

PRACTICE EXAM 5: RED SEAL AUTOMOTIVE SERVICE TECHNICIAN SIMULATION (125 QUESTIONS)

1. A technician is removing a catalytic converter from an exhaust system. The vehicle has been running and the converter is extremely hot. What is the primary hazard associated with handling the hot converter after removal?

A. The residual exhaust gases inside the converter are pressurized and will be released violently when the flanges are separated during the removal process

B. The ceramic substrate becomes brittle at operating temperature and shatters on impact, releasing hazardous ceramic dust particles into the shop breathing zone

C. The converter surface can exceed 500°C during normal operation, causing severe contact burns and potential fire if placed on or near combustible surfaces

D. The converter housing radiates ultraviolet light at operating temperature that can cause severe sunburn-like skin damage to the technician's exposed hands and arms

2. A technician discovers that a co-worker has been pouring used brake cleaner into the waste oil collection tank. What is the concern with this practice?

A. Mixing solvents with waste oil contaminates the oil, making it unsuitable for standard recycling and potentially creating a hazardous chemical reaction or flash fire risk

B. Brake cleaner evaporates on contact with oil and creates a pressurized gas buildup inside the sealed waste oil collection tank that can cause a tank rupture event

C. Used brake cleaner is classified as non-hazardous waste and should be disposed of through regular garbage rather than contaminating the waste oil recycling collection

D. Waste oil tanks are designed exclusively for petroleum products, and chlorinated solvents will chemically dissolve the polyethylene collection tank wall material

3. During a brake service, a technician uses compressed air to blow dust from the inside of a brake drum. What health hazard does this practice create?

- A. Compressed air drives metallic brake dust particles into skin pores, causing a severe allergic contact dermatitis reaction in technicians with nickel sensitivity from the pad material
- B. Compressed air dislodges corroded drum surface particles that become high-velocity projectiles capable of penetrating standard safety glasses at the working distance
- C. Brake dust becomes electrically charged by compressed air, creating a static ignition risk when the charged dust contacts residual brake fluid on the friction surfaces inside the drum
- D. Brake dust may contain hazardous particulate matter that becomes airborne when dispersed by compressed air, creating an inhalation hazard for the technician and nearby workers

4. What information does Section 11 of a Safety Data Sheet provide?

- A. The storage and handling requirements for the product, including maximum temperature ranges, incompatible chemicals, and recommended ventilation specifications
- B. The toxicological information about the product, including the routes of exposure, symptoms of acute and chronic exposure, and the known health effects on humans
- C. The regulatory information for the product, including the applicable federal, provincial, and international regulatory classifications and compliance requirements
- D. The transport information for the product, including the UN identification number, proper shipping name, hazard class, and packing group for domestic and international transport

5. A technician needs to use a bench grinder to sharpen a chisel. The tool rest on the grinder has a gap of approximately 15 mm between the rest and the grinding wheel face. What must be done before using the grinder?

- A. Adjust the tool rest to within 3 mm of the grinding wheel face to prevent the workpiece from being pulled into the gap between the rest and the spinning wheel

B. No adjustment is needed because the 15 mm gap is within the normal acceptable clearance range for bench grinder tool rests during standard shop grinding operations

C. Replace the grinding wheel with a new one because a 15 mm gap indicates the wheel has worn beyond its safe minimum diameter for continued use on this grinder

D. Remove the tool rest entirely and grind the chisel freehand, since a wide gap makes the tool rest more hazardous than operating the grinder without a rest in place

6. A vehicle has been involved in a collision and the front airbags deployed. The vehicle is being towed to the shop for assessment. What SRS-related hazard must be considered during handling?

A. The deployed airbag fabric retains a residual chemical charge from the sodium azide gas generator that causes severe skin burns on direct contact within 48 hours

B. The clockspring mechanism will violently rewind if the steering wheel is rotated, creating a trapping hazard for the technician's hands during vehicle handling and movement

C. The SRS backup capacitor retains a charge that could deploy any undeployed devices if the remaining circuits are disturbed during vehicle transport or initial shop handling

D. Undeployed modules in other locations still contain live pyrotechnic initiators that could deploy if the vehicle sustains additional impact during towing or if wiring is disturbed

7. A technician is tasked with removing a rusted fuel line fitting from a steel brake or fuel line. What is the correct tool to use?

A. A standard open-end wrench that contacts two flat surfaces of the fitting hex, providing adequate grip for loosening the rusted fitting from the line connection

B. An adjustable wrench tightened firmly to the fitting to provide maximum leverage and grip for breaking the corroded fitting free without specialized tools required

C. A flare nut wrench that wraps around five of the six hex surfaces, providing maximum grip while preventing the fitting from rounding during the removal attempt

D. Locking pliers clamped tightly onto the fitting after penetrating oil has soaked for thirty minutes, providing the strongest possible grip on the corroded fitting

8. A shop's exhaust extraction system has a damaged hose on one drop point. What is the primary concern with running an engine at that workstation without a functional extraction hose?

A. The unextracted exhaust gases will contaminate the shop's HVAC intake and be distributed throughout the building, causing unpleasant odors that affect customer satisfaction

B. Carbon monoxide and other toxic exhaust gases will accumulate in the enclosed shop space, creating a potentially lethal atmosphere for all workers in the building

C. The exhaust heat will raise the shop ambient temperature, causing the HVAC system to work harder and increasing the facility's energy consumption during the operating shift

D. The exhaust moisture will condense on cold vehicle surfaces and tools in the immediate area, creating a corrosion hazard for the shop's precision instruments and electronic equipment

9. A customer vehicle has a biohazard contamination — bodily fluids are present on interior surfaces. What precaution must the technician take before performing any work inside the vehicle?

A. Wear appropriate personal protective equipment including disposable gloves, eye protection, and potentially a face mask before contacting any interior surfaces of the vehicle

B. Refuse to work on the vehicle entirely and return it to the customer with instructions to have the interior professionally cleaned before returning the vehicle for service

C. Clean all affected surfaces using standard shop solvent and paper towels before beginning work, disposing of the contaminated cleaning materials in the regular shop waste container

D. Spray all affected areas with brake cleaner to disinfect and evaporate the biological material, since the strong solvent action eliminates all biological contaminants on contact

10. A V6 engine has a P0306 misfire code. The freeze frame shows the misfire at 2,200 RPM, 65% load, and 93°C coolant. The technician swaps the coil from cylinder 6 to cylinder 3. After one drive cycle, the misfire is now on cylinder 3. What is confirmed?

A. The spark plug on cylinder 6 has excessive electrode wear that prevents adequate spark formation, and the coil swap test does not isolate the plug from the coil fault

- B. The cylinder 6 fuel injector has a restricted spray pattern that was coincidentally disturbed by the connector removal during the coil swap, causing the misfire to appear to move
- C. A high-resistance connection in cylinder 6's coil harness is the root cause, and the coil swap temporarily improved the connection before it deteriorated again on the new cylinder
- D. The ignition coil originally installed on cylinder 6 is faulty — the misfire followed the coil to cylinder 3, confirming the coil as the failed component regardless of the cylinder position

11. A customer reports hesitation during moderate acceleration from cruising speed. The scan tool shows STFT jumping to +25% during hesitation, then returning to +3% at steady cruise. What does this transient fuel trim pattern indicate?

- A. The oxygen sensor has developed a slow response time that delays the ECM's correction during transient conditions, producing the overcorrection spike during acceleration events
- B. A lean condition occurs specifically during the acceleration transition — from a momentary fuel delivery shortfall, an unmeasured air leak that opens under load, or a fuel pump volume drop
- C. The throttle position sensor has a dead spot at the specific throttle opening corresponding to moderate acceleration, causing the ECM to miscalculate the base fuel for that throttle range
- D. The ECM's acceleration enrichment calibration is too aggressive for the current operating conditions, commanding excess fuel that the closed-loop correction must then subtract back out

12. An engine with dual VVT has timing chain rattle at cold startup that clears within 15 seconds. Oil changes are on schedule with the correct viscosity. What is the most likely cause?

- A. The chain tensioner's internal check valve is leaking down during shutdown periods, allowing the tensioner to retract and the chain to develop slack until oil pressure rebuilds at startup
- B. The VVT oil control valves are thermally contracted at cold temperatures, temporarily blocking oil flow to the tensioner circuit until the valves warm and expand to their operating clearance
- C. The timing chain has stretched beyond the tensioner's normal take-up range and requires replacement along with the tensioner, guides, and sprockets as a complete timing set

D. The oil filter anti-drain-back valve has failed, allowing the oil gallery that feeds the tensioner to drain during shutdown, starving the tensioner of immediate lubrication at each startup

13. A 2.0L turbocharged engine meets boost specification during WOT acceleration but drops 3 psi below specification during sustained boost at a constant 4,000 RPM. What is the most likely cause?

A. The wastegate actuator is opening prematurely during sustained operation because heat soak from the exhaust manifold is expanding the actuator's internal spring and reducing its holding force

B. The turbocharger's journal bearings are worn and the shaft wobble increases at sustained high speed, causing the compressor wheel to contact the housing and lose efficiency progressively

C. A small boost leak that the turbo can compensate for during brief WOT bursts (by spinning faster) becomes significant during sustained operation when the turbo cannot maintain the compensating speed

D. The intercooler's internal passages are accumulating condensation during sustained boost that partially blocks airflow, and the restriction builds progressively over the sustained boost period

14. A diesel engine produces white smoke at cold startup that transitions to clear exhaust within three minutes. The engine starts without difficulty and runs normally when warm. What does the cold-start white smoke indicate?

A. A minor coolant leak into the combustion chamber through a head gasket breach that seals itself as the engine and head gasket reach operating temperature from thermal expansion

B. Water condensation in the exhaust system that evaporates as the exhaust system heats up, producing visible steam that is commonly mistaken for combustion-related white smoke

C. The turbocharger oil seals leak when cold because the oil is thick and builds excessive pressure behind the seals, forcing oil past them into the exhaust until the oil thins at operating temperature

D. Incomplete combustion of diesel fuel in cylinders that have not yet reached adequate temperature for reliable ignition, producing unburned fuel vapor that appears as white smoke

15. A vehicle has long-term fuel trim of +12% on bank 1 and -2% on bank 2. What does this asymmetric bank-to-bank fuel trim pattern indicate?

- A. The MAF sensor is overreporting total engine airflow, causing the ECM to deliver excess fuel to both banks, with bank 1's correction more advanced than bank 2 due to sensor response lag
- B. A condition is causing bank 1 to run lean independently — such as a vacuum leak, exhaust leak near the O₂ sensor, or a weak injector on that bank — while bank 2 operates normally
- C. The catalytic converter on bank 1 has degraded, and the downstream O₂ sensor's feedback is erroneously influencing the upstream fuel trim correction algorithm through a software error
- D. Both banks have identical fuel delivery conditions, but the bank 1 upstream oxygen sensor has developed a voltage offset that creates a false lean indication to the ECM

16. A technician performs a cylinder power balance test on a four-cylinder engine at idle by disabling each injector individually. When injector 3 is disabled, RPM drops significantly less than when the other three are disabled. What does this indicate?

