque pulse from the engine's first combustion event, which takes up the backlash gap abruptly and produces the impact noise

B. The starter motor's pinion gear is not fully retracting from the flywheel ring gear after the engine starts, and the continued engagement produces the bang as the engine speed overcomes the starter's resistance

C. The torque converter's internal components have settled during the overnight sitting period, and the initial engine rotation repositions them with a single impact noise before the fluid coupling stabilizes the rotation

D. The exhaust system's internal baffles have shifted during the cooling and contraction of the overnight sitting period, and the initial exhaust pulse from the first firing event impacts the misaligned baffles

54. A front-wheel-drive vehicle with an automatic transaxle has a vibration during acceleration from 0 to 30 km/h that disappears at higher speeds. The vibration is felt through the steering wheel. What is the most likely cause?

A. A worn transmission mount that allows the transaxle to shift under the high torque of low-speed acceleration, changing the half-shaft angles and producing vibration that diminishes as torque demand decreases at speed

B. An unbalanced front tire that produces vibration at the specific wheel speed corresponding to the 0-30 km/h range, with the vibration being damped by the suspension at higher speeds above the resonant frequency

C. A worn inner CV joint that produces vibration specifically at low-speed acceleration angles and torque loads but operates smoothly at the reduced joint angles and lower torque demands of higher-speed cruising

D. A worn inner CV joint (tripod joint) that vibrates under the high-torque, low-speed acceleration conditions where the joint is most heavily loaded, with the vibration diminishing as the torque demand decreases at cruising speed

55. A vehicle's differential fluid is drained and the technician finds fine metallic particles on the drain plug magnet but the fluid color is normal. Is this a concern?

A. The metallic particles indicate the differential gears are experiencing catastrophic failure and the differential should be disassembled immediately for inspection before the vehicle is returned to service

B. A small amount of fine metallic particles on the drain plug magnet is normal for a differential — the magnet is designed to capture normal wear particles to prevent them from circulating through the gear set

C. The metallic particles indicate the differential fluid was not changed at the manufacturer's recommended interval, and the accumulated wear debris has exceeded the magnet's normal capture capacity

D. The particles are from the drain plug magnet itself, which deteriorates in the high-temperature differential fluid and sheds metallic fragments that appear as wear debris but are actually magnet degradation

56. An automatic transmission has a P0751 code (Shift Solenoid A Performance/Stuck Off). The transmission shifts normally from first to second but does not upshift to third. What does the code indicate about Shift Solenoid A?

A. Shift Solenoid A has failed in the off position electrically (open circuit or mechanical jam) and the transmission cannot command the valve body to direct fluid to the third-gear circuit without it

B. Shift Solenoid A is receiving the correct electrical command but its internal plunger is mechanically stuck in the off position, preventing the hydraulic circuit from completing the 2-3 shift valve movement

C. The solenoid is operating correctly, but a valve body wear condition is preventing the shift valve from moving to the third-gear position even when the solenoid commands it, mimicking a solenoid fault

D. The shift solenoid's plunger is mechanically stuck or its electrical circuit has a fault, preventing the valve body from directing fluid to the appropriate clutch circuit for third gear engagement

57. A customer's manual transmission makes a whirring noise that is proportional to vehicle speed in all gears. The noise is also present in neutral while rolling. Pressing the clutch does not change the noise character. What bearing is the most likely source?

A. The input shaft bearing, since it rotates with the engine whenever the clutch is engaged and would change character when the clutch is pressed and the shaft stops spinning at idle in neutral

B. The countershaft rear bearing, since it rotates proportionally to input shaft speed and would change noise when the clutch is pressed and the countershaft coasts to a stop in neutral

C. The reverse idler gear bearing, since it is loaded by the constant mesh gear train at all times and produces noise proportional to the countershaft speed regardless of the gear selection or clutch position

D. The output shaft bearing, since the output shaft always rotates proportionally to vehicle speed regardless of gear selection or clutch position, and pressing the clutch does not affect its rotational speed

58. A vehicle's transfer case shifts into 4WD High electronically using a dash-mounted switch. When the switch is pressed, the 4WD indicator light flashes continuously but never illuminates steadily. What does the flashing indicator mean?

A. The transfer case shift motor is receiving the command and attempting to complete the shift, but the shift has not fully engaged — either the motor is weak, the mechanism is binding, or the synchronizer cannot complete the speed match

B. The transfer case is in the process of warming its internal fluid to the minimum temperature required for safe 4WD engagement, and the flashing light indicates the warmup cycle is still in progress

C. The transfer case has successfully shifted to 4WD High, and the flashing indicator is the normal confirmation display that remains flashing for 30 seconds before switching to a steady illumination state

D. The transfer case control module has detected an incompatible tire size that prevents safe 4WD engagement, and the flashing light warns the driver that the tires must be matched before 4WD can be activated

59. A vehicle with an automatic transmission has the transmission fluid level checked on a cold engine (25°C). The fluid level reads at the "Hot" mark on the dipstick. What is the concern?

A. The fluid level reading is inaccurate because automatic transmission fluid contracts when cold and expands when hot, so a cold reading at the "Hot" mark means the transmission will be overfilled when it reaches operating temperature

B. Cold ATF readings at the "Hot" mark indicate the fluid is the correct type but has been mixed with engine oil during a previous service, since the oil contamination raises the fluid's cold volume above specification

C. The transmission is underfilled because the cold fluid level should read above the "Hot" mark to account for thermal expansion, and the current level will drop below the "Hot" mark when the fluid warms up

D. The cold reading is irrelevant because transmission fluid level must only be checked at operating temperature after the vehicle has been driven, and any reading taken on a cold engine is inherently meaningless

60. A heavy-duty pickup truck's clutch pedal has a noticeably higher engagement point than when the truck was new. The pedal free play at the top is within specification. What does the higher engagement point indicate?

A. The clutch master cylinder pushrod has lengthened from thermal expansion cycles, pushing the engagement point higher in the pedal arc and requiring a pushrod adjustment to restore the original engagement height

B. The clutch hydraulic fluid has absorbed moisture over time, increasing its volume and effectively lengthening the hydraulic column, which pushes the engagement point higher in the pedal travel range

C. The clutch disc friction material has worn thinner, requiring less release bearing travel to disengage the pressure plate from the disc, effectively raising the engagement point higher in the pedal arc

D. The pressure plate's diaphragm spring has fatigued and lost its designed clamping force, requiring less pedal effort to disengage and creating the perception of a higher engagement point in the pedal travel

61. A vehicle's headlamp circuit uses a relay controlled by the BCM. The headlamps do not illuminate. The technician activates the headlamp relay using the scan tool's bi-directional control and the headlamps turn on. What does this test confirm?

- A. The headlamp relay contacts are functioning, the wiring from the relay to the headlamps is intact, and the headlamps themselves are good — the fault is in the BCM command circuit or its input signals
- B. The headlamp relay is defective and only responds to the higher-voltage signal from the scan tool rather than the lower-voltage signal from the BCM's normal output driver during standard operation
- C. The headlamp bulbs are the incorrect wattage and draw more current than the BCM's solid-state output driver can supply, but the relay can handle the higher current when commanded by the scan tool
- D. The headlamp circuit has a ground fault that only manifests when the BCM commands the circuit, and the scan tool's bi-directional command bypasses the ground fault by using a different ground path

62. A vehicle's battery is three years old. A conductance test reads "Replace Battery" with a measured CCA of 380 amps. The battery's rated CCA is 650 amps. The battery is fully charged at 12.65 volts. What is the interpretation?

- A. The battery's internal plate structure has degraded to 58% of its original capacity and can no longer reliably deliver the cranking current needed for cold-weather starting, confirming the replacement recommendation
- B. The conductance tester is inaccurate because the battery's voltage is at full charge (12.65V), which proves the battery is healthy, and the CCA reading should be disregarded in favor of the voltage measurement
- C. The battery has one weak cell that is affecting the conductance reading but not the voltage, and a load test should be performed as a second opinion before condemning the battery based on conductance alone
- D. The 380 CCA reading is within the acceptable range for a three-year-old battery, since batteries naturally lose approximately 40% of their CCA over three years of normal service life from plate sulfation

63. A vehicle's A/C system has been evacuated and held under vacuum for 30 minutes. The vacuum gauge shows the system held 29.9 inches of mercury without any decay. What does this confirm?

- A. The A/C compressor's internal valves are sealing correctly and the compressor does not have an internal bypass that would allow refrigerant to leak past the valve plates during normal operation

B. The vacuum pump is powerful enough to compensate for any small leaks in the system, and the held vacuum does not necessarily confirm the system is leak-free because the pump may be masking minor leaks

C. The system is sealed and leak-free, and the vacuum has removed air and boiled off moisture from the system — the system is ready to be charged with the specified weight of refrigerant

D. The system is ready for charging but the vacuum hold test does not confirm the system is leak-free, since very small leaks may not be detectable during the 30-minute hold but will cause refrigerant loss over months

64. A vehicle's starter motor cranks the engine slowly on a cold morning. The battery was tested yesterday and confirmed as fully charged with adequate CCA. What should the technician check?

A. The engine oil viscosity, since oil that is too thick for the cold temperature creates excessive cranking resistance that the good battery may struggle to overcome at the reduced chemical reaction rate in cold conditions

B. The battery cable connections for high resistance that was not apparent during yesterday's warm-temperature test but increases significantly in cold conditions as the metal contracts and corrosion effects worsen

C. The alternator belt tension, since a loose belt can slip during cold startup and prevent the alternator from immediately supplementing the battery's cranking current during the initial engine rotation

D. The fuel system for gelling, since cold-thickened fuel creates higher injection pressure requirements that increase the load on the crankshaft during cranking beyond what the engine normally presents to the starter

65. A vehicle's scan tool shows the A/C compressor is commanded on but the system pressures do not change — the low side and high side remain equalized at approximately 550 kPa (80 psi). What does this indicate?

A. The A/C system is overcharged and the excessive refrigerant has equalized the pressures by flooding both the high side and low side with liquid refrigerant that cannot be compressed by the compressor

B. The compressor clutch is engaging but the compressor has an internal failure — a broken valve plate, a stripped drive hub, or a seized internal mechanism — that prevents it from actually compressing refrigerant

C. The expansion device is stuck wide open, allowing free flow between the high and low sides, and the compressor is working but cannot build a pressure differential against the fully open restriction point

D. The ambient temperature is too high for the system to develop a pressure differential, and the equalized pressures are a normal condition when the outside temperature exceeds the system's designed operating range

66. A vehicle's electric cooling fans run in reverse — they are blowing air forward through the condenser and radiator instead of pulling air rearward through them. What is the most likely cause?

A. The fan motor wiring polarity has been reversed during a previous repair, causing the motor to spin in the opposite direction from its designed rotation and push air the wrong way through the heat exchangers

B. The fan relay has an internal fault that reverses the polarity of the output signal, causing the motor to receive reversed current flow and rotate in the opposite direction from the BCM's intended command

C. The fan motor has a faulty internal commutator that spontaneously reversed its rotational direction due to brush wear that changed the motor's field orientation within the permanent magnet stator housing

D. The BCM has a software fault that commands the fan motor in the wrong rotational direction, and a software update is required to correct the polarity logic in the fan control algorithm for this specific vehicle

67. A vehicle's power window motor on the driver's door operates normally when going down but stalls halfway when going up. The window can be pushed up by hand with moderate effort. What is the most likely cause?

A. The window motor has a partial internal short that reduces its torque output in the up direction but not the down direction, since the motor draws different current in each rotational direction

B. The window regulator track or channel has an obstruction, binding point, or damaged section at the halfway position that creates excessive resistance when the window is being raised against gravity

C. The window switch has higher contact resistance on the up position than the down position, reducing the voltage reaching the motor during the up command and limiting its available torque for lifting

D. The window glass has accumulated debris in its channel guide at the halfway point that creates a physical obstruction, and the motor cannot generate enough force to push the glass past the blocked section

68. A vehicle has a charging system voltage of 14.2 volts with all accessories off. When the headlamps, rear defroster, and blower motor are all turned on, the voltage drops to 13.4 volts. Is this voltage drop acceptable?

A. No — the voltage should remain above 14.0 volts regardless of the electrical load because the alternator's voltage regulator should increase the field current to compensate for any additional accessory demand

B. Yes — a voltage drop from 14.2V to 13.4V under heavy accessory load is within the normal range, as long as the voltage remains above 13.0V the alternator is providing adequate output for the demand

C. No — the 0.8 volt drop indicates the alternator is undersized for the vehicle's electrical load and should be replaced with a higher-output unit to prevent chronic battery undercharging during heavy use

D. Yes — the voltage drop is normal, but only if the engine is at idle; at 2,000 RPM with the same load the voltage should return to 14.0V or above, confirming the alternator's output capacity at higher speed

69. A vehicle's HVAC system has a clicking noise from behind the dashboard that occurs every time the temperature setting is changed. The noise lasts approximately 5 seconds and then stops. What is the most likely cause?

A. The blower motor's squirrel cage has a loose blade that contacts the housing when the airflow direction changes in response to the temperature adjustment command from the control panel

B. The HVAC control module has a faulty relay that rapidly cycles on and off when processing the temperature change command, producing the clicking noise heard from behind the dashboard area

C. The heater core has an internal air pocket that shifts position when the blend door changes position, creating a clicking noise as the air bubble moves through the core passages during the temperature change

D. A blend door actuator is repositioning the blend door in response to the temperature command, and the clicking noise is the actuator's electric motor and gear train operating during the 5-second repositioning movement

70. A vehicle has an ADAS forward collision warning that activates falsely in clear weather on a straight road with no vehicles ahead. The camera and radar have been inspected and are clean. What should be checked?

A. The forward-facing camera or radar sensor alignment, since a slight misaim can cause the system to detect roadside objects, signs, overpasses, or guardrails as vehicles in the forward collision path

B. The vehicle's windshield for a replacement that uses non-OEM glass without the correct optical properties for the ADAS camera, causing the camera to process distorted images that trigger false detections

C. The ADAS control module for a software update, since false alerts in clear conditions are almost always caused by calibration software bugs that manufacturers address in updated software releases

D. The vehicle's wheel alignment, since a vehicle tracking slightly off-center creates a heading error that the ADAS system interprets as approaching a stationary object at the edge of the lane ahead

71. A technician measures 0.3 volts across a battery cable connection during a starter cranking test. The specification is less than 0.5 volts. Another connection measures 0.7 volts. Which connection needs service?

A. Both connections need service because any measurable voltage drop across a connection indicates unwanted resistance that reduces the available cranking power to the starter motor during engine starting

B. Only the 0.7-volt connection needs service — it exceeds the 0.5-volt maximum specification, indicating excessive resistance at that point that must be cleaned, tightened, or replaced to restore low-resistance contact

C. Neither connection needs service because both readings are below 1.0 volt, which is the actual maximum allowable voltage drop for individual connections in the high-current starter motor cranking circuit

D. Both connections should be cleaned as preventive maintenance, since the combined voltage drop of 1.0 volt across both connections reduces the total available cranking voltage below the acceptable minimum

72. A vehicle's A/C system has a restriction. The high-side pressure is very high and the low-side pressure is very low. The liquid line between the condenser and the expansion device feels very cold — much colder than normal. Why is the liquid line cold?

A. The restricted refrigerant flow is causing the liquid line to act as a secondary evaporator, with the small amount of refrigerant that passes through the restriction evaporating and absorbing heat from the line surface

B. The high pressure upstream of the restriction is compressing the refrigerant to a higher density that absorbs heat from the surrounding air more effectively, producing the cold sensation on the liquid line

C. The restriction is causing the condenser to supercool the refrigerant below its normal subcooling temperature because the reduced flow rate allows the refrigerant to spend more time in the condenser coils

D. The cold liquid line is a normal condition during maximum A/C operation and does not indicate a restriction — the line temperature should be used to confirm the system is fully charged rather than restricted

73. A vehicle's brake lights stay on continuously even when the brake pedal is released. The brake light switch has been replaced. What should be checked?

A. The BCM for a software fault that is commanding the brake light relay continuously regardless of the brake switch input, overriding the switch's open-circuit state when the pedal is released

B. The brake light fuse for a short to power that bypasses the brake switch circuit entirely, providing continuous battery voltage to the brake lamp filaments without passing through the switch circuit

C. The turn signal switch for an internal short that bridges the brake light circuit with the tail light circuit, providing continuous power to the brake lamp filaments through the always-energized tail light feed

D. The brake pedal and switch mounting for adjustment — if the switch is not positioned correctly relative to the pedal arm, the pedal may not fully release the switch plunger, leaving the brake lights energized

74. A vehicle's alternator charges normally at idle and moderate RPM, but the charging voltage drops below 13.0 volts at sustained high RPM (above 4,000). What is the most likely cause?

A. The voltage regulator has a fault that limits field current at high RPM, reducing the alternator's output instead of maintaining it, causing the charging voltage to drop below specification at sustained high speed

B. The alternator's stator has a partial short between two windings that becomes significant at high RPM where the higher frequency increases the current flow through the shorted path, reducing total output

C. The serpentine belt is slipping at high RPM because the belt tensioner has weakened, and the reduced alternator speed causes the output to drop below the charging threshold at the elevated engine speed

D. The battery is fully charged and the voltage regulator is correctly reducing the alternator output at high RPM to prevent overcharging, which is normal behavior for a voltage regulator protecting a fully charged battery

75. A vehicle has a parasitic draw of 400 milliamps. The technician pulls fuses one at a time and finds that two separate fuse circuits each account for 150 milliamps of the draw, while the remaining 100 milliamps is the normal module keep-alive draw. What is the next step?

A. Replace both fuses with higher-amperage fuses since the circuits are drawing current that exceeds the original fuse rating, and the higher-rated fuses will accommodate the increased draw without blowing

B. Investigate each of the two 150 mA circuits individually by disconnecting the components on each fused circuit to identify the specific component drawing the excessive current in each circuit

C. Replace the BCM, since it controls both circuits and a faulty BCM output driver is most likely commanding both circuits to remain active during the key-off sleep period when they should be deactivated

D. Disconnect the vehicle's battery when it is parked to prevent the drain, and schedule the vehicle for a dealer-level parasitic draw diagnosis that requires specialized equipment not available in a general repair shop

76. A vehicle's A/C system has R-1234yf refrigerant. The technician only has R-134a recovery/recycling equipment. Can the technician service this system?

A. Yes — R-1234yf and R-134a are chemically compatible and can be serviced with the same equipment, since the only difference is the environmental impact rating and not the physical properties

B. Yes — the technician can recover the R-1234yf using R-134a equipment as long as the recovered refrigerant is stored in a separate, dedicated container marked for R-1234yf to prevent cross-contamination

C. No — R-1234yf requires dedicated R-1234yf-certified equipment with different fittings, hoses, and recovery tanks, and using R-134a equipment would contaminate both the equipment and the refrigerant

D. No — R-1234yf systems can only be serviced by the vehicle manufacturer's dealership using proprietary equipment, and independent shops are prohibited from purchasing R-1234yf servicing equipment

77. A vehicle's scan tool data shows the intake air temperature sensor reads -40°C when the ambient temperature is 22°C . What does the -40°C reading indicate?

A. The IAT sensor has an open circuit — most ECMs interpret an open IAT circuit as -40°C because the open circuit produces maximum voltage at the ECM's signal input, which corresponds to the coldest calibration point

B. The IAT sensor is functioning correctly but is located in a position that receives direct airflow from the A/C system's cold air discharge, cooling the sensor below the ambient temperature reading

C. The IAT sensor has a short to ground that produces minimum voltage at the ECM's signal input, which the ECM interprets as the coldest possible temperature in its calibration table at -40°C

D. The scan tool is displaying the data in Fahrenheit rather than Celsius, and -40°F is the equivalent of -40°C , which is a coincidental display error that does not represent an actual sensor fault condition

78. A vehicle's electric power steering has completely lost assist. The EPS warning light is on. The scan tool shows a DTC for EPS motor circuit open. What should be checked?

- A. The EPS torque sensor, since a faulty torque sensor prevents the PSCM from determining the driver's steering input and defaults to zero assist as a safety measure against unintended steering intervention
- B. The EPS system's 12V power supply fuse and main power relay, since an open fuse or relay would prevent current from reaching the EPS motor and produce an "open circuit" code from the lack of current flow
- C. The vehicle's battery state of charge, since the EPS system requires a minimum of 12.0 volts to operate and a weak battery can prevent the motor from drawing adequate current for steering assist
- D. The EPS motor wiring harness connector and the motor's internal winding continuity, since an open circuit in the motor's power wiring or a broken internal winding prevents current flow through the motor

79. A customer reports that their heated steering wheel only heats on the left side. The right side remains cold. What is the most likely cause?

- A. The heated steering wheel control module is intentionally heating only the left side based on the driver's hand position detected by the capacitive touch sensors embedded in the steering wheel rim surface
- B. The heating element in the steering wheel has an open circuit on the right side, preventing current from flowing through that portion of the element while the left side continues to heat normally
- C. The clockspring has a partially damaged ribbon that carries the heated steering wheel current, and the damaged conductor supplies adequate current to the left element but insufficient current to the right
- D. The steering wheel heater switch has a faulty dual-output circuit where one output activates the left side normally but the second output for the right side has failed from a corroded contact within the switch

80. A vehicle's cabin air filter housing has a "recirculation" mode and a "fresh air" mode controlled by a door inside the HVAC case. In recirculation mode, what air source does the system use?

- A. The system draws air from the engine bay through a filtered port in the firewall, providing warm air during winter and cool air during summer based on the underhood temperature conditions
- B. The system draws air from the trunk area through a duct that runs along the vehicle's interior floor, providing a secondary air source that supplements the dashboard vents during recirculation mode

C. The system recirculates the air already inside the vehicle cabin through the evaporator and heater core, without drawing any fresh outside air through the cowl intake, maximizing cooling or heating efficiency

D. The system draws air from directly behind the front bumper through a dedicated low-pressure duct, providing the coolest available air during summer driving for maximum air conditioning performance

81. A vehicle's scan tool shows that the upstream oxygen sensor voltage on bank 1 is fixed at 0.45 volts and does not switch between rich and lean. The engine runs normally with no drivability complaints. What does the fixed 0.45V reading indicate?

A. The oxygen sensor is functioning correctly at stoichiometric, and the 0.45V reading represents the ideal air-fuel ratio where the sensor voltage is balanced between the rich and lean switch points

B. The ECM is in open-loop fuel control mode and not using the oxygen sensor for fuel trim correction, which is why the sensor shows a fixed voltage at its bias point rather than actively switching

C. The oxygen sensor has failed at its reference voltage and is no longer switching between rich and lean, but the ECM's open-loop fuel tables are providing adequate fuel control that masks any drivability symptoms

D. The wideband oxygen sensor is reading correctly at 0.45V, which represents a slightly lean condition that the ECM is intentionally commanding for fuel economy optimization during the current operating condition

82. A vehicle's rear window defroster operates for only 3 minutes before shutting off. The specification is a 10-minute operating cycle. What is the most likely cause?