- A. Cylinder 3's fuel injector is delivering more fuel than the other three, and removing its contribution actually improves the overall air-fuel balance of the remaining three cylinders at idle
- B. The scan tool is not correctly disabling injector 3 due to a protocol mismatch between the scan tool software and the ECM's injector driver hardware for that specific output channel
- C. Cylinder 3 is contributing less power than the other cylinders due to a compression, fueling, or ignition fault, so disabling it has minimal impact on the engine's total output at idle
- D. Cylinder 3 is the weakest cylinder and already has such low combustion quality that the ECM has been progressively reducing its fuel delivery to prevent catalytic converter damage

17. A customer asks why their new GDI engine has intake valve carbon buildup while their older PFI engine never did. What is the correct explanation?

- A. GDI engines operate at higher compression ratios that produce more blowby gases, and the increased crankcase vapor volume overwhelms the PCV system's ability to keep valves clean
- B. GDI engines use a different combustion chemistry that produces carbon compounds with stronger molecular adhesion to valve surfaces compared to PFI combustion byproducts

C. PFI engines have higher exhaust gas recirculation rates that create a reducing atmosphere in the intake that chemically prevents carbon from adhering to the intake valve surfaces

D. PFI engines spray fuel into the intake ports, and the fuel continuously washes carbon deposits from the intake valve surfaces — GDI injects directly into the cylinder, so no fuel touches the valves

18. An engine oil analysis report shows elevated silicon levels in the oil sample. What is the most likely source of the silicon contamination?

A. Dirt and sand entering the engine through a compromised air filtration system — a torn filter element, loose intake duct connection, or missing air filter housing seal

B. The piston ring coatings contain silicon-based compounds that release silicon into the oil as the rings wear during normal high-mileage engine operation over extended service intervals

C. The engine coolant contains silicate corrosion inhibitors that are entering the oil through an internal leak path such as a failing head gasket or a breached internal oil-to-coolant heat exchanger

D. The motor oil formulation itself contains silicon-based anti-foam additives that concentrate as the oil ages between changes, producing the elevated readings on the analysis report

19. A returnless fuel system vehicle has steady +15% LTFT at all speeds and loads. The fuel pressure is ECM-controlled. What should be checked first?

A. The upstream oxygen sensors for contamination or slow response that would cause the ECM to calculate incorrect fuel trim corrections across the entire operating range of the engine

B. The actual fuel rail pressure with a mechanical gauge compared to the ECM's commanded pressure, to verify the fuel pressure control module is delivering the correct pressure to the rail

C. The mass airflow sensor calibration using the scan tool's calculated airflow versus the expected airflow for the engine displacement and RPM, to verify the sensor is reading within tolerance

D. The catalytic converter efficiency using the downstream oxygen sensor activity, since a degraded converter can cause the ECM to add fuel trim correction that mimics a fuel delivery problem

20. A vehicle with distributor ignition has a no-start after timing belt replacement. The engine cranks normally. Spark and fuel delivery are both confirmed. What is the most likely cause?

A. The distributor rotor has been installed 180 degrees out, directing the spark to the wrong cylinder during each firing event despite the crankshaft and camshaft marks being correctly aligned

B. The engine coolant temperature sensor is reading an incorrect temperature after being disturbed during the timing belt service, causing the ECM to command an incorrect cold-start fuel strategy

C. The new timing belt has a different tooth count than the original, causing the camshaft to advance or retard by several degrees relative to the crankshaft at all rotational positions

D. The timing marks on the crankshaft and camshaft were not correctly aligned during the belt installation, so the valve events are occurring at the wrong piston positions in the cycle

21. A vehicle has a P0302 code. Compression is normal on all cylinders. The plug, coil, and injector from cylinder 2 have been swapped to cylinder 4 — the misfire stays on cylinder 2. What possible causes remain?

A. A condition specific to cylinder 2's intake or exhaust port — such as an intake manifold gasket leak, a carbon-restricted runner, or an exhaust port obstruction — that reduces combustion efficiency

B. A faulty ECM output driver for the cylinder 2 injector circuit that prevents any injector installed in that position from receiving the correct electrical signal to fire at the proper pulse width

C. A stretched timing chain that has caused a slight valve timing deviation on cylinder 2 only, which would not be detected by a standard compression test but affects combustion at idle speed

D. A crankshaft reluctor wheel with a damaged tooth that generates a false misfire flag specifically for the cylinder 2 firing position without any actual combustion problem present in that cylinder

22. An engine has a P0301 misfire only under heavy load above 4,000 RPM. At idle and light load, the engine runs perfectly. What fault type is most consistent with this load-dependent pattern?

A. A fuel delivery fault that causes cylinder 1 to run lean specifically under the high-demand conditions of heavy load, such as a restricted fuel injector that cannot flow enough fuel at peak demand

B. A mechanical valve sealing issue on cylinder 1 that permits slight leakage under the extreme cylinder pressures of high-load, high-RPM operation but seals adequately at lower pressures

C. An ignition fault — a coil with degraded insulation or a plug with an excessively wide gap — that fires successfully under lower cylinder pressures but fails to bridge the gap under the higher pressures of heavy load

D. A camshaft position sensor signal dropout that occurs only at high RPM due to increased electromagnetic noise in the engine bay, causing the ECM to miscalculate cylinder 1's injection timing

23. A V8 engine has positive fuel trims on both banks at idle (+14% bank 1, +12% bank 2) that normalize at cruise (+2% and +1%). What single cause could produce this pattern?

A. Both upstream oxygen sensors have developed an identical lean bias from contamination, with the bias being more apparent at idle when the sensor's output voltage is near its minimum operating range

B. A vacuum leak at a component that feeds both banks centrally — such as the intake manifold gasket, brake booster hose, or PCV system — that is proportionally significant only at idle airflow

C. The fuel pump is producing marginally low pressure that causes lean conditions predominantly at idle, where the low rail pressure is insufficient to maintain accurate injector flow at short pulse widths

D. The EVAP purge valve is stuck closed, preventing fuel vapors from entering the intake at idle where the vacuum normally draws a significant volume of fuel vapor through the purge circuit

24. A diesel engine's forced regeneration via scan tool aborts after 30 seconds. What condition most commonly causes the regeneration to abort?

A. The ambient air temperature is below 0°C, and the ECM does not allow forced regeneration in freezing conditions because the condensation in the exhaust system could freeze and block the DPF

B. The engine oil level is below the minimum mark on the dipstick, and the ECM blocks all aftertreatment events until the oil level sensor confirms the oil is within the acceptable operating range

C. The transmission is in a gear other than park or neutral, and the ECM requires the vehicle to be stationary with the transmission in park before allowing a stationary forced regeneration cycle

D. A prerequisite condition is not met — such as coolant temperature below the minimum, DPF inlet temperature failing to reach the soot combustion threshold, or an active fault blocking the regen

25. A variable-geometry turbocharger (VGT) has its vane position stuck at 45% regardless of the ECM's commands. What drivability symptom would this produce?

A. Poor low-RPM torque because the vanes cannot close to accelerate exhaust flow at low engine speed, combined with potential overboost at high RPM where the partially closed vanes restrict flow insufficiently

B. Normal performance at all RPM because 45% vane position represents the mid-range design point that provides adequate boost across the entire engine speed range without any noticeable performance deficit

C. Excessive boost at all RPM because the 45% vane position is equivalent to the fully closed position that generates maximum exhaust velocity and drives the turbine at its maximum speed continuously

D. Complete loss of boost because the 45% vane position creates a full bypass of the turbine that allows all exhaust to flow around the turbine wheel rather than through it at any engine speed

26. A diesel engine has a rough idle after a cylinder 4 injector replacement. The new injector's calibration code has been programmed into the ECM. What else should be checked if the rough idle persists?

A. The fuel return line on cylinder 4 for a restriction that creates backpressure and prevents the new injector from closing cleanly between individual injection events during each cycle

B. The old injector's adaptive learned fuel correction data, which should be cleared after the replacement to prevent the ECM from applying the old injector's compensation values to the new one

C. The high-pressure fuel rail for a pressure drop when cylinder 4 fires, indicating the new injector has a higher flow rate than specified and is consuming more fuel than the rail can supply per injection event

D. The ECM's injector learned correction values from the old injector, which must be reset so the ECM can begin learning the new injector's delivery characteristics from baseline zero correction

27. A V6 engine has a P0172 (System Too Rich) code on bank 1 only. Long-term fuel trim on bank 1 is -20%. The technician performs a propane enrichment test and the RPM does not increase when propane is introduced near the intake manifold. What does the absence of RPM increase during the propane test confirm?

A. The engine is already operating at the stoichiometric limit on bank 1, and adding more fuel via propane cannot improve combustion because the oxygen supply is already fully consumed

B. The rich condition is genuine — the engine is already receiving excess fuel, so adding more fuel via propane does not improve combustion and may actually cause the RPM to decrease slightly

C. The propane enrichment test is not applicable to V6 engines because the propane distribution between banks is unequal and cannot provide a conclusive result for single-bank fuel trim diagnosis

D. The upstream oxygen sensor on bank 1 has failed in a fixed lean position, causing the ECM to add fuel despite the actual mixture being correct, and the propane test fails because the mixture is not actually lean

28. A vehicle has a P0401 code (EGR Insufficient Flow Detected). The EGR valve has been tested and opens correctly when commanded. What should be checked next?

A. The EGR cooler for a leak that is venting exhaust gas to the atmosphere before it reaches the intake manifold, reducing the volume of recirculated gas below the monitored threshold

B. The DPFE (differential pressure feedback EGR) sensor or its hoses for blockage or disconnection that prevents the sensor from accurately measuring the actual EGR flow volume

C. The EGR passages in the intake manifold for carbon buildup that restricts the exhaust gas flow even though the valve itself opens fully when commanded by the ECM during testing

D. The exhaust manifold for a crack near the EGR takeoff port that reduces the exhaust pressure available to drive gas through the EGR circuit when the valve opens during normal operation

29. A technician is checking fuel injector operation on a PFI system using a noid light. The noid light flashes on all injector connectors except cylinder 4. What does the absent noid light flash on cylinder 4 indicate?