A. The rear window defroster timer relay has a faulty internal timing circuit that counts down faster than the designed rate, completing its programmed cycle in 3 minutes instead of the specified 10 minutes

B. The defroster grid is drawing excessive current from a low-resistance short within the grid, and the overcurrent protection circuit in the defroster module shuts the system down after 3 minutes to prevent overheating

C. The BCM has a software fault that limits the defroster operating time to 3 minutes instead of the factory-programmed 10 minutes, and a software update is required to restore the correct timer duration

D. The vehicle's charging system voltage drops below the minimum threshold when the defroster is activated (from the combined accessory load), and the BCM shuts the defroster off to protect the battery from excessive discharge

83. A vehicle's power seat moves forward and backward normally but will not tilt the seat cushion up or down. The switch sends the correct signal for the tilt function when tested. What is the most likely cause?

A. The seat track motor has an internal fault that prevents it from operating in the tilt direction while allowing it to operate in the fore-and-aft direction due to a partial brush or commutator failure

B. The seat tilt motor or its drive mechanism has failed — either the motor has an open winding, the gear drive has stripped, or the motor's wiring has an open circuit that prevents current from reaching the motor

C. The seat frame has a mechanical interference that prevents the tilt mechanism from moving, and the motor stalls against the obstruction while the fore-and-aft mechanism operates on a separate unobstructed track

D. The BCM's seat control output for the tilt function has failed while the fore-and-aft output continues to work, since the BCM controls each seat motor function through an individual solid-state output driver

84. A vehicle pulls to the right during braking and tracks straight during normal driving. The technician finds the left front brake caliper's piston is not extending fully during brake application. What is preventing full piston extension?

A. The brake rotor on the left front has excessive runout that pushes the piston back into the bore after each revolution, preventing the piston from maintaining full contact with the pad during application

B. The caliper slide pins on the left front are seized, preventing the caliper from floating and the piston from extending fully because the entire caliper body is binding on its mounting bracket

C. The left front caliper piston is corroded or seized in its bore, limiting its travel and reducing the braking force on that side, creating an imbalance that pulls the vehicle toward the stronger right front brake

D. The master cylinder's primary piston seal is bypassing, reducing the hydraulic pressure available to the left front caliper circuit while the right front circuit receives full pressure from the secondary piston

85. A vehicle has excessive steering play that the technician traces to the steering gear. On this vehicle, the steering gear has an adjustable sector shaft preload. What is the consequence of over-tightening the sector shaft adjustment?

A. Over-tightening increases the internal friction of the gear mesh, causing the steering to bind at the center position, reducing steering wheel return-to-center, and accelerating wear on the sector shaft and worm gear

B. Over-tightening increases the gear's internal fluid pressure beyond the pump's output capacity, causing the power steering pump to whine and overheat during normal steering operations at all speeds

C. Over-tightening has no negative consequences and should be performed to the maximum extent possible to eliminate all steering play and provide the tightest possible steering response for the driver

D. Over-tightening causes the steering gear to develop a memory position at the center point, making the steering wheel prefer to snap back to center rather than maintaining the turned position during cornering

86. A vehicle's left rear brake drum is found to be out-of-round by 0.5 mm during inspection. The maximum allowable out-of-round specification is 0.25 mm. What symptom would this out-of-round drum produce?

A. A pulsation in the brake pedal during braking that is felt as a rhythmic push-back against the driver's foot as the out-of-round drum pushes the brake shoes in and out with each revolution of the drum

B. A constant grinding noise from the left rear wheel during all driving conditions, regardless of whether the brakes are applied, from the shoes contacting the high spots of the out-of-round drum during rotation

C. A pull to the left during braking because the out-of-round drum produces a periodic grabbing effect as the high spot contacts the shoes, increasing the average braking force on the left rear during each revolution

D. A pedal pulsation and potentially a rhythmic noise during braking from the left rear, caused by the brake shoe-to-drum contact varying with each wheel revolution as the drum's varying diameter rotates past the shoes

87. A vehicle has a steering system that uses an electric power steering rack with a dual-pinion design — one pinion is driven by the driver through the steering column, and a second pinion is driven by the EPS motor. What advantage does this design provide?

- A. The dual-pinion design provides redundant steering input so that if the EPS motor fails, the driver retains full mechanical steering through the driver's pinion without any increase in steering effort
- B. The dual-pinion design separates the driver's mechanical input from the motor's assist input, allowing the motor to apply assist force directly to the rack without adding friction or resistance to the driver's steering feel
- C. The dual-pinion design doubles the steering ratio, providing a faster steering response with fewer turns lock-to-lock than a single-pinion system while maintaining the same rack travel for the same wheel angle
- D. The dual-pinion design allows the EPS motor to be mounted externally on the rack housing rather than inside it, making motor replacement easier and less expensive than column-mounted EPS motor designs

88. A tire's load index is 95. The customer wants to replace the tires with a different brand that has a load index of 89. Is this acceptable?

- A. Yes — the load index difference of 6 points is within the acceptable substitution range for passenger vehicles and will not affect the tire's ability to support the vehicle's weight at the correct inflation
- B. Yes — the load index is only relevant for commercial vehicles and does not apply to passenger vehicles, where the tire size and speed rating are the only specifications that must be maintained during replacement
- C. No — the replacement tire's load index must meet or exceed the original specification, since a lower load index means the tire is rated to carry less weight and may be overloaded on this vehicle
- D. No — load index specifications must match exactly between the original and replacement tires, and neither a higher nor lower load index tire should be installed as a substitute for the original specification

89. A vehicle's ABS modulator has been replaced. After installation, the ABS warning light remains on. The scan tool shows no DTCs. What procedure is most likely needed?

- A. The ABS system requires a bleeding procedure after modulator replacement to remove air from the internal passages and restore full hydraulic function before the warning light will extinguish

B. The ABS module requires a manual light reset through the scan tool because the warning light latch circuit does not clear automatically when the fault condition (the old module) is removed and replaced

C. The ABS system requires a full four-wheel brake bleed followed by an ABS automated bleed cycle using the scan tool to cycle the internal solenoids and purge air from the modulator's internal circuits

D. The replacement ABS modulator requires programming with the vehicle-specific calibration data, VIN, and wheel speed sensor configuration before it will operate correctly and extinguish the warning light

90. During a brake inspection, the technician finds that the inboard brake pad on the left front caliper has 2 mm of friction material remaining while the outboard pad has 7 mm. The right front caliper shows even pad wear at 5 mm on both sides. What does the uneven wear on the left front indicate?

A. The left front caliper piston is not retracting fully due to a corroded bore or deteriorated piston seal, leaving the inboard pad in partial contact with the rotor between brake applications and wearing it faster

B. The left front brake rotor has excessive thickness variation that causes the inboard pad to contact the rotor's thick spots during every revolution, wearing the inboard pad faster than the outboard pad

C. The brake pad friction compound on the left inboard pad is softer than the outboard pad due to a manufacturing defect in the pad set, causing the softer inboard pad to wear at a faster rate regardless of caliper condition

D. The left front caliper's guide pins are seized, preventing the caliper body from floating and causing only the piston side to generate braking force, wearing the inboard pad disproportionately faster than the outboard

91. A vehicle equipped with TPMS has a sensor battery that is dying — the sensor transmits intermittently. What symptom would the driver observe?

A. The TPMS pressure reading for that wheel position would freeze at the last received value and remain unchanged for extended periods, with occasional updates when the sensor has enough power to transmit

B. The TPMS warning light would flash for approximately one minute after the vehicle is started, then illuminate steadily, indicating a system fault rather than a low-pressure condition for the affected wheel position

C. The affected wheel's pressure reading would show 0 psi on the dashboard display, since the system defaults to zero when it cannot receive a signal from the sensor at that wheel position within the expected window

D. The TPMS warning light would illuminate steadily with the message "Low Tire Pressure" for the affected wheel, since the system interprets the missing signal as a flat tire condition rather than a system fault

92. A vehicle has a vibration during braking that is felt through the brake pedal only — not through the steering wheel. The vibration is rhythmic and proportional to wheel speed. What does this pattern indicate?

A. The front brake rotors have thickness variation, since front rotor DTV transmits vibration through both the steering wheel (via the knuckle and tie rod) and the brake pedal simultaneously

B. The rear brake rotors have thickness variation, since rear rotor DTV transmits vibration through the brake pedal hydraulics but has no connection to the steering system to transmit steering wheel vibration

C. Both the front and rear brake rotors have identical thickness variation that cancels the steering wheel vibration through destructive interference while reinforcing the brake pedal vibration through constructive interference

D. The ABS system is activating during normal braking and the pressure modulation is felt through the pedal, since ABS pulsation is not transmitted through the steering system when all four channels modulate simultaneously

93. A vehicle's power steering fluid reservoir has a foamy appearance and the power steering pump makes a groaning noise. The fluid level is correct. What is the most likely cause?

A. The power steering fluid has been contaminated with brake fluid, which has caused a chemical reaction that produces gas bubbles within the power steering hydraulic circuit during normal pump operation

B. The power steering fluid has been overheated from sustained full-lock steering and the heat has caused the fluid's anti-foam additives to break down, allowing air entrainment from the pump's normal cavitation

C. The power steering pump's inlet hose or a connection has a crack or loose clamp that draws air into the suction side of the pump, mixing air with the fluid and producing the foam and the groaning pump noise

D. Air is being drawn into the power steering system through a compromised suction hose, loose fitting, or failing pump shaft seal on the inlet side, creating the foamy fluid condition and the groaning pump noise

94. A customer requests a wheel alignment. During the pre-alignment inspection, the technician discovers the right front lower ball joint has detectable vertical play beyond the manufacturer's specification. What is the correct action?

A. Inform the customer that the worn ball joint must be replaced before the alignment is performed, because aligning the vehicle with a worn ball joint produces an alignment that will change as soon as the joint is replaced

B. Perform the alignment as requested and note the worn ball joint on the repair order, since the alignment machine compensates for component wear and the alignment will be accurate despite the worn joint

C. Perform the alignment first to determine how much of the customer's tire wear complaint is from misalignment versus the worn ball joint, then recommend the ball joint replacement as a separate follow-up service

D. Replace the ball joint without contacting the customer first, since the worn joint is a safety hazard and the technician has an obligation to repair safety-critical components immediately upon discovery

95. A vehicle's electronic stability control (ESC) has a DTC for the yaw rate sensor. The sensor has been replaced. The ESC warning light remains on. What additional procedure is required?

A. The ABS hydraulic modulator must be bled using the scan tool's automated bleed function after any ESC component replacement to purge air that may have entered during the sensor installation

B. The yaw rate sensor requires a calibration or initialization procedure after replacement to establish its zero-point reference, which the ESC module needs to accurately detect vehicle rotation during driving

C. The ESC module must be replaced along with the yaw rate sensor because the two components are paired at the factory and cannot communicate with a replacement sensor that has a different serial number

D. The vehicle must be driven at highway speed for 30 minutes to allow the ESC module to automatically learn the new sensor's calibration values through its self-calibration algorithm during normal driving

96. A vehicle has a tire with a nail puncture in the shoulder area — the area between the tread face and the sidewall. Can this tire be repaired?

A. Yes — shoulder punctures can be repaired using the same internal patch-plug method as tread punctures, as long as the puncture does not extend into the sidewall flex zone below the shoulder reinforcement

B. No — the shoulder area is outside the repairable zone, and punctures in this area compromise the tire's structural integrity at the junction between the tread belts and the sidewall cords, requiring replacement

C. Yes — but only if the nail diameter is less than 6 mm and the puncture angle is perpendicular to the tire surface, since angled punctures in the shoulder area damage the internal belt edges and cannot be sealed

D. No — only the exact center of the tread face is considered repairable, and any puncture that is not in the geometric center of the tread pattern must be treated as unrepairable regardless of the puncture size

97. A vehicle's rear drum brakes have a pull to the right during moderate braking on a flat road. Inspection shows even pad wear and correct adjustment on both sides. The wheel cylinders are not leaking. What should be inspected?

A. The front brake system for a fault that reduces the left front braking force, since a front brake problem can manifest as an apparent rear pull due to the diagonal brake circuit routing

B. The rear brake hardware (springs, adjusters, and backing plates) for correct installation, since installed incorrectly positioned springs or a contaminated shoe can alter the braking force on one side

C. Both rear drums for out-of-round conditions that create different friction characteristics during braking, producing an asymmetric braking force between the two rear wheels during application

D. The rear brake shoes for grease or fluid contamination on one side that reduces the friction coefficient of the affected shoes, producing less braking force on that side and creating the directional pull

98. A vehicle's steering wheel is centered but the vehicle's rear end tracks slightly to the right of the front during straight driving — the vehicle appears to "dog-track" or "crab walk." What alignment parameter is out of specification?

A. The rear thrust angle is not zero, causing the rear axle to aim slightly to the right of the vehicle's centerline and creating the visual and dynamic offset between the front and rear wheel tracks during driving

B. The front toe is set with an asymmetric split that allows the front wheels to track straight while pointing the steering rack slightly off-center, creating the appearance of a rear tracking offset

C. The front caster is unequal between the left and right sides, creating a steering pull that the driver corrects with a slight steering offset that aligns the front wheels but not the rear during straight driving

D. The front camber is unequal between the left and right sides, causing the front tires to track at different angles that create a visual offset between the front and rear wheel paths during straight-line driving

99. A vehicle's brake fluid tests at 3.8% water content using a brake fluid tester. The manufacturer's replacement threshold is 3.0%. What is the safety concern with excessive water content in brake fluid?

A. The water content has caused internal corrosion of the ABS modulator's aluminum bore surfaces, creating metallic particles that will clog the system's fine-mesh internal screens and restrict brake fluid flow

B. The water content has diluted the brake fluid's lubricating additives below the effective concentration, causing accelerated wear of the master cylinder and caliper piston seals that leads to hydraulic leaks

C. The water molecules have expanded the brake fluid's total volume beyond the master cylinder reservoir capacity, creating residual pressure in the system that prevents the brake pads from fully retracting

D. Water in the brake fluid lowers the fluid's boiling point, and during heavy or sustained braking the fluid can boil at the caliper, creating gas bubbles that compress under pedal pressure and cause a spongy or fading brake pedal

100. A vehicle has a tire size of P245/45R18. The customer wants to install P245/40R18 tires. What effect does the lower aspect ratio (40 vs. 45) have on the vehicle?

A. The lower aspect ratio tire has a shorter sidewall, which reduces the overall tire diameter, affects the speedometer accuracy, and changes the ride height slightly — the speedometer will read faster than actual speed

B. The lower aspect ratio provides a softer ride because the shorter sidewall flexes more easily than the taller sidewall, providing more cushioning over road imperfections during normal driving at any speed

C. The lower aspect ratio tire has a shorter sidewall that provides quicker steering response and a sportier feel, but the reduced tire diameter makes the speedometer read slightly higher than actual vehicle speed

D. The lower aspect ratio has no measurable effect on the vehicle's ride, handling, speedometer accuracy, or ride height because the section width remains the same at 245 mm for both tire specifications

101. A customer complains that the driver's seatbelt retracts too slowly and does not lock during a quick pull test. What component is most likely at fault?

A. The seatbelt anchor point has shifted from a previous collision repair, changing the belt's geometry and preventing the inertia lock from engaging at the correct deceleration threshold during the pull test

B. The seatbelt buckle has an internal spring fault that prevents it from providing adequate tension to the belt webbing, causing the belt to retract slowly and feel loose during normal use and quick-pull testing

C. The seatbelt webbing has accumulated dirt, body oils, and contaminants that increase friction within the retractor mechanism, slowing the retraction speed and preventing the inertia lock from responding quickly

D. The seatbelt retractor mechanism is faulty — the internal spring that provides retraction force has weakened and the inertia locking mechanism is worn or contaminated, requiring retractor replacement

102. A vehicle's windshield has been replaced by a glass shop. After the replacement, the driver notices a wind noise at highway speed that was not present before. What is the most likely cause?

- A. The replacement windshield is a different thickness than the original, creating a turbulence pattern at the A-pillar junction that produces wind noise at highway speeds above the original glass frequency
- B. The windshield was not installed with the correct adhesive application pattern or thickness, leaving a gap or void in the seal that allows air to pass between the glass and the pinch weld at highway speed
- C. The replacement windshield has a slightly different curvature than the original, creating an aerodynamic mismatch with the vehicle's A-pillar that produces turbulent airflow and the resultant wind noise
- D. The cowl cover or windshield trim pieces were not reinstalled correctly after the glass replacement, leaving a gap that allows air to enter between the trim and the glass at highway speed

103. A vehicle's power liftgate opens but the struts do not assist — the liftgate opens under motor power only and does not hold itself open when the motor stops. What is the correct repair?

- A. Reprogram the liftgate control module with the correct vehicle weight parameters, since incorrect programming causes the module to calculate insufficient motor force for the liftgate opening assistance
- B. Adjust the liftgate hinge tension bolts to increase the mechanical resistance at the hinge, which provides the holding force that keeps the liftgate open after the motor completes its opening stroke
- C. Replace the liftgate gas struts (assist cylinders), which have lost their internal gas charge and can no longer provide the lift assistance and hold-open force that supplements the power liftgate motor
- D. Lubricate the liftgate hinge pins with lithium grease, since corroded and dry hinges create friction that overpowers the gas strut assist force and prevents the liftgate from holding the open position

104. A vehicle's horn operates when the horn button on the steering wheel is pressed, but the horn also sounds briefly when the key fob lock button is pressed. The customer did not have this feature before and wants it disabled. What is the explanation?

- A. The horn chirp on lock is a configurable feature that was likely enabled during a recent service visit when the BCM was accessed for another purpose — it can be disabled through the vehicle's settings menu or the scan tool
- B. The horn chirp indicates a fault in the BCM that is cross-connecting the keyless entry lock signal with the horn relay output, and the BCM must be replaced to separate the two circuits and stop the chirp

C. The horn chirp was activated by a recent battery replacement that reset the BCM to its factory default settings, and the feature must be disabled by disconnecting the horn relay for 30 seconds and reconnecting

D. The horn chirp is mandated by Transport Canada regulations for all vehicles sold in Canada after 2020, and it cannot be legally disabled by the dealer, the customer, or any service provider in Canada

105. A vehicle's exterior door handle chrome plating is peeling and the customer asks if the handle can be rechromed. What is the recommended repair?

A. Rechroming automotive door handles is the industry standard repair, since the handle mechanism is separate from the decorative chrome shell and only the shell requires replating at a specialized shop

B. Replace the door handle assembly, since automotive exterior handles are not practically rechromable — the plastic substrate, multiple plating layers, and integrated mechanisms make replacement more reliable and cost-effective

C. Sand the peeling chrome with fine-grit sandpaper and apply an automotive chrome spray paint, which provides a matching finish that is durable enough for exterior door handle applications in all climates

D. Apply a chrome vinyl wrap to the existing handle surface, which provides a factory-appearance match and UV protection that extends the remaining chrome's lifespan on the non-peeling areas of the handle

106. A vehicle's automatic headlamp leveling system adjusts the headlamp beam height based on vehicle load. The vehicle is loaded with heavy cargo in the rear trunk. What should the leveling system do?

A. Raise the rear suspension to compensate for the heavy load, restoring the vehicle to its normal ride height and maintaining the original headlamp beam angle without any headlamp adjustment

B. Disable the headlamps entirely until the vehicle load is removed, since the heavy rear load tilts the headlamp beam upward beyond the safe angle for oncoming traffic visibility

C. Increase the headlamp brightness to compensate for the upward beam angle caused by the rear-heavy loading, providing the driver with equivalent road illumination despite the altered beam geometry

D. Tilt the headlamp beam downward to compensate for the rear-heavy vehicle attitude that would otherwise aim the headlamp beam too high and create glare for oncoming drivers

117. A hybrid vehicle's regenerative braking system captures approximately 60% of the available kinetic energy during normal city driving. Where does the remaining 40% go?

A. The remaining 40% is stored as thermal energy in the brake rotors and pads from the friction braking that supplements the regenerative system during the portions of each stop where regen cannot provide full deceleration

B. The remaining energy is converted to heat by the drive motor's electrical resistance during the regenerative process and dissipated through the motor's cooling system rather than being stored in the battery

C. The remaining energy is lost to aerodynamic drag and tire rolling resistance during the deceleration phase, which consume kinetic energy independently of both the regenerative and friction braking systems

D. The remaining 40% is lost through a combination of friction braking (supplementing regen at low speed), electrical losses in the motor and inverter, heat generated in the battery from internal resistance, and rolling/aero drag during deceleration

118. A battery electric vehicle's range drops dramatically when the cabin heater is used in cold weather. What technology addresses this energy consumption problem most effectively?

A. A larger HV battery pack that provides additional capacity specifically reserved for cabin heating, separate from the propulsion energy budget, ensuring the driving range is not affected by heater demand

B. A diesel-fired auxiliary cabin heater that operates independently of the HV battery, providing cabin heat without consuming any of the battery's stored energy that would otherwise be available for propulsion

C. An auxiliary 12V electric heater powered by the 12V auxiliary battery through the DC-DC converter, which provides cabin heat without directly drawing current from the HV battery's propulsion energy reserve

D. A heat pump system that moves heat from the outside air into the cabin using the refrigeration cycle in reverse, consuming 2-3 times less electrical energy than a resistive heater for the same heat output

119. A technician is inspecting a hybrid vehicle's HV battery pack cooling system. The system uses a dedicated radiator and electric pump. The coolant is clear and at the correct level, but the technician

notices the coolant temperature is 45°C after 30 minutes of driving. The specification is 20-35°C. What is the most likely cause?

- A. The HV battery cooling circuit radiator is restricted or the cooling fan is not operating, preventing adequate heat rejection from the coolant circuit and allowing the temperature to rise above specification
- B. The HV battery cells have degraded and their increased internal resistance generates more heat during normal charge-discharge cycling, overwhelming the cooling system's designed heat rejection capacity
- C. The coolant mixture ratio is incorrect — too much antifreeze and not enough water reduces the coolant's thermal conductivity and heat capacity, preventing adequate heat transfer from the battery to the radiator
- D. The ambient temperature is too high for the cooling system's designed capacity, and the elevated coolant temperature is a normal condition during warm-weather driving that does not require any corrective action

120. What is the purpose of the "vehicle-to-grid" (V2G) capability that some newer battery electric vehicles are equipped with?