- A. The ECM is not sending a pulse signal to the cylinder 4 injector — the fault is in the ECM's driver circuit, the wiring between the ECM and the injector, or the injector connector itself
- B. The cylinder 4 injector has an internal short that is immediately consuming the ECM's output signal before it can illuminate the noid light, indicating the injector must be replaced
- C. The noid light is defective and cannot detect the higher-frequency pulse used for cylinder 4's sequential injection event, which fires at a different timing than the other three cylinders
- D. The cylinder 4 injector has excessive internal resistance that limits the current flow below the noid light's illumination threshold, but the injector is still functioning and delivering fuel

30. An engine has a P0016 code (Crankshaft Position — Camshaft Position Correlation, Bank 1 Sensor A). The engine runs but has reduced power and a rough idle. What is the most common cause of this correlation code?

- A. A failed crankshaft position sensor that is reporting an incorrect crankshaft angle, causing the ECM to calculate a camshaft position error that does not actually exist in the mechanical system
- B. A stretched timing chain on bank 1 that has allowed the intake camshaft to retard beyond the expected correlation window relative to the crankshaft position, setting the correlation fault code
- C. A faulty camshaft position sensor on bank 1 that is reporting an incorrect camshaft angle while the actual mechanical timing between the crankshaft and camshaft remains within specification
- D. A worn camshaft lobe on the bank 1 intake camshaft that has reduced valve lift, altering the airflow pattern enough for the ECM to detect a correlation error between the expected and actual signals

31. An engine has an erratic idle speed that fluctuates between 550 and 1,100 RPM continuously. The LTFT is +8% and the scan tool shows IAC counts fluctuating wildly. What is the most likely cause?

- A. The idle air control valve is functioning correctly but the throttle body has a carbon buildup around the throttle plate that alternately blocks and unblocks the idle air passage as the plate oscillates
- B. The fuel pressure regulator has a ruptured diaphragm that allows fuel to be drawn directly into the intake manifold through the vacuum reference line, creating an intermittent rich condition

C. A vacuum leak exists that is large enough to upset idle control but intermittent in nature — such as a cracked vacuum hose, a loose PCV valve, or a leaking intake manifold gasket that opens and closes with thermal cycling

D. The MAP sensor is producing a noisy signal that oscillates randomly, causing the ECM to continuously recalculate the idle air target and create the hunting idle speed condition observed

32. A vehicle's instrument cluster intermittently goes completely dark for one to two seconds while driving, then returns to normal. No DTCs are stored. All other electrical systems continue to function normally during the blackout. What is the most likely cause?

A. The vehicle's CAN bus has an intermittent signal dropout that causes the instrument cluster to lose its data feed and display nothing until communication is reestablished on the network

B. The alternator has a failing rectifier diode that produces voltage spikes that momentarily overload the instrument cluster's internal voltage regulator and cause it to shut down protectively

C. The instrument cluster's internal power supply circuit has an intermittent fault that is not related to the CAN bus, since all other systems continue to operate normally during the blackout event

D. The instrument cluster has an intermittent power supply or ground connection fault at its harness connector, momentarily losing the voltage it needs to operate while all other circuits remain unaffected

33. A scan tool shows that a vehicle's TCM has a "Configuration Mismatch" fault after a PCM replacement. The new PCM has been programmed with the correct vehicle software. What additional step is likely needed?

A. The PCM must be returned to the dealer for exchange because configuration mismatch faults indicate the replacement module has a hardware incompatibility with the vehicle's network architecture

B. The TCM must be reconfigured or the vehicle identification data must be updated so that the new PCM and existing TCM recognize each other's identifiers and communicate compatible data formats

C. The TCM must be replaced simultaneously with the PCM because both modules are paired at the factory and cannot communicate with any module other than their original paired partner

D. The configuration mismatch will clear automatically after several ignition cycles as the two modules negotiate their communication parameters and establish a new synchronized data exchange

34. A vehicle has multiple DTCs across several modules, all set at approximately the same time. The battery was recently replaced. What is the most likely explanation?

A. The momentary loss of battery power during the replacement caused all modules to lose their keep-alive memory and power-on self-test data, generating fault codes during the subsequent power restoration

B. The new battery has a higher cold cranking amp rating than the original, and the increased available current has overwhelmed the sensitive inputs of multiple modules, triggering their overcurrent protection

C. The battery replacement was performed with the ignition in the accessory position, and the momentary voltage dip corrupted the active data streams being processed by modules that were powered on

D. The replacement battery has a manufacturing defect that produces voltage spikes above 16 volts during charging, and these spikes have damaged the input protection circuits of multiple vehicle modules

35. A technician needs to perform a TPMS sensor replacement on one wheel. After installing the new sensor, what procedure is required?

A. A TPMS relearn procedure must be performed to register the new sensor's unique identification code with the TPMS module so it correctly identifies which sensor is at which wheel position

B. The vehicle must be driven for at least 30 km at highway speed to allow the TPMS module to automatically detect and register the new sensor without any manual intervention by the technician

C. All four TPMS sensors must be replaced simultaneously because the TPMS module can only accept a complete set of four new sensor IDs during a single relearn event and cannot update one individually

D. The TPMS warning light must be manually reset using the instrument cluster's menu, and the new sensor will automatically sync during the next ignition cycle without a formal relearn procedure

36. A vehicle's backup camera displays a black screen when reverse is selected. The scan tool shows communication with the camera module is lost. All other features controlled by the same infotainment head unit work normally. What should be checked?

- A. The infotainment head unit's internal video processor for a fault that prevents it from switching to the camera input when the reverse signal is received from the transmission range sensor
- B. The camera's video output circuit for a fault that prevents the image signal from reaching the head unit, since the camera module is a separate component with its own power and signal connections
- C. The transmission range sensor for an incorrect signal that is not properly indicating reverse gear to the infotainment system, preventing the system from activating the camera input selection
- D. The backup camera module's power supply, ground, and communication wiring for a fault that prevents the camera from powering on or communicating with the head unit when reverse is selected

37. What does a LIN bus "checksum error" logged in a master module's diagnostic data indicate?

- A. The LIN master module has a software fault that is generating incorrect checksum values when transmitting data frames to the slave devices on the LIN sub-network
- B. A slave device on the LIN bus is transmitting corrupted data — the data frame arrives at the master but the calculated checksum does not match the transmitted checksum, indicating a data integrity error
- C. The LIN bus wiring has excessive capacitance from running parallel to a high-current power cable, causing signal distortion that corrupts the data frames during transmission between devices
- D. The LIN master module's clock crystal has drifted from the specified frequency, causing timing errors that prevent correct data frame assembly and produce checksum calculation mismatches

38. A vehicle has an intermittent "Service ESC" warning that appears randomly and clears after the ignition is cycled off and on. No DTCs are stored permanently. What diagnostic approach is most effective?

- A. Replace the ESC control module preemptively, since intermittent warnings with no stored DTCs indicate an internal module fault that cannot be diagnosed through conventional means
- B. Monitor the ESC system's live data during a test drive, specifically watching wheel speed sensor signals, yaw rate, and steering angle for any dropouts or erratic readings that correlate with the warning
- C. Perform a four-wheel alignment and check all tire pressures, since misalignment and uneven tire pressure are the most common causes of intermittent ESC warnings without stored fault codes

D. Update the ESC module software to the latest calibration, since intermittent warnings without DTCs are almost always caused by software glitches that manufacturers address in updated releases

39. A vehicle's remote start system activates the engine for the programmed 10-minute period but the climate control does not turn on during the remote start event. The climate control works normally when the driver is in the vehicle. What is the most likely cause?

A. The climate control module is not receiving the CAN bus message from the remote start module that signals it to activate, due to a communication fault between the two modules on the network

B. The remote start system was aftermarket-installed and does not have the integration wiring to the climate control module that is required for automatic HVAC activation during remote start events

C. The HVAC module requires a physical input from the ignition switch to activate, and the remote start system bypasses the physical switch by directly signaling the PCM without triggering HVAC operation

D. The remote start feature is programmed to activate the climate control only when the cabin temperature exceeds 35°C or falls below -10°C, and the current temperature is between those thresholds

40. A vehicle's scan tool shows that the ECM is in "Reduced Power Mode" with a DTC for an electronic throttle control fault. The accelerator pedal position sensors both read correctly on the scan tool data. What else could trigger the reduced power mode?

A. The throttle body motor or its position feedback sensor has a fault that prevents the ECM from accurately controlling or confirming the actual throttle plate position in response to driver input commands

B. The ECM's internal processor has detected a checksum error in its flash memory that indicates a partial calibration corruption, triggering a reduced power mode as a protective self-diagnostic response

C. The vehicle's battery voltage has dropped below the minimum threshold for the electronic throttle system's dual-redundant circuit to operate, and the ECM has entered reduced power until voltage recovers

D. The brake pedal position sensor is signaling a simultaneous brake-and-throttle application that the ECM interprets as a conflict, triggering reduced power mode to prevent unintended acceleration

41. A vehicle's key fob has been reprogrammed to the vehicle but the remote start function does not work. The lock and unlock functions work correctly from the fob. What is the most likely cause?

- A. The key fob battery is too weak to transmit the longer-range, higher-power remote start command, even though it has sufficient power for the shorter-range lock and unlock signal transmissions
- B. The vehicle's hood latch switch indicates the hood is open (possibly from a misadjusted switch), and the remote start system will not activate the engine while the hood status indicates it is ajar
- C. The remote start feature was not enabled during the key fob programming procedure — the lock, unlock, and remote start functions are programmed in separate steps and require individual activation
- D. The vehicle's battery is below the minimum state of charge required for the remote start system to activate the starter motor, so the system blocks the remote start command to prevent battery drain

42. What is the purpose of the "gateway" module on vehicles that use one?

- A. The gateway module provides internet connectivity to the vehicle's infotainment system by bridging the internal CAN bus network to an external cellular modem for over-the-air software updates
- B. The gateway module controls access between different CAN bus networks, translating messages between buses operating at different speeds and filtering which data each bus is allowed to receive
- C. The gateway module stores all diagnostic trouble codes from all modules in a centralized database that can be accessed from the OBD II DLC without requiring individual module communication
- D. The gateway module provides the master clock signal that synchronizes all module communication timing across the vehicle, ensuring all modules transmit their data frames at the correct intervals

43. A vehicle's blind spot monitoring system intermittently detects objects that are not present — the warning indicator activates when no vehicle is in the adjacent lane. The system uses radar sensors mounted in the rear bumper. What should be investigated?

- A. The radar sensors' detection sensitivity setting, which may have been increased above the default level during a previous service event and is now detecting road surface reflections as objects

B. The blind spot monitoring module's software version, which may contain a known calibration error that causes false detections under specific driving conditions that the manufacturer has addressed with an update

C. The vehicle's exhaust system for a leak near the rear bumper that produces hot gas turbulence in the radar sensor's detection zone, creating false reflections that the system interprets as nearby objects

D. The rear bumper cover for damage, misalignment, or aftermarket modification that has shifted the radar sensors' aim or introduced a reflective surface that creates false returns within the detection zone

44. A front-wheel-drive vehicle has a vibration during moderate acceleration that is felt through the steering wheel and disappears when the driver lifts off the throttle. The vibration is not present during coasting or braking. What is the most likely cause?

A. A worn or damaged inner CV joint on one of the half-shafts that produces vibration under the torque loading of acceleration but is unloaded and silent when the driver lifts off the throttle

B. A slipping drive belt on the accessory system that vibrates the power steering pump and transmits the vibration through the hydraulic fluid to the steering wheel during acceleration loading

C. An unbalanced front tire that produces vibration at the specific wheel speed achieved during moderate acceleration, which coincidentally occurs at the resonant frequency of the steering system

D. A worn engine mount on the transaxle side that allows the transaxle to shift under acceleration torque, changing the half-shaft angles and producing vibration that resolves when the load is released

45. A vehicle's automatic transmission has a flare during the 2-3 shift. Engine RPM increases approximately 500 RPM during the shift before the next gear engages. What does this flare indicate?

A. The engine is producing more torque than the transmission can absorb during the 2-3 shift, causing the engine to briefly accelerate before the next gear's clutch pack can clamp against the increased load

B. The torque converter clutch is engaging during the 2-3 shift and creating a momentary disconnect between the engine and transmission that allows the RPM to increase before reconnecting

C. A timing overlap problem where the releasing clutch (second gear) is releasing before the applying clutch (third gear) has fully engaged, creating a momentary neutral condition during the transition

D. The 2-3 shift solenoid is activating too quickly, causing the valve body to redirect fluid to the third-gear circuit before the second-gear circuit has fully exhausted, creating a hydraulic pressure conflict

46. A rear-wheel-drive truck with a two-piece drive shaft makes a cyclic vibration at highway speed. The technician measures the U-joint operating angles and finds the front section is operating at 4 degrees while the rear section operates at 1 degree. The manufacturer specifies that the operating angles between sections should be equal within 1 degree. What is the correction?

A. Replace the front U-joint with a double-cardan (CV) joint that can operate at 4 degrees without producing a vibration, eliminating the need to correct the angle difference between sections

B. Install shims under the transmission mount to raise the transmission tail shaft, reducing the front section angle while simultaneously increasing the rear section angle to equalize them

C. Rotate the drive shaft 180 degrees in its yoke to change the phase relationship of the front and rear U-joints, which cancels the speed variation caused by the unequal operating angles

D. Adjust the pinion angle at the rear differential using shims or tapered wedges under the leaf spring U-bolts to change the rear section angle until it matches the front section within specification

47. A manual transmission has difficulty engaging first gear from a stop. The clutch pedal feels normal, and the transmission shifts into all other gears smoothly including first gear while the vehicle is rolling. What is the most likely cause?

A. The clutch is not fully releasing, leaving the input shaft spinning slightly and preventing the unsynchronized first-gear engagement from meshing cleanly when the vehicle is completely stopped

B. The first gear synchronizer blocking ring is worn and cannot match the input shaft speed to the output shaft speed, causing grinding or difficulty during the engagement attempt from a stop

C. The transmission oil is too thick for the ambient temperature and is creating hydraulic drag on the input shaft that prevents it from decoupling from the gear train when the clutch is disengaged

D. The shift fork for the first-gear sliding sleeve is bent slightly, preventing it from pushing the sleeve far enough into full engagement with the first gear when shifting from the neutral position

48. A customer reports a "whirring" noise from the rear of their AWD vehicle that increases with vehicle speed and is present in all drive modes (2WD and AWD). What component is most likely the source?

A. The transfer case chain, which produces a speed-dependent whirring noise from chain stretch and wear that is independent of the AWD engagement mode since the chain always rotates

B. The rear differential ring and pinion gear set, which produces a speed-dependent whirring noise regardless of whether the AWD coupling is engaged or disengaged, since the rear wheels always drive the differential gears

C. The rear drive shaft center support bearing, which produces a speed-dependent whirring noise from bearing wear that is present whenever the rear wheels are rotating at any vehicle speed

D. The front differential, which produces a speed-dependent whirring noise that is transmitted through the vehicle structure from the front to the rear, making it appear to originate from the rear

49. A vehicle's automatic transmission has a P0741 code (Torque Converter Clutch Circuit Performance/Stuck Off). The TCC solenoid has been replaced but the code returns. What should be investigated next?

A. The TCC solenoid wiring and connector for intermittent open circuits or high resistance that prevents the solenoid from receiving adequate current despite the new solenoid being mechanically functional

B. The valve body for a stuck TCC apply valve or a worn bore that prevents the valve from moving to the TCC apply position even when the solenoid commands it, blocking hydraulic pressure to the TCC

C. The transmission fluid for contamination that is causing the TCC friction material to slip rather than lock, producing the "stuck off" condition — the clutch is applying but not holding under load

D. The torque converter itself, which is the component that actually locks up — the TCC apply piston or friction surface inside the converter may be worn or damaged, preventing lockup regardless of solenoid or valve body function

50. A dual-clutch transmission (DCT) has a shudder during slow-speed maneuvers in first gear. The shudder disappears in all higher gears. What is the most likely cause?

- A. The first-gear synchronizer blocking ring has worn and cannot maintain speed synchronization during the low-speed shifts, creating a vibration that is transmitted through the drivetrain as a shudder
- B. The transmission control module's first-gear clutch engagement calibration is not smooth enough for the vehicle's current operating conditions and may require a software update to improve modulation
- C. The differential within the DCT housing has a worn spider gear that allows unequal torque distribution to the half-shafts during low-speed turning, creating the shudder felt through the drivetrain
- D. The odd-numbered clutch (which controls first gear) has worn friction material that grabs and releases rather than engaging progressively during the high-demand low-speed modulation required in first gear

51. What is the function of the differential in a drive axle assembly?

- A. The differential multiplies the engine torque by a fixed ratio determined by the ring and pinion gear set, providing the mechanical advantage needed to accelerate the vehicle from a stop
- B. The differential changes the direction of power flow from the longitudinal drive shaft to the transverse axle shafts on a rear-wheel-drive vehicle through the right-angle ring and pinion gear set
- C. The differential allows the drive wheels to rotate at different speeds during turns while distributing torque to both wheels, preventing drivetrain bind and tire scrubbing during cornering
- D. The differential provides a neutral gear for coasting by disconnecting the axle shafts from the ring gear when the driver releases the throttle, reducing parasitic drag and improving fuel economy

52. A vehicle with a hydraulic clutch has a pedal that slowly sinks to the floor when held at the engagement point under steady pressure. When released and pressed again, the pedal returns to its normal height. What does this symptom indicate?

- A. The clutch disc is worn and the reduced thickness allows the pressure plate to bottom out against the flywheel, preventing the hydraulic system from maintaining a constant pedal position
- B. The clutch master cylinder has an internal seal bypass that allows fluid to leak past the piston under sustained pressure, causing the pedal to creep downward until the pressure is released

C. The clutch slave cylinder return spring has weakened, allowing the slave piston to slowly extend under the residual system pressure, pulling the pedal down through the hydraulic linkage

D. The pressure plate diaphragm spring is fatiguing and gradually collapsing under sustained load, allowing the release bearing to advance and the pedal to sink until the load is removed

53. A technician is replacing a clutch on a rear-wheel-drive vehicle. During disassembly, the flywheel friction surface shows a pattern of blue discoloration (heat spots) and fine cracks. What is the correct action?

A. Resurface or replace the flywheel before installing the new clutch — the heat damage has changed the metallurgical properties of the friction surface, and installing a new disc on a damaged surface will cause premature failure

B. Install the new clutch disc on the existing flywheel because the heat spots are superficial cosmetic marks that do not affect the friction surface's ability to grip the new clutch disc material

C. Replace the flywheel's friction surface ring only, since the ring gear and mounting flange are not affected by the heat damage and can be reused with a new friction ring pressed onto the assembly

D. Treat the flywheel surface with a friction-enhancing chemical compound that removes the heat discoloration and restores the surface's original friction coefficient for proper clutch disc engagement

54. A customer's AWD vehicle has a center differential with a viscous coupling. The customer reports that the vehicle does not pull equally from all four wheels on a loose gravel surface — the front wheels spin freely while the rear wheels receive little power. What is the most likely cause?

A. The viscous coupling is functioning normally because it requires a significant speed differential between front and rear to transfer torque, and the spinning front wheels have not created enough differential yet

B. The front differential has failed and is allowing both front wheels to spin without transmitting torque through the center differential to the rear axle, even though the center differential is functioning correctly

C. The viscous coupling fluid has degraded from age and heat, losing its ability to shear and transfer torque between the input and output shafts of the coupling when a speed differential exists

D. The transfer case shift motor has failed in the front-wheel-drive-only position and is not engaging the center differential's coupling mechanism that distributes torque to the rear axle drive shaft

55. A manual transmission makes a whining noise in fifth gear only. All other gears are quiet. What is the most likely cause?

A. The countershaft bearing nearest to the fifth gear set has worn, and the bearing noise is only audible in fifth gear because it is the most lightly loaded gear and produces less gear mesh noise to mask the bearing

B. The fifth gear set has worn or chipped teeth that produce a whining noise when those specific gears are meshed under load, while all other gear sets remain in good condition and mesh quietly

C. The fifth-gear synchronizer hub has a damaged spline that produces a whine as the output shaft rotates through the damaged section during each revolution in fifth gear engagement only

D. The transmission output seal is leaking and allows air to enter the transmission case, producing a whining noise from the air being drawn past the seal during the high rotational speed of fifth gear

56. A vehicle with an electronically controlled automatic transmission has a DTC for a pressure control solenoid stuck in the high-pressure position. What drivability symptoms would this produce?

A. The transmission would slip in all gears because the high line pressure would overwhelm the clutch apply circuits and blow past the accumulator pistons without controlling the apply rate

B. The transmission would not shift from first gear because the high line pressure would hold all shift valves in their default positions, preventing any shift from occurring during driving

C. The transmission would have no engagement in any gear because the high line pressure would hold the pressure regulator valve open, dumping all fluid back to the sump without pressurizing anything

D. The transmission would shift harshly in all gears because the excessive line pressure causes the clutch packs and bands to apply abruptly without the gradual pressure rise that cushions normal shifts

57. A four-wheel-drive truck has a vibration that occurs only at speeds between 60 and 80 km/h and only when the vehicle is in 4WD High. The vibration is absent in 2WD at all speeds. What is the most likely cause?