- A. V2G allows the vehicle's navigation system to communicate with the electrical grid infrastructure to locate available charging stations and reserve charging time slots in advance for the driver's convenience
- B. V2G allows the vehicle to upload its driving telemetry data to the grid operator's servers for traffic management and road condition monitoring through the vehicle's cellular communication network
- C. V2G allows the vehicle to discharge its HV battery energy back into the electrical grid or a home's electrical system, effectively using the vehicle as a mobile energy storage device that can power external loads
- D. V2G allows the vehicle to communicate its state of charge and charging schedule to the grid operator, enabling the grid to manage the total electrical demand from all connected EVs during peak usage periods

121. A plug-in hybrid vehicle's engine runs more frequently than expected during cold weather. The customer reports that the engine starts almost immediately after turning on the vehicle, even with a full battery charge. What is the most likely explanation?

A. The HV battery has a cold-weather degradation fault that causes the BMS to falsely report a lower SOC than actual, triggering the engine to start for charging despite the battery being at full capacity

B. The hybrid control module starts the engine to provide cabin heat via the conventional heater core, since the electric cabin heater's energy consumption would drastically reduce the vehicle's EV driving range in cold conditions

C. The engine starts to warm the catalytic converter to operating temperature, since cold-weather emissions regulations require the converter to reach light-off temperature within a specific time window after vehicle startup

D. The transmission requires warm fluid to operate correctly, and the engine must run to heat the transmission fluid through the engine's exhaust-to-transmission heat exchanger before EV mode can be safely engaged

122. A battery electric vehicle has a DTC for "HV Battery Cell Voltage Imbalance." The scan tool shows one cell module at 3.4V while all others are between 3.7V and 3.8V. What effect does this imbalanced cell have on the battery pack?

A. The imbalanced cell has no significant effect on overall pack performance because the BMS adjusts the charging algorithm to equalize all cells during each charge cycle, compensating for the voltage difference

B. The imbalanced cell forces the BMS to reduce the pack's maximum charge level, since the weak cell reaches full charge before the others, and the BMS must stop charging to protect the weakest cell from overcharging

C. The imbalanced cell causes the HV contactors to cycle on and off as the weak cell's voltage fluctuates, creating an intermittent loss of HV power that the driver perceives as a momentary hesitation during driving

D. The weak cell limits both the pack's maximum usable charge and its minimum discharge level — the BMS stops charging when the weak cell is full and stops discharging when the weak cell is empty, reducing total usable capacity

123. A customer asks how long a battery electric vehicle's HV battery will last before it needs replacement. What is the most accurate general answer?

- A. HV batteries in BEVs typically last 3-5 years before requiring replacement, similar to the replacement interval of a conventional 12V automotive battery in a non-electric vehicle application
- B. HV batteries in BEVs are designed to outlast the vehicle and will never require replacement under any normal driving conditions, temperature ranges, or charging patterns over the vehicle's entire service life
- C. Most BEV manufacturers design HV batteries for 8-15+ years of service life with gradual capacity loss, and many offer warranties covering 8-10 years or 160,000+ km for significant capacity degradation
- D. HV battery life is measured exclusively in charge cycles rather than years, and most batteries are rated for exactly 1,000 full charge cycles before requiring replacement regardless of the vehicle's age or mileage

124. A technician must remove the HV battery service disconnect plug on a hybrid vehicle as part of the de-energization procedure. After removing the plug, what must the technician do before touching any HV components?

- A. Wait the manufacturer-specified time for the inverter capacitors to discharge through their internal bleed-down resistors, then verify zero voltage at the HV terminals using a CAT III rated multimeter
- B. Immediately begin the HV component service, since removing the service disconnect plug instantly de-energizes all HV circuits and no waiting period or voltage verification is required after plug removal
- C. Connect a shorting bar across the HV battery pack terminals to rapidly discharge any remaining energy, ensuring the pack voltage drops to zero within seconds rather than waiting for the natural bleed-down period
- D. Reconnect the 12V auxiliary battery to power the BMS, which will command the HV contactors to open and actively discharge the inverter capacitors through the motor windings rather than through the passive resistors

125. A battery electric vehicle's total stopping distance is slightly shorter than an identical conventional vehicle at the same speed. What contributes to the BEV's shorter stopping distance?

- A. The BEV's tires are made from a softer compound than conventional vehicle tires, providing a higher coefficient of friction that reduces the stopping distance during both regenerative and friction braking

B. The BEV's regenerative braking provides an initial deceleration force the instant the driver lifts off the accelerator, beginning the speed reduction before the driver applies the friction brake pedal

C. The BEV's ABS system operates at a higher modulation frequency than conventional vehicles, providing more precise wheel speed control that maximizes the tire's braking traction during each ABS cycle

D. The BEV's heavier weight from the battery pack increases the normal force on the tires, providing more friction for braking that more than compensates for the additional momentum the heavier vehicle carries

Practice Exam 9: Answer Key and Explanations

1. D — A full 205-liter oil drum weighs approximately 180 kg — far beyond safe manual lifting or carrying limits. A drum dolly, hand truck, or drum cart is specifically designed to support the weight and provide controlled mobility. Rolling the drum on its edge risks losing control, and carrying it even with two people exceeds safe manual handling weight limits.

2. A — Disconnecting the negative cable first eliminates the ground return path. If the wrench contacts any grounded metal surface while removing the positive terminal, no short circuit occurs because the ground path is already broken. Disconnecting the positive cable first leaves the ground path intact, and any contact between the positive terminal wrench and the vehicle body creates a direct short.

3. C — Without functioning ventilation, exhaust gases — particularly carbon monoxide — accumulate rapidly in the enclosed shop space. CO is odorless and colorless, and concentrations can reach lethal levels within minutes in an unventilated enclosed building. No engines should be started or run inside the shop until the ventilation system is repaired or adequate alternative airflow is established.

4. B — A cheater bar multiplies the force applied to the wrench beyond its designed capacity. The wrench can fracture at the stress concentration point (typically the box end or handle bend), or the bolt can shear suddenly, causing the technician to lose balance and strike their hand or body against surrounding components. The sudden release of stored energy creates a significant injury risk.

5. D — A cracked windshield has internal stress concentration points at the crack tips. Thermal shock from hot sparks landing on cold glass causes rapid localized expansion at the impact point, propagating the existing cracks across the windshield. A crack that was previously repairable may become unrepairable or the entire windshield may fracture from the thermal stress event.

6. C — Concentrated sulfuric acid causes immediate severe damage to eyes, skin, and mucous membranes. Chemical splash goggles protect the eyes from splashes and mist, acid-resistant gloves protect the hands, and a face shield protects the face from larger splashes during pouring or handling. Standard safety glasses do not provide adequate seal against splashes from above or the sides.

7. A — CAN bus wires carry precise differential voltage signals with tight impedance requirements. Scotch-lock connectors pierce the wire insulation, potentially damaging the conductor, altering the circuit impedance at the tap point, and introducing a reflection point that disrupts the differential signal integrity. This can cause intermittent communication faults and U-codes across all modules on the affected bus.

8. B — The angular force from the scan tool pulling on the DLC connector can bend the internal pins that carry the CAN bus signals, power, and ground. Bent pins can create intermittent contact, short adjacent pins together (potentially shorting CAN-H to CAN-L), or crack the connector housing. The DLC should be inspected for pin damage before attempting any future scan tool connections.

9. D — Flammable storage cabinets are engineered with self-closing doors as a critical fire protection feature. The doors contain flammable vapors during normal storage and protect the cabinet's contents during a fire by maintaining the cabinet's fire resistance rating. Propping the doors open defeats both functions and violates NFPA and local fire code requirements.

10. A — With the coil, plug, and injector eliminated by swapping, and compression confirmed normal, the remaining cylinder-specific causes are intake or exhaust port restrictions. A stuck intake runner flap restricts the airflow into that specific cylinder, reducing the volumetric efficiency enough to cause incomplete combustion at idle and light load without reducing the static compression reading.

11. B — Valve springs that have lost tension from fatigue, heat cycling, or incorrect installed height allow the valves to "float" at high RPM — the cam lobe lifts the valve faster than the weakened spring can close it, causing the follower to momentarily separate from the cam. This valve float produces a ticking or rattling noise at high RPM that is absent at lower speeds where spring tension is adequate.

12. B — Eight months of storage allows moisture to condense inside the exhaust system, intake manifold, and combustion chambers from repeated temperature cycling. At startup, this accumulated moisture is heated and expelled as white steam from the exhaust. The rough running occurs as the cold engine burns off the moisture and the fuel system stabilizes its cold-start enrichment routine.

13. D — Black smoke at all operating conditions with adequate air supply and normal boost indicates excessive fuel delivery. Worn injector nozzle seats allow fuel to leak past the seating surface, incorrect injector opening pressure causes premature injection, and damaged nozzle tips produce poor spray patterns with large, poorly atomized fuel droplets that cannot burn completely in the available combustion time.

14. A — The propane enrichment test adds fuel to the intake. The RPM increase and STFT correction toward zero confirm the engine responded positively to the additional fuel — meaning the mixture was genuinely lean before the propane was added. This validates the P0171 code and the +22% LTFT as a real fuel deficit or unmetered air entry on bank 1, not a sensor or monitoring error.

15. B — Cleaning the intake valves removes the symptom but not the cause. The PCV system recirculates crankcase vapors (containing oil mist, blowby gases, and combustion byproducts) through the intake manifold past the intake valves. If the engine produces excessive blowby from worn rings, or the PCV system has a fault that increases vapor flow, the carbon precursors overwhelm the intake valves and reaccumulate rapidly.

16. C — At -15°C , fuel atomization is significantly degraded because the cold intake manifold and combustion chamber surfaces prevent the fuel droplets from fully vaporizing. The large, poorly atomized fuel droplets do not form a homogeneous air-fuel mixture, resulting in inconsistent combustion across all cylinders during the first 60 seconds until the manifold and combustion chambers warm enough to aid vaporization.

17. D — Standard smoke testing may not detect very small leaks at the test pressure. The EVAP system's onboard monitor uses a more sensitive method — either a vacuum decay test or a pressure decay test — that can detect smaller leaks than the smoke machine. Using the scan tool to run the onboard monitor and monitoring the pressure decay rate provides a more precise measurement of leak severity and confirms whether the leak is in the fuel tank itself.

18. A — Fuel pressure that is below specification during cranking but meets specification during running indicates the rail is losing its residual pressure during key-off periods. The high-pressure pump's internal check valve allows fuel to bleed back from the rail into the pump's low-pressure side during shutdown. Extended cranking is needed for the pump to rebuild pressure from zero before the injectors can deliver a combustible fuel charge.

19. C — A whistle or high-pitched whine that increases with boost pressure is the hallmark of pressurized air escaping through a small opening. A boost leak at a charge pipe connection, intercooler

hose clamp, or throttle body gasket allows compressed air to escape. The leak may be small enough that the turbocharger can compensate and maintain specification boost, but the escaping air produces the audible whistle.

20. B — The P0016 correlation code confirms the camshaft is out of its expected position relative to the crankshaft. Chain deflection of 12 mm (double the 6 mm specification) proves the chain has stretched — the elongated chain allows the camshaft sprocket to lag behind the crankshaft's rotational position. The tensioner has reached its maximum extension and can no longer compensate for the stretch.

21. D — The EGR valve opens when commanded (verified by testing) and the passages are clear (verified by inspection), but the DPFE sensor's voltage doesn't change between EGR-off and EGR-on conditions. A functional DPFE sensor would show a significant voltage change when EGR flow creates a pressure differential across its sampling orifice. The fixed voltage indicates the sensor has failed, or its sampling hoses are clogged, disconnected, or swapped.

22. A — Short-trip driving patterns prevent the engine oil from reaching the temperature (typically above 100°C) needed to evaporate fuel that accumulates in the crankcase from normal fuel wash past the piston rings during cold-start enrichment. Each short trip adds a small amount of fuel to the oil that never reaches the evaporation temperature, progressively diluting the oil between changes.

23. B — Three findings converge on a single diagnosis: low dry compression (75 psi vs. 145-150 normal), significant wet test improvement (75→135 psi, confirming the rings as the primary leak path), and air escaping at the oil fill cap during leak-down (confirming the air is leaking past the rings into the crankcase). All three tests consistently identify the piston rings as the failed component on cylinder 4.

24. D — Oil pressure that flickers the warning light at hot idle but recovers immediately above 1,000 RPM is the classic presentation of worn bearings with excessive clearance. At hot idle, the oil is at its thinnest viscosity and the pump is at its lowest output — the combination cannot maintain pressure against the leak-down rate through the enlarged bearing clearances. Higher RPM increases pump output enough to overcome the leak-down.

25. A — During deceleration, manifold vacuum is at its highest (throttle closed, engine spinning at road speed). An intake valve that doesn't seal completely allows the extreme vacuum to pull air and oil past the compromised seal during the deceleration phase. This disrupts the charge in that cylinder specifically during deceleration, producing the misfire that is absent at other operating conditions where vacuum is lower.

26. D — The SCR aftertreatment system has multiple components that can each cause a NO_x efficiency fault. The DEF injector may be clogged or its heater failed (preventing injection), the SCR catalyst substrate may be degraded (reducing conversion efficiency), or the NO_x sensors may have drifted from calibration (misreporting the conversion ratio). Each component must be systematically tested to identify the specific failure.

27. B — A cyclical RPM surge every 3-4 seconds at cruise with normal fuel trims and no DTCs suggests a periodic fuel vapor input. The EVAP purge valve opens cyclically as the ECM modulates the purge flow rate, and if the canister is heavily loaded with fuel vapor, each purge cycle introduces a rich slug of vapor into the intake that the engine burns as a momentary RPM increase.

28. C — A sensor reading 15°C when the actual temperature is 25°C means the ECM perceives the engine as 10°C colder than it actually is. The ECM will command slightly more cold-start enrichment and maintain it slightly longer than necessary, increasing fuel consumption and emissions during the warmup period. The offset affects every temperature-dependent calculation the ECM makes throughout the engine's operating range.

29. A — The sensor has been replaced (eliminating the sensor element itself). The code returns, indicating the fault is in the circuit rather than the sensor. The heater circuit wiring and connector between the ECM and the sensor must be tested for an open circuit, high resistance, corrosion, or physical damage that prevents the heater power or ground signal from reaching the new sensor's heater element.

30. D — An intermittent, unpredictable loss of boost that resolves with a restart is characteristic of VGT vane sticking from carbon and soot accumulation. The vanes intermittently bind in the fully open position (no boost), and the restart procedure cycles the actuator through its range, breaking the vanes free of the carbon deposits and restoring normal VGT function until they stick again.

31. B — Severe STFT oscillation during cold idle (+35% to -10%) indicates the ECM is aggressively chasing a mixture imbalance. The large positive swings represent the ECM adding substantial fuel to correct a lean condition, and the brief negative swings are momentary overcorrections. The 30-second resolution timeframe corresponds to the oxygen sensor reaching operating temperature and the closed-loop control stabilizing.

32. C — The ECM has no U-code for the TCM, which means the ECM is receiving the TCM's broadcast data on the CAN bus normally. If the TCM were completely offline, the ECM would store a U0101. The TCM is communicating on the bus but its diagnostic service function — the part that

responds to scan tool requests — has a fault or incompatibility that prevents the scan tool from establishing a diagnostic session.

33. A — Customer key programming procedures require precise timing and sequence — typically involving cycling the ignition a specific number of times within tight time windows, then pressing the fob button within seconds. The most common failure is the operator not executing the steps within the required timing or performing them out of sequence. The fob, immobilizer, and receiver are functional but the procedure wasn't followed correctly.

34. A — CAN bus communication uses error counters within each module's CAN controller. When a module detects excessive transmission errors (from bus noise, signal corruption, or its own faulty transceiver), its error counter increments. If the counter exceeds the "bus off" threshold, the module removes itself from the bus to prevent its erroneous transmissions from disrupting other modules' communication.

35. B — The remote start system performs safety checks before allowing the engine to remain running. A check engine light, low oil pressure indication, hood-ajar switch signal, or vehicle-in-gear indication triggers an automatic safety shutdown within seconds of starting. A faulty hood latch switch that falsely indicates "hood open" is one of the most common causes of immediate remote start shutdown.

36. C — The vehicle speed data on the CAN bus originates from the ABS module, which calculates speed from the wheel speed sensors. If the ABS module has an intermittent fault — a faulty internal processor, a corrupted speed calculation, or an erratic wheel speed sensor input — the corrupted speed data is broadcast on the CAN bus and the instrument cluster displays whatever erratic values it receives.

37. B — A dual-channel oscilloscope connected to CAN-H and CAN-L reveals the physical layer signal quality that no scan tool can access. It shows the actual voltage levels, the symmetry between CAN-H and CAN-L transitions, rise and fall times, signal ringing, noise, intermittent signal disruptions, and reflections from impedance mismatches — all of which are invisible to a scan tool that only processes decoded data.

38. C — The dashcam runs 24/7, drawing current from the battery continuously. Combined with the vehicle's normal module keep-alive draw, the total parasitic current exceeds the rate at which the battery can sustain itself during extended parking periods. Over time, the voltage drops below the BCM's threshold (typically 11.5–12.0V), and the BCM stores the low-voltage code during the overnight discharge period.

39. C — Indirect TPMS systems (no physical sensors in the wheels) use wheel speed comparisons from the ABS module to detect pressure differences. A low-pressure tire has a smaller rolling circumference and rotates faster than a properly inflated tire. After tire rotation, the baseline speed comparisons change. The TPMS reset procedure re-establishes the baseline speed ratios for the tires in their new positions.

40. B — The repair information lists all modules installed on this vehicle model. If the scan tool finds 35 of the expected 37, two modules are not responding. They may have lost power (blown fuse), lost their ground connection, have damaged CAN bus spur wiring, have unplugged connectors, or have failed internally. Each missing module must be investigated individually to determine why it cannot communicate.

41. D — The vibration from crossing a large expansion joint creates a brief wheel speed sensor signal disruption as the wheels pass over the gap. The ACC module monitors wheel speed for speed regulation, and the momentary signal disruption is interpreted as an abrupt speed change that triggers a protective disengagement. The system immediately re-engages once stable sensor signals return after clearing the joint.

42. A — Stop-start vehicles use AGM or EFB batteries with tighter voltage tolerance requirements during programming. The stop-start battery management system continuously monitors battery health and may interpret the sustained discharge during a long programming session as a battery fault condition, entering a protective mode that reduces the available voltage below the programming threshold, corrupting the update.

43. B — A parking sensor warning that appears only below 0°C and resolves at warmer temperatures points to a temperature-sensitive connection. A marginal wiring connection — corroded terminal, partially seated connector, or cracked solder joint — contracts further in cold temperatures, breaking electrical contact and triggering the fault. When the temperature rises, the metal expands enough to restore contact.

44. B — A vibration at exactly double the frequency of a lower vibration speed (40 and 80 km/h) is characteristic of a rotating component's harmonic. The half-shaft rotates at a speed that produces its fundamental balance vibration at 40 km/h, and the second harmonic of the same rotational frequency produces a vibration at 80 km/h. No other operating parameter changes between these two speeds to explain the double occurrence.

45. D — A vibration present under power (drive torque loading the U-joint) that disappears on coast (torque removed from the U-joint) indicates a U-joint with a tight or binding bearing cap. Under load,

the joint's rotational movement is resisted by the tight cap, creating a cyclic vibration with each revolution. On coast, the load direction reverses and the binding releases, allowing smooth rotation.

46. A — Consistent firm shift quality in all gears without DTCs indicates the line pressure is globally elevated above the normal calibration. A sticking electronic pressure control solenoid, a stuck main pressure regulator valve, or an incorrect adaptive pressure learning value can all cause the system to maintain higher-than-designed apply pressure, producing the uniformly firm shift feel across all transitions.

47. A — In neutral with the clutch engaged, the engine drives the input shaft, which drives the countershaft through the constant-mesh gear pair. The countershaft bearings support the spinning countershaft and all its gears. Worn countershaft bearings produce a growling noise proportional to input shaft speed. Pressing the clutch disconnects the input shaft from the engine, the countershaft coasts to a stop, and the noise ceases.

48. C — The incorrect coupling fluid was installed during the recent service. AWD couplings require a specific fluid formulation with friction modifier properties that allow the internal clutch pack to engage progressively without grabbing. Using the wrong fluid — even if it appears similar — eliminates the friction modifier chemistry, causing the clutch plates to alternate between grabbing and slipping during engagement.

49. A — A clutch pedal that slowly sinks under sustained pressure at the engagement point but returns to normal when released and repumped is the definitive symptom of a master cylinder internal seal bypass. The piston seal is worn and allows fluid to leak past the piston within the bore when steady pressure is applied. Releasing the pedal allows the piston to return and the seal to reseat temporarily.

50. D — A low-speed turning clunk from the front differential present in both 2WD and 4WD indicates the differential internals — not the 4WD engagement mechanism. Excessive ring-and-pinion backlash allows the gears to shift during the torque reversals that occur when the steering changes direction at full lock, producing the impact noise as the backlash gap is taken up with each direction change.

51. B — Some degree of low-speed launch hesitation is an inherent characteristic of dry dual-clutch transmissions (DCTs). The dry clutch must modulate between fully disengaged and fully engaged without the fluid coupling that smooths launches on conventional automatic transmissions. Software updates optimize the clutch engagement profile but cannot completely eliminate the mechanical limitation of dry clutch modulation.

52. C — The input/turbine speed sensor measures the speed of the torque converter turbine shaft (transmission input). The TCM compares this to the output speed sensor to calculate the actual gear ratio (confirming correct gear engagement), torque converter slip percentage (for TCC control), and optimal shift timing. Without the input speed sensor, the TCM loses its ability to verify gear engagement and manage TCC operation.

53. A — A single bang at initial startup results from the engine's first combustion impulse taking up accumulated driveline backlash. Overnight, the drivetrain components settle and the ring-and-pinion gear teeth rest with full backlash gap between them. The first firing event sends a sudden torque pulse through the driveline, and the backlash gap closes with a single impact that is audible as a loud bang.

54. D — A vibration during low-speed acceleration on a FWD vehicle felt through the steering wheel is the signature of a worn inner CV joint (tripod joint). The inner joint accommodates both plunge and angle changes under high torque loading during acceleration from a stop. The worn joint produces vibration that diminishes as speed increases and the torque demand decreases at cruising.

55. B — A small amount of fine metallic particles on the differential drain plug magnet is normal and expected. The magnet is specifically designed to attract and capture normal microscopic wear particles from the gear surfaces, preventing them from circulating through the gear mesh. As long as the particles are fine (powder-like) and the fluid is not discolored, this is normal wear debris collection.