A. The front drive shaft operating angles are incorrect or the front drive shaft is out of balance, and the vibration only manifests when the front drive shaft is spinning under load in 4WD mode

B. The transfer case has an internal bearing fault that produces vibration only in the 4WD High range position due to the different gear loading and shaft alignment in that specific mode

C. The front differential pinion bearing is worn and produces vibration when the front drive shaft delivers torque through the pinion gear under the load conditions of 4WD engagement

D. The front tires are a slightly different size than the rear tires, and the speed differential between axles creates a vibration through the transfer case that is only present when both axles are connected

58. A conventional open differential in a rear-wheel-drive vehicle has one rear wheel spinning on ice while the other rear wheel remains stationary. Why does the spinning wheel receive all the torque?

A. The open differential's side gears are designed to deliver torque preferentially to the wheel with less traction, as a safety feature that prevents the stationary wheel from breaking traction and spinning

B. An open differential splits torque equally between both wheels — but the spinning wheel requires minimal torque to spin on ice, so both wheels receive equally low torque, and the stationary wheel simply cannot move with that limited force

C. The open differential's spider gears are binding from wear and cannot rotate freely, causing them to transfer all available torque to the spinning wheel rather than distributing it between both axle shafts

D. The ABS system is actively braking the stationary wheel to prevent it from spinning, and the differential is responding by sending all available torque to the unbraked spinning wheel on the ice surface

59. An electronically controlled automatic transmission shifts normally at light throttle but holds each gear approximately 1,000 RPM longer at heavy throttle before upshifting. Is this normal behavior?

A. No — the TCM should command shifts at the same RPM regardless of throttle position, and the extended shift points indicate a faulty throttle position sensor providing an incorrect load signal to the TCM

B. No — the extended shift points indicate the transmission line pressure is too high, causing the shift valves to require more governor pressure to overcome the throttle pressure before commanding the upshift

C. Yes — this is normal adaptive shift scheduling, where the TCM holds gears longer at heavier throttle to keep the engine in its power band for acceleration and shifts earlier at light throttle for economy

D. Yes — the extended shift points are caused by the torque converter clutch engaging at heavy throttle and preventing the transmission from upshifting until the TCC releases at the higher RPM threshold

60. A vehicle's transfer case has a leak at the front output shaft seal. The technician replaces the seal, but the leak returns within one week. What should be investigated?

A. The front output shaft's seal journal surface for wear grooves, scoring, or roughness that damages the new seal's lip and allows fluid to bypass the seal despite it being new and correctly installed

B. The transfer case vent for a blockage that creates internal pressure buildup during operation, forcing fluid past the new seal by overcoming the seal's lip pressure with positive internal case pressure

C. The front drive shaft yoke's surface finish for corrosion or scoring at the seal contact area that creates a channel for fluid to escape past the new seal's lip during shaft rotation under driving load

D. The transfer case fluid level, which may have been overfilled during the seal replacement, causing the excess fluid to be pushed past the seal by the rotating output shaft during normal operating conditions

61. A vehicle's power window on the driver's door operates sluggishly — it moves up and down but much more slowly than normal. The battery is fully charged and all other power windows operate at normal speed. What is the most likely cause?

A. The driver's window switch has high internal contact resistance that reduces the voltage reaching the window motor, limiting its speed to a fraction of normal operating rate

- B. The window regulator mechanism is binding from dried-out or contaminated lubrication, a bent track, or a worn cable that creates excessive mechanical resistance for the motor to overcome
- C. The BCM is intentionally limiting the current to the driver's window motor as a protective measure because it has detected an overcurrent condition in the motor's winding during previous operation
- D. The window glass has accumulated debris or adhesive residue in its channel guides that increases the friction resistance against the glass, slowing the window's travel speed in both directions

62. A vehicle's charging system produces 14.5 volts at the alternator output terminal but only 13.8 volts at the battery positive terminal. A voltage drop test across the charging circuit wire under load reads 0.7 volts. Is this voltage drop acceptable?

- A. Yes — the 0.7 volt drop is within the maximum acceptable range of 1.0 volt for the complete positive charging circuit from the alternator output to the battery positive terminal
- B. Yes — any voltage reaching the battery above 13.5 volts is adequate for charging, so the 0.7 volt drop has no practical impact on the battery's ability to accept a full charge from the alternator
- C. No — the maximum acceptable voltage drop for the entire positive charging circuit is 0.5 volts, and 0.7 volts indicates excessive resistance that must be located and repaired to prevent undercharging
- D. No — the maximum acceptable voltage drop for the positive charging circuit is 0.2 volts, and 0.7 volts represents a severe resistance problem that will prevent the battery from ever reaching full charge

63. A technician is testing a fuel pump circuit. The pump is commanded on by the ECM but runs slowly. Battery voltage is 12.6V. Voltage at the pump connector is 10.2V while the pump is running. What does this indicate?

- A. The fuel pump motor is worn internally and is drawing excessive current, which is pulling the voltage down at the connector due to the increased current flow through the normal circuit resistance
- B. The fuel pump relay's internal contacts are burned and have high resistance, dropping 2.4 volts across the relay before the remaining voltage reaches the pump motor through normal wiring
- C. Excessive resistance exists in the fuel pump circuit — in the relay contacts, wiring, connectors, or ground path — that is consuming 2.4 volts before the voltage reaches the pump motor

D. The ECM is intentionally commanding a reduced voltage to the fuel pump during the current operating condition to limit fuel delivery and prevent an overrich condition at the engine

64. A vehicle has intermittent electrical issues that correlate with the use of the air conditioning system. When the A/C compressor clutch engages, the headlamps dim noticeably and the radio briefly cuts out. What is the most likely cause?

A. A poor battery cable connection or ground strap that cannot support the additional current demand of the A/C compressor clutch without excessive voltage drop affecting all other circuits

B. The A/C compressor clutch relay has failed and is creating a momentary short to ground each time it engages, causing a system-wide voltage collapse until the short clears and the relay resets

C. The alternator is producing marginal output and the additional load of the A/C compressor clutch causes the system voltage to drop below the minimum operating threshold for all accessories

D. The A/C compressor clutch generates a large electromagnetic field when engaging that induces voltage spikes in the adjacent wiring, interfering with the headlamp and radio circuits directly

65. A vehicle's left rear brake light does not illuminate when the brake pedal is pressed, but the left rear turn signal and tail lamp work correctly at the same bulb socket. The bulb has dual filaments and has been replaced with a known-good unit. What should be checked?

A. The brake light switch at the brake pedal, since a switch fault would affect all brake lamps and not just the left rear — eliminating the switch and focusing on the left rear circuit specifically

B. The turn signal flasher module for a fault that is routing the brake light signal incorrectly through the turn signal circuit rather than through the dedicated brake lamp circuit to the left rear socket

C. The instrument cluster, which on some vehicles processes the brake light signal and redistributes it to each corner through the CAN bus, and a cluster fault could affect one corner independently

D. The brake lamp circuit supply wire and connector for the left rear lamp, since the turn signal and tail lamp filaments work on their separate circuits, proving the ground and socket are functional

66. A vehicle's engine cooling fans run at high speed continuously — even with the engine cold and the A/C off. What is the most likely cause?

A. The ECT sensor has failed or its wiring has shorted, sending a signal to the ECM that indicates the engine is overheating, causing the ECM to command maximum fan speed as a protective measure

B. The cooling fan relay has welded its contacts closed, providing continuous full power to the fan motors regardless of any ECM command or temperature condition on the vehicle's cooling system

C. The fan motor has a short in its control circuit, causing it to bypass the fan speed controller and receive full battery voltage directly through the shorted wiring to ground in the engine compartment

D. The A/C high-pressure switch is stuck in the closed position, signaling the fan control module to maintain high-speed fan operation as if the A/C head pressure is critically high and requires maximum airflow

67. A technician measures the resistance of a heated rear window defroster grid element. The manufacturer specifies the total grid resistance should be between 1.0 and 3.0 ohms. The technician measures 8.5 ohms. What does this high reading indicate?

A. One or more grid lines are broken, increasing the total circuit resistance because the current must flow through fewer parallel paths, which raises the overall resistance of the parallel grid network

B. The bus bar connections at the edges of the rear window have corroded, adding resistance at the connection points between the grid elements and the vehicle's defroster wiring harness

C. The rear window glass has developed a thermal crack that has broken the conductive grid elements internally within the glass, even though no crack is visible on the exterior surface

D. The defroster relay has internal resistance that is being included in the measurement because the technician is measuring from the wiring harness connector rather than directly at the grid terminals

68. A vehicle's heated seats work on the "high" setting but not on the "low" setting. What is the most likely cause?

- A. The heated seat control module has a faulty output transistor that can supply full power for the high setting but cannot modulate the PWM signal required for the reduced-power low setting
- B. The heated seat element has a partial open circuit that allows enough current to flow for noticeable heating on high but not enough temperature difference to be felt on the reduced-power low setting
- C. The heated seat switch has a faulty low-setting contact that does not complete the circuit for the low heating mode, while the high-setting contact functions correctly and provides full heating power
- D. The occupant weight sensor detects insufficient weight in the seat and limits the heated seat to high-only operation as a power management strategy to conserve battery energy for other systems

69. A vehicle's HVAC system blows warm air from the passenger side and cold air from the driver's side in a dual-zone system when both sides are set to the same temperature. What is the most likely cause?

- A. The heater core is partially plugged on the driver's side, preventing hot coolant from circulating through the driver's side half of the core and providing heat to that side of the cabin
- B. The passenger-side blend door actuator has failed in the heat position, delivering warm air regardless of the temperature setting, while the driver's side actuator is working correctly
- C. The HVAC control module has a calibration fault that reverses the temperature commands between the two zones, sending the heat command to the passenger side and the cool command to the driver
- D. The evaporator has a restriction on the passenger side that prevents the refrigerant from cooling the air on that side, causing the unrestricted airflow to bypass the evaporator and pass over the heater core

70. A vehicle's scan tool shows that the A/C high-side pressure is 2,400 kPa (350 psi) and the low-side pressure is 35 kPa (5 psi). The compressor is running. What does this extreme pressure differential indicate?

- A. The A/C system is severely overcharged with refrigerant, causing the compressor to generate excessive head pressure while the evaporator is flooded with liquid that raises the low-side pressure
- B. The condenser fan is inoperative, causing the high-side pressure to rise from inadequate heat rejection while the low-side drops from the reduced refrigerant flow caused by the restriction effect

C. The compressor has failed internally and is only partially compressing the refrigerant, allowing equalized pressures between the high and low sides that appear as both sides being near the same level

D. A restriction exists in the liquid line, receiver-drier, or expansion device that is preventing refrigerant from flowing from the high side to the low side, causing pressure to build on one side and starve the other

71. A technician is diagnosing an intermittent no-crank condition. When the fault occurs, the starter solenoid clicks once but the engine does not crank. Jumping the solenoid's high-current terminals directly with a remote starter switch causes the engine to crank normally. What does this confirm?

A. The starter motor is functioning normally and the battery has adequate power, but the solenoid's internal contact disc is burned or worn and cannot pass sufficient current to the motor when it engages

B. The battery has a weak cell that provides enough voltage to energize the solenoid coil and click it closed but cannot sustain the high current required for the starter motor to crank the engine

C. The starter motor has an intermittent armature winding fault that prevents it from drawing current through the solenoid's normal circuit but allows current flow when applied directly at the terminals

D. The solenoid's internal contact disc is functioning correctly, and the fault is in the battery cable connections that have high resistance limiting current flow during the solenoid's normal engagement

72. A vehicle's automatic climate control maintains the correct temperature on the driver's side but the passenger side is always cooler than the set temperature. There are no DTCs. What should be checked?

A. The passenger-side in-cabin temperature sensor for contamination or blockage that prevents it from accurately measuring the cabin air temperature near the passenger zone

B. The passenger-side blend door actuator for a calibration error that is positioning the door slightly too far toward the cool position, reducing the heat blend for the passenger zone

C. The passenger-side blend door actuator for a calibration error or mechanical restriction that prevents it from moving fully to the correct position, limiting the heat delivery to that zone

D. The heater core flow for a partial restriction on the passenger side that limits the coolant flow and heat transfer capacity available to warm the air directed to the passenger zone of the cabin

73. A vehicle's courtesy lights (dome light, map lights) stay on continuously after all doors are confirmed closed. The door jamb switches have been verified as functioning correctly. What is the most likely cause?

A. The BCM's theater dimming timer has malfunctioned and is keeping the courtesy lights at full brightness continuously instead of dimming them down to off after the programmed delay period

B. The headlamp switch has a separate courtesy light override position that the driver has inadvertently selected, commanding the BCM to illuminate the interior lights continuously regardless of door status

C. The courtesy light fuse has been replaced with a higher-amperage fuse that bypasses the BCM's control circuit and provides continuous power directly to the lights without module control capability

D. The instrument cluster dimmer wheel or knob has been rotated fully to the maximum position, which on many vehicles activates the interior courtesy lights to full brightness in the continuous-on override mode

74. A vehicle's A/C system has been recovered, evacuated, and recharged. The system cools well initially, but after 30 minutes of operation, the evaporator begins to freeze and airflow decreases significantly. What is the most likely cause?

A. The evaporator temperature sensor or cycling clutch switch is faulty and not cycling the compressor off before the evaporator surface reaches the freezing point, allowing ice to build on the fins

B. The A/C system is overcharged, and the excess refrigerant volume causes the evaporator to operate at a lower temperature than designed, producing ice buildup on the fin surfaces over time

C. The system was not properly evacuated and residual moisture is freezing at the expansion device, gradually restricting refrigerant flow and causing the evaporator to alternate between cooling and freeze-up

D. The cabin air filter is restricted, reducing the airflow across the evaporator and causing the surface temperature to drop below freezing because insufficient warm air is passing over the cold fins

75. A vehicle has an ADAS lane keep assist system that gently steers the vehicle back toward the lane center when the vehicle begins to drift. After a wheel alignment, the lane keep assist steers the vehicle slightly toward the right lane marker. What is the most likely cause?

A. The alignment changed the steering wheel center position, and the steering angle sensor has not been recalibrated to recognize the new center, causing the ADAS to misinterpret the vehicle's intended direction

B. The steering angle sensor was not recalibrated after the alignment, causing the ADAS system to misinterpret the vehicle's centered steering position as a slight turn, and it corrects toward what it believes is center

C. The right front tire has a slightly different rolling circumference than the left front after the alignment adjustment, causing the lane keep assist to detect a subtle drift and continuously correct toward the right

D. The forward camera's aim was disturbed when the technician accessed the alignment adjustment points and needs static recalibration to restore its correct detection of the lane markings and vehicle position

76. A vehicle has a starter that cranks the engine very slowly even though the battery has been tested and confirmed as fully charged and healthy. The battery cables have been cleaned and tightened. What should be checked next?

A. The starter motor's internal condition — worn brushes, a shorted armature, damaged field coils, or a seized bushing — which would cause high current draw and slow cranking despite a good battery and cables

B. The engine for a mechanical condition — such as excessive valve train preload, incorrect ignition timing, or hydrostatic lock — that is creating abnormal resistance to crankshaft rotation during cranking

C. The ignition switch for excessive resistance in the start circuit contacts that reduces the voltage reaching the starter solenoid, preventing full solenoid engagement and limiting current flow to the motor

D. The ECM for a fault in the anti-theft system that is intentionally limiting the starter motor's crank speed as a theft deterrent until the correct key or fob is detected by the immobilizer system

77. A technician connects an oscilloscope to an alternator's B+ terminal to check for AC ripple. The reading shows 1.8 volts AC with the engine running at 2,000 RPM. The specification is less than 0.5V AC. What does this indicate?

A. The alternator's output is within acceptable limits because the 1.8V AC reading is a normal characteristic of the three-phase rectification process at that specific RPM

- B. The voltage regulator is failing and allowing the field current to fluctuate, producing an output voltage variation that appears as AC ripple on the oscilloscope reading
- C. One or more rectifier diodes inside the alternator have failed, allowing AC to pass through the rectifier bridge unfiltered, producing the excessive AC ripple at the output terminal
- D. The serpentine belt is slipping on the alternator pulley, causing intermittent alternator output that the oscilloscope interprets as AC ripple due to the varying rotational speed of the rotor

78. A vehicle's cabin heater blows warm air when the vehicle is moving but the air temperature drops to ambient when the vehicle stops at a traffic light. What is the most likely cause?

- A. The water pump impeller has deteriorated and can only push adequate coolant flow through the heater core at higher engine RPM, losing flow at idle when the pump speed is at its lowest
- B. The thermostat is stuck partially open, allowing excessive coolant flow through the radiator at idle that cools the engine below the minimum temperature for effective heater core operation
- C. The heater core is partially restricted and requires the higher coolant flow rate produced at driving RPM to push adequate hot coolant through the narrow remaining passages in the core
- D. The heater core coolant flow is adequate at idle, but the blend door actuator is shifting position when the engine returns to idle RPM due to a vacuum-operated actuator losing its vacuum signal at idle

79. A vehicle's TPMS light illuminates steadily. The technician checks all four tires and finds the left rear at 22 psi while the others are at 35 psi. After inflating the left rear to 35 psi, the TPMS light remains on. What should be done?

- A. Replace the left rear TPMS sensor, since the low pressure condition has damaged the sensor's internal pressure transducer and it is now reporting an incorrect pressure to the module
- B. Drive the vehicle for several minutes above 25 km/h to allow the TPMS module to receive updated pressure data from the sensor, since many systems require driving to update their readings
- C. Perform a TPMS relearn procedure, since the system has lost the sensor identification data and cannot determine which sensor is reporting the corrected pressure from the left rear position

D. Replace the TPMS module, since the module has stored a permanent fault from the prolonged low-pressure condition that cannot be cleared by correcting the tire pressure alone

80. A vehicle's electric cooling fan does not activate when the coolant temperature reaches the fan activation threshold. The fan motor runs when 12 volts is applied directly to its terminals. What is the next diagnostic step?

A. Check the fan relay and the ECM's control signal to the relay, since the motor is proven functional and the fault is in the control circuit that commands the relay to energize at the correct temperature

B. Replace the coolant temperature sensor, since the fan motor is functional and the only remaining possibility is that the sensor is not reporting the correct temperature to the fan control circuit

C. Check the fan motor's ground connection for high resistance, since the motor ran on direct voltage but a high-resistance ground could prevent adequate current flow through the normal circuit

D. Replace the fan relay preemptively, since the relay is the most common failure point in the cooling fan circuit and the direct motor test confirms the motor is not the cause of the non-activation

81. A vehicle with a blind spot detection system has a warning light indicating the system is unavailable. The vehicle has rear bumper damage from a minor parking lot impact. What is the most likely cause?

A. The blind spot radar sensors are integrated into the rear bumper cover, and the bumper damage may have shifted their position or physically damaged them, preventing normal operation

B. The impact activated the vehicle's crash sensor, which disabled the blind spot system as a protective measure, and the system requires a crash sensor reset before it will reactivate

C. The rear bumper's paint has been chipped by the impact, and the bare metal surface creates radar reflections that interfere with the blind spot sensors' ability to detect adjacent vehicles

D. The blind spot detection system requires communication with the rear parking sensors, which were damaged in the impact, and the blind spot system cannot function without parking sensor input

82. A vehicle with push-button start will not start. The brake pedal is depressed, the dashboard displays "Key Detected," and the starter does not engage when the button is pressed. What should be checked?

- A. The starter relay for a fault that prevents it from closing the high-current circuit to the starter motor, since the key detection and brake input confirm the starting authorization is complete
- B. The brake light switch circuit for a secondary confirmation signal, since some vehicles use the brake light switch as an independent redundant verification that the brake is applied before allowing the start
- C. The battery terminals and cable connections for high resistance that allows enough current for the dash display and key detection but collapses when the starter demands high current at the push
- D. The shift interlock system for a fault in the park position sensor, since the vehicle must be in park or neutral for the starter to engage, and a sensor fault could prevent the start authorization

83. A vehicle has a check engine light with a P0443 code (EVAP Purge Control Valve Circuit). The scan tool can command the purge valve open and closed. When commanded open, the engine RPM drops slightly and stabilizes. When commanded closed, RPM returns to its original level. What does this operational test confirm?

- A. The purge valve and its electrical circuit are functioning correctly — the valve responds to commands and the RPM change confirms vapor flow when open — so the DTC may be intermittent or from a previous condition
- B. The purge valve is stuck open and the RPM drop when commanded open is actually the ECM compensating for the additional fuel vapor, not a response to the valve actually changing position
- C. The purge valve circuit has high resistance that triggers the DTC under normal ECM-controlled operation but functions when the scan tool commands it because the scan tool uses a different voltage level
- D. The charcoal canister is saturated with fuel vapors, and the RPM drop when the valve opens is from excessive fuel vapor being drawn into the intake, confirming a canister overload condition

84. A vehicle has uneven front tire wear — the left front shows inner-edge wear while the right front shows outer-edge wear. What does this asymmetric wear pattern indicate?

- A. Both tires have been driven significantly underinflated, but the left tire lost pressure from a slow leak while the right tire lost pressure from an impact that also damaged the wheel rim

B. The vehicle has a toe-out condition on the left and a toe-in condition on the right, likely caused by a bent steering component or unequal tie rod length that creates opposite toe angles

C. The left front has excessive negative camber while the right front has excessive positive camber, indicating a shifted subframe, bent component, or collision damage affecting the geometry asymmetrically

D. The vehicle has been driven exclusively on roads with a significant crown (center higher than edges), causing the left tire to carry more load on its inner edge and the right tire on its outer edge

85. A vehicle's power steering makes a groaning noise during tight turns and the steering effort increases slightly at full lock. The power steering fluid is at the correct level and shows no contamination. What is the most likely cause?