56. D — P0751 indicates Shift Solenoid A has a performance fault — either mechanically stuck off (the plunger cannot move) or electrically faulted (open circuit or high resistance prevents the solenoid from energizing). Without Shift Solenoid A commanding the valve body, the hydraulic circuit cannot complete the 2-3 shift valve movement needed to direct fluid to the third-gear clutch apply circuit.

57. D — The output shaft bearing rotates whenever the vehicle is moving, regardless of gear selection (all gears connect through the output shaft), and regardless of clutch position (the output shaft is driven by the wheels, not the input shaft). Pressing the clutch stops the input shaft and countershaft but does not affect the output shaft, which continues spinning proportionally to vehicle speed.

58. A — A flashing 4WD indicator light that never becomes steady indicates the transfer case is attempting to engage but has not completed the shift. The shift motor is receiving the command and trying to move the mechanism, but something is preventing full engagement — the motor is weak, the synchronizer is worn, the shift mechanism is binding, or the actuator cannot overcome the speed mismatch.

59. A — ATF expands significantly when heated from ambient to operating temperature (approximately 70–100°C). A cold reading at the "Hot" mark means that when the fluid reaches operating temperature and expands, the level will rise above the "Full Hot" mark — an overfilled condition. Overfilled ATF causes foaming, aeration, erratic shifting, and potential seal damage from the increased internal pressure.

60. C — As the clutch disc friction material wears thinner, the pressure plate moves closer to the flywheel. Less release bearing travel is needed to disengage the thinner disc. This effectively raises the engagement point higher in the pedal arc — the clutch grabs closer to the top of the pedal travel because the decreased disc thickness requires less piston movement to separate the disc from the flywheel.

61. D — The scan tool commanded the headlamp relay directly, bypassing the BCM's control circuit. The headlamps illuminated, confirming the relay contacts, wiring to the headlamps, and the bulbs are all functional. The fault is upstream of the relay — in the BCM's command output to the relay coil, the BCM's input signals (headlamp switch, ambient light sensor), or the BCM's internal logic.

62. A — A conductance test measures the battery's internal plate condition. A fully charged battery (12.65V) that tests at 380 CCA against a 650 CCA rating has lost 42% of its cranking capacity from internal degradation — sulfation, plate shedding, or grid corrosion. The battery may start the engine in warm conditions but will likely fail during cold-weather cranking when the demand is highest.

63. C — A 30-minute vacuum hold at 29.9 inches of mercury without any decay confirms two things: the system is sealed (no leaks that would allow air to enter and break the vacuum), and the vacuum has boiled off moisture from the system (water boils at room temperature under deep vacuum). The system is ready to receive the specified weight of fresh refrigerant.

64. A — The battery tested good yesterday in warm conditions. Cold-morning slow cranking with a good battery and clean cables points to increased cranking resistance from the engine itself. Oil viscosity increases dramatically in cold temperatures — if the oil grade is too heavy for the ambient temperature, the thickened oil creates excessive resistance that the battery must overcome during cranking.

65. D — Equalized high-side and low-side pressures at 550 kPa with the compressor commanded on indicate the compressor is not creating a pressure differential. The compressor clutch engages (it was commanded on), but the compressor has an internal failure — a broken valve plate, a stripped clutch hub, a sheared drive shaft, or a seized mechanism — that prevents it from actually compressing refrigerant.

66. A — A cooling fan running in reverse pushes air forward through the heat exchangers instead of pulling air rearward through them. Reversed fan motor wiring polarity (swapped power and ground connections during a previous repair) causes the DC permanent-magnet motor to spin in the opposite direction from its design. Correcting the wiring polarity restores the correct rotational direction.

67. D — The window goes down easily (gravity assists) but stalls at the halfway point going up (against gravity). The motor can generate enough torque for the downward movement but not enough to push past a physical obstruction at the halfway point. Debris, a bent channel guide, or a pinched weatherstrip at the halfway position creates a resistance point that the weakening motor cannot overcome.

68. B — A voltage drop from 14.2V (no load) to 13.4V (heavy load) is within the normal acceptable range for a charging system under heavy electrical demand. As long as the voltage remains above 13.0V under maximum accessory load, the alternator is producing adequate output to both power the accessories and maintain the battery charge. Below 13.0V would indicate insufficient alternator capacity.

69. D — The clicking noise that occurs for approximately 5 seconds each time the temperature is adjusted is the blend door actuator's electric motor and gear train repositioning the blend door to the new temperature setting. The motor runs until the door reaches the commanded position, then stops. This is normal actuator operation — not a fault.

70. A — False forward collision warnings in clear weather with clean sensors point to a sensor alignment issue. A forward-facing camera or radar sensor that is slightly misaimed — even by 1-2 degrees from the vehicle's centerline — can detect roadside objects (signs, guardrails, bridge abutments, overpasses) as vehicles in the forward collision path, triggering false warnings.

71. B — The voltage drop specification is less than 0.5 volts per connection. The 0.3V connection passes (below 0.5V). The 0.7V connection fails (above 0.5V), indicating excessive resistance at that specific connection point. Only the 0.7V connection requires service — cleaning, tightening, or replacing the cable or terminal to reduce the resistance below the 0.5V threshold.

72. C — When a restriction exists in the liquid line, the refrigerant upstream of the restriction is under high pressure. The reduced flow through the restriction allows the refrigerant that does pass through to spend more time in the condenser, subcooling it well below its normal condensing temperature. The deeply subcooled liquid refrigerant makes the line feel abnormally cold to the touch upstream of the restriction.

73. D — The brake light switch was replaced but the lights stay on. The most common remaining cause is the switch adjustment — if the replacement switch is not positioned correctly on its mounting bracket relative to the brake pedal arm, the pedal may not push the switch plunger far enough to open the circuit when the pedal is released. Adjusting the switch position to match the pedal's released position resolves the continuous illumination.

74. A — An alternator that charges normally at idle and moderate RPM but drops below 13.0V at sustained high RPM has a voltage regulator fault. The regulator should increase field current to maintain output as electrical demand requires — it should never reduce output at higher RPM. A faulty regulator that limits field current at high speed produces the paradoxical drop in charging voltage.

75. B — Two separate circuits each drawing 150 mA indicates two independent faults. Each fused circuit must be investigated individually — disconnecting the components on each circuit one at a time to identify which specific component is drawing the excessive current. The two faults are likely unrelated, and each requires its own diagnosis and repair.

76. C — R-1234yf and R-134a require completely separate, dedicated service equipment. R-1234yf equipment has different service port fittings (to prevent cross-contamination), different recovery tanks, different hoses, and specific leak detection requirements. Using R-134a equipment on an R-1234yf system would contaminate both the equipment and the refrigerant, violating EPA/Environment Canada regulations.

77. A — Most automotive ECMs interpret an open IAT sensor circuit as -40°C . The open circuit produces maximum voltage at the ECM's analog input (the pull-up resistor voltage without the thermistor's voltage divider effect), and the ECM's calibration table maps this maximum voltage to the coldest temperature in its range — which is -40°C . This is a standard diagnostic indicator of an open sensor circuit.

78. D — "EPS motor circuit open" means no current can flow through the motor's power circuit. The fault is in the electrical path to the motor — either the motor's wiring harness connector is disconnected or damaged, or the motor's internal winding has an open break. The PSCM cannot drive the motor because the circuit is interrupted, resulting in complete loss of power assist.

79. B — A heated steering wheel uses a resistance heating element embedded in the wheel rim. If the element has an open circuit on the right side (from a broken conductor, a damaged connection, or a manufacturing defect), current cannot flow through that portion, and only the left side heats. The element is a continuous circuit that, when broken, stops heating from the break point outward.

80. C — In recirculation mode, the HVAC system closes the fresh air intake door and draws air exclusively from inside the vehicle cabin. This recirculated cabin air passes through the evaporator (for cooling) or the heater core (for heating) and returns to the cabin. Recirculation mode maximizes cooling efficiency because the system is re-cooling already-cooled air rather than continuously conditioning hot outside air.

81. D — A fixed 0.45V with no switching on an upstream oxygen sensor, combined with no drivability complaints, most likely indicates the ECM is in open-loop fuel control mode. During open-loop (cold start, WOT, certain operating conditions), the ECM does not use the O₂ sensor for fuel trim correction, so the sensor sits at its bias voltage (approximately 0.45V) without switching between rich and lean.

82. C — The defroster timer is designed for a 10-minute cycle, but the system shuts off after 3 minutes. A BCM software fault that limits the timer duration to an incorrect value is a documented concern on some vehicles. The manufacturer may have a software update that restores the correct 10-minute timer cycle. Without the update, the shortened cycle fails to clear the rear window effectively.

83. B — The fore-and-aft function works (confirming the seat wiring, BCM output, and switch signal are functional for that axis). The tilt function does not respond despite a correct switch signal. The tilt motor is a separate motor with its own wiring and drive mechanism. An open motor winding, a stripped gear in the tilt drive, or an open circuit in the tilt motor's specific wiring path is the most likely isolated fault.

84. C — The left front caliper piston not extending fully during braking reduces the braking force on the left side. The right front generates full braking force, creating an asymmetric braking force that pulls the vehicle toward the right (the side with stronger braking). A corroded or seized piston in the caliper bore physically prevents full extension, limiting pad-to-rotor contact and clamping force.

85. A — The sector shaft preload adjustment controls the mesh clearance between the worm gear and the sector shaft gear. Over-tightening eliminates all clearance and forces the teeth into constant contact, creating excessive friction that binds the steering at the center position. This prevents smooth steering wheel return-to-center and accelerates wear on both the worm gear and sector shaft surfaces.

86. D — An out-of-round drum (0.5 mm vs. 0.25 mm maximum specification) causes the shoe-to-drum contact to vary with each wheel revolution during braking. As the drum's high spots pass the shoes, the braking force increases momentarily; as the low spots pass, the force decreases. This produces a rhythmic pedal pulsation and potentially an audible rhythmic noise from the left rear during braking.

87. B — A dual-pinion EPS design separates the driver's mechanical input from the motor's electrical assist. The driver's pinion transmits the driver's steering feel directly from the column to the rack without any motor resistance in the path. The EPS motor drives a second pinion to apply assist force. This separation provides more natural steering feel because the motor's cogging and inertia do not affect the driver's tactile feedback.

88. C — The load index number specifies the maximum weight each tire can safely support at the maximum inflation pressure. A lower load index (89 vs. 95) means each tire is rated to carry less weight. If the vehicle's weight requires the load capacity of a 95-rated tire, installing 89-rated tires risks overloading them, which can cause tire failure, handling degradation, and accelerated wear.

89. D — A replacement ABS modulator is a generic unit that requires vehicle-specific programming to operate correctly. The module must be programmed with the vehicle's VIN, the wheel speed sensor configuration, the brake proportioning calibration, and the ABS intervention parameters specific to that vehicle's weight, wheelbase, and braking system. Without programming, the module cannot function and the warning light remains on.

90. A — Severe uneven pad wear on one caliper (2 mm inboard vs. 7 mm outboard) with even wear on the opposite caliper isolates the fault to the left front caliper's piston. The piston is not fully retracting between brake applications — a corroded bore or deteriorated seal keeps the inboard pad in partial contact with the rotor continuously. The outboard pad only contacts when the caliper floats during braking.

91. B — A failing TPMS sensor battery that transmits intermittently triggers the system malfunction indicator — a flashing TPMS light for approximately one minute after startup, then steady illumination. This is the standard TPMS malfunction indication pattern that distinguishes a system fault (flashing then steady) from a simple low-pressure condition (steady only). The sensor must be replaced.

92. B — Brake pedal pulsation without steering wheel vibration isolates the rotor DTV to the rear brakes. Front rotor DTV transmits vibration through the steering knuckle, tie rods, and rack to the steering wheel — producing both pedal and steering wheel vibration simultaneously. Rear rotor DTV only transmits through the hydraulic circuit to the pedal, since the rear brakes have no connection to the steering system.

93. D — Foamy power steering fluid with a groaning pump noise and correct fluid level indicates air intrusion into the suction side of the system. A cracked or loose suction hose, a deteriorated hose clamp,

or a failing pump shaft seal allows atmospheric air to be drawn into the pump's inlet. The air mixes with the fluid to produce foam, and the cavitation from the air creates the characteristic groaning pump noise.

94. A — A worn ball joint beyond specification is a safety-critical finding that directly affects the wheel alignment geometry. Performing an alignment on worn suspension components is counterproductive — the alignment will change as soon as the joint is replaced because the new joint's tighter fit alters the suspension geometry. The ball joint must be replaced first, then the alignment performed with all components in serviceable condition.

95. B — After replacing the yaw rate sensor, the new sensor must be initialized (calibrated) to establish its zero-point reference — the voltage output that corresponds to zero vehicle rotation. Without this calibration, the ESC module cannot accurately detect yaw (rotation) because it doesn't know what "straight ahead" looks like from the new sensor's signal. The initialization procedure is a required post-replacement step.

96. B — The shoulder area of the tire is outside the repairable zone defined by the Rubber Manufacturers Association and the Tire Industry Association. The shoulder is the transition zone where the tread belt package meets the sidewall cord structure. Punctures in this area compromise the structural integrity at this critical junction, and no repair method can reliably restore the tire's load-bearing capability at this location.

97. C — Even pad wear and correct adjustment on both sides eliminate the most common causes of brake pull. The next most likely cause is a drum that is out-of-round on one side, creating a varying contact pattern that produces different average braking force between the two rear wheels during application. Even slight out-of-round conditions can produce enough force asymmetry to cause a noticeable directional pull.

98. A — Dog-tracking (rear tracking offset from front) with a centered steering wheel indicates the rear axle is pointing in a different direction than the vehicle's geometric centerline. This is a thrust angle deviation — the rear wheels aim to one side, and the front wheels must be turned slightly to compensate, creating the visible offset between the front and rear wheel tracks during straight-line driving.

99. B — At 3.8% water content (above the 3.0% replacement threshold), the brake fluid's boiling point has dropped significantly. Glycol-based brake fluids are hygroscopic and their boiling point decreases proportionally with moisture content. During heavy or sustained braking, the fluid temperature at the caliper can reach the reduced boiling point, causing the fluid to vaporize. The vapor compresses under pedal pressure, producing a spongy pedal and dangerous brake fade.

100. C — A lower aspect ratio (40 vs. 45) means a shorter sidewall. The sidewall height drops from 110 mm (245×0.45) to 98 mm (245×0.40) — a 12 mm reduction per side, reducing the overall tire diameter by approximately 24 mm. The shorter sidewall provides quicker steering response and less sidewall flex, but the smaller diameter causes the speedometer to read higher than actual speed.

101. D — A seatbelt retractor that retracts slowly and fails the quick-pull lock test has a faulty internal mechanism. The retraction spring has weakened from age and the inertia locking mechanism is worn or contaminated — it can no longer respond quickly enough to lock the belt during a sudden deceleration event. The retractor assembly must be replaced to restore the seatbelt's crash protection function.

102. B — Wind noise after a windshield replacement that was not present before points to the installation quality. An incorrect adhesive application pattern, insufficient adhesive thickness, or a void in the adhesive bead creates a gap between the glass and the pinch weld. At highway speed, air is forced through this gap, producing the wind noise. The windshield must be resealed or reinstalled with the correct adhesive application.

103. C — Power liftgate gas struts (assist cylinders) are pressurized with nitrogen gas that provides the lift force. Over time, the gas charge leaks past the piston seal, and the struts lose their ability to assist the opening and hold the liftgate in the open position. Replacing the gas struts in pairs restores the lift assistance and hold-open force that supplements the power liftgate motor.

104. A — The horn chirp on lock is a configurable feature on many vehicles. It is typically enabled or disabled through the vehicle's infotainment settings menu, the driver information center, or the scan tool. A recent service visit where the BCM was accessed may have changed this setting. The feature is a user preference, not a fault, and can be easily toggled through the settings.

105. B — Modern automotive exterior door handles are typically made from plastic substrates with multiple plating layers (copper, nickel, chrome). Rechroming requires stripping all layers, which often damages the plastic substrate. The integrated mechanical components (pivot, spring, release mechanism) make reuse impractical. Replacement with a new handle assembly is more reliable and cost-effective.

106. D — When heavy cargo loads the rear, the vehicle's nose rises and the tail drops. This pitch change tilts the headlamp beam upward, potentially blinding oncoming drivers. The automatic leveling system detects the ride height change through the rear height sensor and commands the headlamp actuators to tilt the beam downward, compensating for the vehicle's loaded attitude and maintaining safe beam aim.

107. C — The HV battery cooling circuit's radiator is restricted or its cooling fan is inoperative. At 45°C (above the 35°C specification), the system cannot reject heat adequately. A restricted radiator (debris, internal deposits), a failed fan motor, or a blown fan fuse would all prevent adequate airflow through the cooling circuit's heat exchanger, allowing the coolant temperature to rise progressively.

108. A — Many modern vehicles require a 12V battery registration procedure after replacement. The battery management system needs to recalibrate its charging algorithm for the new battery's characteristics. Without this initialization, the hybrid control system may not authorize the HV contactors to close, preventing the vehicle from entering Ready mode despite having a fully charged new 12V battery installed.

109. B — The HV battery cooling circuit is a dedicated, independent system. Low coolant level from a leak, a failed electric coolant pump, air pockets blocking flow, or a restricted coolant passage would all reduce the flow rate below the BMS's required threshold. Each component must be checked individually to identify the specific cause of the insufficient cooling flow.

110. D — Vehicle-to-grid (V2G) technology allows the BEV's HV battery to discharge energy back into the electrical grid or a home's electrical system through a bidirectional charger. The vehicle becomes a mobile energy storage device capable of powering a home during outages, selling stored energy during peak demand, or providing grid stabilization services.

111. C — Parking sensor warnings appearing only below 0°C typically result from ice or condensation forming on the sensor face. Below freezing, moisture on the sensor surface freezes and physically blocks the ultrasonic signal, triggering the service warning. Once ambient temperature rises above freezing, the ice melts and normal sensor function resumes.

112. A — The seatbelt retractor's internal rewind spring has weakened from age, and the inertia lock mechanism is worn or contaminated. The slow retraction and failed quick-pull lock test confirm the retractor can no longer perform its safety function — it must be replaced with a new unit to restore proper belt tension and crash-protection locking capability.

113. B — After a windshield replacement, wind noise from an incorrect adhesive application is the most common installation-related complaint. An inadequate bead, void, or gap in the adhesive allows air to pass between the glass edge and the vehicle body at highway speed, producing the wind noise. The glass must be resealed with the correct adhesive pattern and thickness.

114. D — When heavy rear cargo loads the vehicle, the nose rises and the tail drops, tilting the headlamp beam upward. The automatic leveling system detects this attitude change through the rear height sensor and commands the headlamp actuators to tilt the beam downward, compensating for the vehicle's loaded posture and maintaining safe beam aim for oncoming traffic.

115. C — The HV battery cooling system's dedicated radiator is either restricted or its cooling fan is not operating, preventing adequate heat rejection. At 45°C after 30 minutes (above the 20-35°C specification), the system cannot remove heat fast enough. The radiator airflow (fan operation, radiator face cleanliness) and coolant flow (pump operation, passage restrictions) must be verified.

116. A — The horn-chirp-on-lock is a configurable convenience feature that can be enabled or disabled through the vehicle's settings menu, infotainment system, or the scan tool. It was likely changed during a recent service or a battery reset that restored default settings. The customer can disable it through the vehicle's settings or request the shop adjust it.

117. B — During regenerative braking, the electric motor operates as a generator, converting kinetic energy to electrical energy. However, this conversion is not 100% efficient — the motor's copper winding resistance, iron core losses, and inverter switching losses convert a significant portion of the recaptured kinetic energy into heat rather than stored electrical energy. This thermal loss in the motor and power electronics accounts for a substantial portion of the energy not captured by the regenerative system.

118. D — A heat pump uses the refrigeration cycle in reverse to extract thermal energy from outside air and transfer it into the cabin. This process moves existing heat rather than generating it from scratch, achieving a coefficient of performance of 2 to 3 — meaning it delivers 2 to 3 times more heat energy than the electrical energy it consumes. This dramatically reduces the battery energy required for cabin heating compared to a resistive heater.

119. A — The HV battery cooling system's dedicated radiator is restricted with debris, its electric cooling fan is not operating, or its coolant flow is reduced by a weak pump or restricted passage. At 45°C (above the 20–35°C specification), the system cannot reject heat adequately. The radiator face, cooling fan operation, coolant pump flow, and passage cleanliness must all be verified to identify the restriction.

120. C — Vehicle-to-grid (V2G) capability allows the BEV to discharge stored energy from its HV battery back into the electrical grid or a home's electrical system through a bidirectional charger. This

transforms the vehicle into a mobile energy storage device that can power a home during outages, reduce electricity costs by selling energy during peak rates, or participate in grid stabilization.

121. B — In cold weather, the cabin heater's energy draw from the HV battery would dramatically reduce the EV driving range. The hybrid control module starts the engine to provide cabin heat through the conventional heater core using the engine's waste heat — free thermal energy that would otherwise be wasted. This preserves the HV battery's stored energy for propulsion rather than consuming it for cabin heating.

122. D — A cell module at 3.4V while others read 3.7–3.8V limits the entire pack's usable range. The BMS must stop charging when the weak cell reaches its maximum voltage (it fills first), and must stop discharging when the weak cell reaches its minimum voltage (it empties first). Both the top and bottom of the usable SOC window are constrained by the weak cell, reducing the total usable capacity of the entire pack.

123. C — Most BEV manufacturers design their HV batteries for 8 to 15+ years of service life, with gradual capacity loss rather than sudden failure. Many manufacturers warrant the battery for 8 to 10 years or 160,000+ km against significant capacity degradation (typically below 70% of original capacity). Real-world data shows many batteries retain 80%+ capacity well beyond the warranty period.

124. A — After removing the HV service disconnect plug, the inverter's large capacitors still hold a potentially lethal charge. The technician must wait the manufacturer-specified time (typically 5 to 10 minutes) for the capacitors to discharge through their internal bleed-down resistors. After the wait period, the technician must verify zero voltage at the HV terminals using a CAT III rated multimeter before touching any HV component.

125. B — Regenerative braking begins decelerating the vehicle the instant the driver lifts off the accelerator pedal — before the brake pedal is applied. This pre-braking effect reduces the vehicle's speed before the driver initiates friction braking, effectively shortening the total stopping distance by adding a deceleration phase that conventional vehicles do not have during the driver's reaction time before braking.