A. The power steering pump's internal pressure relief valve is opening at full lock, creating the noise and limiting pressure that the driver perceives as increased effort during tight turning maneuvers

B. The power steering rack has internal wear on the piston seal that allows fluid to bypass the piston at full lock, reducing the hydraulic assist and creating turbulence noise in the rack housing

C. The power steering hoses have developed internal deterioration that creates a restriction at full lock when the hose lining collapses under the increased pressure demand of tight turning conditions

D. The power steering pump is at the beginning of failure — the internal vanes or rotors are worn and cannot maintain adequate flow at the high-demand conditions of full steering lock turns

86. A brake rotor has been resurfaced (machined on a lathe). After installation, the brakes pulsate during the first few stops but the pulsation diminishes after several moderate stops and eventually disappears. What caused the initial pulsation?

A. The brake lathe was not properly calibrated and cut the rotor with a slight taper that seated itself against the pads during the first few brake applications and established full-contact alignment

B. The new rotor surface has microscopic lathe ridges that create uneven friction during the initial pad break-in period, and the ridges wear smooth during the first several brake applications

C. The rotor was installed on a hub with excessive runout, and the first few brake applications wore a new friction surface into the pads that conformed to the runout pattern and eliminated the pulsation

D. The brake pads need to transfer a thin layer of friction material onto the new rotor surface (pad material transfer), and the initial pulsation occurs until this transfer layer is evenly established across the rotor

87. A vehicle's steering wheel returns to center after a turn on its own but feels stiff and catches during the return. What is the most likely cause?

A. A worn or dry upper strut mount bearing that provides resistance to the steering return rotation, causing the catching or binding sensation as the strut assembly rotates during steering return

B. The power steering pump is producing excessive pressure that overcomes the natural caster return force and prevents the steering from returning smoothly to the center position after turns

C. The steering rack mounting bushings have deteriorated and the rack shifts position during the turn, then catches on the mounting bolts as it tries to return to its centered position with the steering

D. The steering column intermediate shaft universal joints are dry and need lubrication, creating a notchy feel as the joints rotate through their binding points during the steering return motion

88. During a four-wheel alignment, the technician discovers that the left front caster is $+2.0^\circ$ and the right front caster is $+5.5^\circ$. The specification is $+4.5^\circ$ to $+5.5^\circ$ with a maximum side-to-side difference of 0.5° . What symptom would this caster difference produce?

A. The vehicle will pull to the right because the side with more positive caster provides stronger self-centering force, pushing the vehicle away from the high-caster side toward the low-caster side

B. The vehicle will oversteer in left turns and understeer in right turns because the unequal caster changes the dynamic cornering characteristics differently for each turning direction

C. The vehicle will pull to the left (toward the side with less positive caster) because the reduced caster on the left creates less self-centering force, allowing the vehicle to drift in that direction

D. The steering wheel will be off-center to the right because the unequal caster creates different steering geometry angles that require a steering wheel offset to maintain straight-ahead tracking

89. A vehicle's ESC system activates the individual wheel brakes to correct oversteer during a turn. Which wheel or wheels does the ESC system brake to correct oversteer (a rear-end slide)?

- A. Both rear wheels simultaneously to slow the rear axle and allow it to regain traction through reduced rotational speed and weight transfer to the rear tires
- B. Both front wheels simultaneously to slow the vehicle and reduce the lateral forces that are causing the rear of the vehicle to slide outward during the cornering event
- C. The inside rear wheel to increase the drag on the inside of the turn and reduce the vehicle's yaw rate, helping straighten the vehicle's path of travel during the oversteer event
- D. The outside front wheel to create a yaw moment that counters the oversteer rotation, pulling the front of the vehicle toward the outside of the turn and straightening the vehicle's path

90. A tire has been repaired with a plug from the outside without demounting the tire. The customer asks if this is an acceptable permanent repair. What is the correct answer?

- A. Yes — external plugs are an industry-accepted permanent repair method for tread punctures when installed correctly with vulcanizing cement and allowed to cure before the tire is reinflated to pressure
- B. No — the only industry-accepted permanent repair is an internal patch-plug combination installed from the inside of the tire after the tire is demounted and the interior is inspected for hidden damage
- C. Yes — external plugs are acceptable for temporary use only up to 30 days, after which the tire must be demounted for a permanent internal repair or replaced with a new tire for continued service
- D. No — any tire that has been punctured must be replaced regardless of the repair method used, since the structural integrity of the carcass has been compromised by the nail or screw penetration

91. A vehicle with hydraulic power steering has a steering wheel that vibrates at idle but smooths out above 1,000 RPM. The vibration is felt only in the steering wheel and not in the vehicle body. What is the most likely cause?

- A. The engine idle speed is too low and allows the engine's combustion pulses to be transmitted through the accessory drive belt to the power steering pump, creating a pulsation in the hydraulic circuit

B. The power steering pump has worn internal components that produce a pulsating flow at low RPM, transmitted through the hydraulic fluid to the steering gear and felt as vibration in the steering wheel

C. The power steering pump is cavitating from a restricted inlet hose that collapses at idle vacuum and recovers at higher RPM when pump flow demand increases and the hose reinflates from internal pressure

D. The serpentine belt tensioner is weak and allows belt slippage at idle that transmits a vibration through the power steering pump pulley, and the increased belt tension at higher RPM eliminates the slip

92. A vehicle has a tire blowout on the right front at highway speed. What is the safest driver response?

A. Maintain a firm grip on the steering wheel, gradually ease off the accelerator without hard braking, and allow the vehicle to slow progressively while steering gently to a safe stopping area

B. Apply the brakes firmly and immediately to bring the vehicle to a stop as quickly as possible before the damaged tire causes the vehicle to lose directional control on the highway surface

C. Immediately steer to the right shoulder while accelerating slightly to compensate for the drag from the flat tire that is pulling the vehicle to the right and slowing it below a safe highway speed

D. Shift the transmission to neutral immediately to disconnect the engine from the drivetrain, then coast to a stop using the steering to maintain control without any braking input from the driver

93. A vehicle has a front brake caliper that is not releasing fully after the brake pedal is released. The caliper slides freely on its pins. What could cause the piston not to retract?

A. The brake pads are the incorrect type for this caliper and are slightly oversized, preventing them from moving away from the rotor surface even when the caliper piston fully retracts

B. The master cylinder's compensating port is blocked by debris or a swollen piston seal, preventing the fluid from returning to the reservoir and trapping pressure in the caliper circuit

C. The caliper piston itself is seized in the bore from corrosion behind the piston, preventing it from retracting into the bore when the brake pedal is released and hydraulic pressure drops to zero

D. The caliper piston seal (square-cut seal) has lost its ability to retract the piston due to deterioration or incorrect installation, and the brake pedal residual pressure is holding the piston extended

94. A vehicle's anti-lock braking system has a DTC for the right front wheel speed sensor. The sensor has been tested and reads correct resistance. What else should be inspected?

A. The ABS hydraulic control unit for a faulty internal solenoid on the right front channel that is creating a false signal interpreted by the module as a sensor fault during self-test diagnostics

B. The tone ring (reluctor ring) for the right front wheel speed sensor for damaged, missing, or contaminated teeth, and the sensor air gap for debris or incorrect spacing that affects signal quality

C. The ABS module's internal wiring harness for a connection fault between the sensor input pin and the signal processing circuit, which would cause the module to report a sensor fault despite correct resistance

D. The brake rotor for runout that is interfering with the tone ring signal by creating a variable air gap as the rotor wobbles past the sensor, producing an erratic signal the module interprets as a sensor fault

95. A customer reports that the vehicle pulls to the right during hard braking but tracks straight during normal driving and light braking. What is the most likely cause?

A. The right front tire has a higher coefficient of friction than the left, causing it to generate more braking force than the left side during hard braking when the traction differential becomes significant

B. The left front caliper has a leaking piston seal that can maintain adequate pressure for light braking but cannot hold pressure during the higher hydraulic demand of hard braking, reducing left braking force

C. The left front brake caliper's piston is partially seized and cannot fully extend under the higher hydraulic pressure of hard braking, limiting the braking force on the left side during hard stops only

D. The front brake proportioning circuit has a fault that reduces the left front brake pressure during hard braking while maintaining correct pressure distribution during normal and light braking events

96. A tire rotation is being performed on a vehicle with directional tires. What restriction applies to directional tires during rotation?

- A. Directional tires can only be rotated front-to-rear on the same side of the vehicle — they cannot be crossed to the opposite side without demounting and remounting them in the reverse direction
- B. Directional tires cannot be rotated at all and must remain on their original wheel position for the entire life of the tire, with the only wear equalization coming from occasional alignment adjustments
- C. Directional tires can be rotated in any pattern as long as the vehicle's alignment is checked after the rotation to compensate for the changed tread pattern direction on each corner of the vehicle
- D. Directional tires can only be rotated between the front and rear axles as complete axle sets, swapping both front tires to the rear and both rear tires to the front simultaneously without crossing sides

97. A vehicle's brake fluid reservoir level has dropped noticeably below the full mark over a six-month period. There are no visible external leaks. The brake pads have been recently inspected and show moderate wear. What is the most likely explanation?

- A. The brake fluid level drops naturally as the brake caliper pistons extend further to compensate for pad wear, displacing fluid from the reservoir into the caliper bores behind the pistons
- B. The brake fluid has evaporated from the reservoir due to the heat generated by normal braking, and the level should be topped up with fresh fluid to restore the correct level for safe operation
- C. The master cylinder has a slow internal bypass leak that is displacing fluid from the primary to the secondary chamber, causing the level in the reservoir to drop without any external fluid loss
- D. The brake fluid has absorbed moisture and the increased water content has reduced the fluid volume through chemical reaction, causing the level to drop proportionally with the moisture absorption

98. A vehicle has a vibration that is present at all speeds and is felt through both the steering wheel and the seat. Balancing all four wheels does not resolve the vibration. What should be checked?

- A. The engine and transmission mounts for deterioration that allows drivetrain vibration to transmit into the vehicle body at all speeds through the mount connection points to the subframe and body
- B. The exhaust system for a contact point with the vehicle body or subframe that transmits exhaust vibration into the passenger compartment structure at all rotational frequencies during driving

C. A tire or wheel with excessive radial or lateral runout that produces vibration at all speeds, since a tire with a defective internal belt or a bent wheel will vibrate regardless of how well it is balanced

D. The CV joints for wear that produces a constant vibration at all speeds rather than the typical clicking pattern, indicating the joint has progressed past the clicking stage into full vibration failure

99. A customer reports that the steering wheel is off-center to the left but the vehicle tracks straight on a level road. What is the most likely cause?

A. The steering gear is mounted off-center on the subframe, causing the rack to rest in an asymmetric position that displaces the steering wheel from its intended center position during straight driving

B. The total front toe is correct (allowing straight tracking) but was set with the steering wheel off-center — one side has more toe-in and the other less, totaling the correct combined value but unequally distributed

C. The rear thrust angle is misaligned, causing the vehicle to compensate by tracking with the front wheels slightly turned to maintain a straight path, which positions the steering wheel off-center

D. The power steering gear has an internal asymmetric assist condition that provides more pressure in one direction, rotating the steering wheel off-center during the constant straight-ahead assist application

100. A vehicle's brake pad wear sensor has triggered the brake wear warning light on the dashboard. The brake pads are measured at 3 mm thickness. The minimum specification is 2 mm. What is the correct action?

A. Replace the brake pads and the wear sensor, because the wear sensor is a single-use component that triggers when the pad wears to the sensor contact point and must be replaced with each pad change

B. Acknowledge the warning and schedule a pad replacement for the customer's next service visit within 5,000 km, since the pads are above the minimum thickness and have remaining service life available

C. Reset the wear sensor by removing and reinstalling it in the new pad, since wear sensors are reusable components designed to trigger at the contact point and reset when reinstalled in a fresh pad

D. Disconnect the wear sensor and clear the warning light, since the sensor has served its purpose of alerting the driver to the impending need for service and will not provide additional useful information

101. A vehicle's front passenger seat occupant detection system has a fault that keeps the airbag status indicator showing "PASSENGER AIRBAG OFF" even when an adult is seated. What is the safety implication?

- A. There is no safety concern because the driver's airbag and all other supplemental restraints remain fully functional and the passenger is still protected by the seatbelt and side curtain airbags
- B. The passenger will receive enhanced airbag protection because the "OFF" status causes the system to deploy a reduced-force deployment that is actually safer for average-sized adult occupants
- C. The fault must be diagnosed immediately because the passenger airbag may deploy unexpectedly with full force regardless of what the indicator shows, creating a risk of injury from an unannounced deployment
- D. The front passenger airbag will not deploy in a frontal collision, leaving the passenger with significantly reduced crash protection compared to a properly functioning dual-airbag restraint system

102. A vehicle's power sunroof moves to the open position but will not close using the switch. The technician can close the sunroof using the scan tool's bi-directional control function. What is the most likely cause?

- A. The sunroof motor is weakening and can generate enough force to open (gravity assists the opening motion on tilting sunroofs) but not enough force to close against the seal resistance
- B. The sunroof track has debris that blocks the closing travel but not the opening travel, and the scan tool command overrides the anti-pinch detection that would otherwise stop the motor during normal operation
- C. The sunroof switch has a faulty close-direction contact that does not complete the circuit for the close command, while the open-direction contact functions correctly and sends the open command properly
- D. The sunroof control module has a calibration error in the close-direction travel that prevents it from closing via the switch, but the scan tool bypasses this calibration and commands the motor directly

103. A vehicle has a water leak into the driver's footwell. The leak occurs during rain and car washes. There is no sunroof. What is a common source of water intrusion in this location?

- A. The door weatherstrip seal at the base of the A-pillar has deteriorated, allowing rainwater to enter at the door jamb and flow down the interior panel into the footwell below the dashboard area
- B. The fresh air intake plenum drain at the base of the windshield is blocked with debris, causing water to pool in the plenum and overflow into the HVAC case, which drains into the footwell area
- C. The brake master cylinder has a slow external leak that allows fluid to seep into the firewall pass-through grommet and drip into the driver's footwell, where it pools and is mistaken for rainwater
- D. The steering column pass-through seal in the firewall has deteriorated, allowing rainwater that enters the engine bay through the fresh air intake to flow through the column opening into the footwell

104. A vehicle's automatic headlamp leveling system has a DTC indicating the right rear height sensor has failed. What will the headlamp leveling system do with this fault?

- A. The system will default the headlamps to their lowest beam position to prevent glare for oncoming drivers, since it cannot determine the vehicle's actual attitude without the rear height sensor input
- B. The system will maintain the headlamps at their last known correct position and will not adjust them based on vehicle load or attitude changes until the sensor is replaced and the system is recalibrated
- C. The system will switch to a fixed headlamp position based on the vehicle's unladen ride height specification stored in the module's memory, providing approximate but not dynamically adjusted leveling
- D. The system will continue to operate normally using the remaining height sensors to calculate the vehicle's attitude, compensating for the lost sensor with an algorithm that estimates the missing value

105. A customer's keyless entry system intermittently fails to lock all four doors simultaneously — sometimes only two or three doors lock when the fob button is pressed. What should be investigated?

- A. The key fob battery for insufficient output that limits the signal strength, causing only the closest door lock actuators to receive the command while the more distant ones fail to detect the weakened signal
- B. The BCM's antenna system for a fault that intermittently reduces the signal reception strength, causing the BCM to process only a partial lock command that reaches some but not all door actuators

C. The individual door lock actuators for intermittent electrical faults, worn motors, or corroded connectors that prevent them from responding to the lock command consistently on every activation attempt

D. The keyless entry receiver module's ground connection for high resistance that limits the module's available current during the multi-actuator lock command, causing some actuators to fail when all are commanded simultaneously

106. A vehicle's exterior mirror glass is heated but the defrost feature does not clear the mirror surface. The mirror heater element tests good with correct resistance. What should be checked next?

A. The mirror switch for a faulty defrost position contact that appears to command the heater on but does not actually complete the circuit to provide power to the heating element in the mirror assembly

B. The power supply circuit to the mirror heater element for a voltage drop under load, since the element's resistance may test normal but inadequate voltage delivery would limit the heat output below effective levels

C. The ambient temperature sensor for an incorrect reading that prevents the BCM from commanding the mirror heater on, since many systems only activate the mirror heater below a specific ambient temperature

D. The mirror glass adhesive layer between the heating element and the glass surface for delamination, which would allow the element to heat normally but prevent the heat from transferring to the glass surface

107. A hybrid vehicle's regenerative braking system produces a clicking noise from the front of the vehicle during deceleration. The noise is rhythmic and corresponds to wheel speed. What is the most likely cause?

A. A stone or debris trapped between the brake rotor and the dust shield that contacts the rotor with each revolution, coincidentally noticed during regenerative braking because of the quieter drivetrain

B. The electric motor's permanent magnets are developing cracks that produce a clicking sound as the magnetic field strength fluctuates during the regenerative braking deceleration of the motor rotation

C. The regenerative braking control module is cycling the motor's torque on and off rapidly rather than providing smooth deceleration, creating the clicking sensation through the drivetrain components

D. The inverter power transistors are switching at an audible frequency during the regenerative braking mode that produces a clicking noise transmitted through the motor housing to the vehicle structure

108. A battery electric vehicle has a DTC indicating a ground fault on the HV positive bus. The insulation resistance measurement between the HV positive bus and the chassis reads 200 k Ω . The specification requires a minimum of 500 Ω per volt (for a 400V system, minimum 200 k Ω). What is the assessment?

A. The reading is above the minimum specification and the DTC is a false detection that should be cleared and monitored for recurrence before any physical inspection is performed on the HV system

B. The reading of 200 k Ω is exactly at the calculated minimum threshold, indicating the insulation is critically degraded and must be investigated before the vehicle is returned to service

C. The reading is well above the minimum specification because the 500 Ω per volt calculation yields only 200 k Ω minimum, and the actual reading equals this value, confirming the system passes

D. The reading is at the absolute minimum threshold, meaning the insulation has degraded to the point where any further deterioration will trigger a fault, and the source of the degradation must be identified and repaired

109. A plug-in hybrid vehicle charges to 100% state of charge from a Level 2 station but the electric-only range is only 60% of the manufacturer's rated range. The battery temperature is within normal range. What is the most likely cause?

A. The Level 2 charging station is delivering reduced voltage that causes the onboard charger to report 100% SOC before the battery has actually received a full charge, resulting in reduced actual range

B. The vehicle's tire pressure is significantly below specification, increasing rolling resistance and reducing the electric-only range proportionally to the increased energy consumption per kilometer

C. Normal battery capacity degradation has reduced the total energy storage, so 100% of the degraded capacity represents less energy than 100% of the original capacity, directly reducing range

D. The regenerative braking system has a fault that is not recovering energy during deceleration, causing the battery to deplete faster during driving and reducing the effective electric-only driving range

110. What is the purpose of the pre-charge circuit in a hybrid or electric vehicle's high-voltage system?

- A. The pre-charge circuit charges the 12V auxiliary battery to the correct voltage before the HV contactors close, ensuring the 12V system has adequate power to control the HV contactor engagement
- B. The pre-charge circuit gradually charges the large capacitors in the inverter through a resistor before the main contactors close, preventing the damaging inrush current that would occur if the full battery voltage were applied instantaneously
- C. The pre-charge circuit verifies the HV battery's state of charge before allowing the main contactors to close, preventing the system from operating if the battery voltage is below the minimum threshold
- D. The pre-charge circuit conditions the HV battery cells by applying a small current to warm them before the main contactors close, ensuring the cells are at their optimal operating temperature for current delivery

111. A hybrid vehicle owner reports that the vehicle's fuel economy has decreased significantly over the past three months. The ICE engine runs more frequently than it did previously. The scan tool shows the HV battery SOH at 72%. What is the relationship between the reduced SOH and the decreased fuel economy?

- A. The reduced battery SOH causes the BMS to limit the regenerative braking energy recovery, forcing the vehicle to rely more heavily on the friction brakes and wasting the kinetic energy as heat
- B. The reduced battery SOH forces the hybrid control module to start the ICE more frequently because the battery can store less energy and reaches its minimum charge threshold sooner during driving
- C. The reduced battery SOH causes the electric motor to operate less efficiently because the lower voltage from the degraded battery reduces the motor's torque output, requiring the ICE to assist more
- D. The reduced battery SOH triggers the hybrid system to operate in a charge-sustaining mode that keeps the ICE running continuously to maintain the battery at a minimum SOC, eliminating EV-only driving

112. A battery electric vehicle's DC fast charging session stops at 80% SOC even though the driver selected a 100% charge target. The vehicle does not display any error messages. What is the explanation?

- A. Many BEV charging systems and BMS strategies significantly reduce or terminate DC fast charging above 80% SOC to protect battery longevity, switching to slower Level 2 rates for the remaining capacity
- B. The DC fast charging station has a maximum energy delivery limit per session that corresponds to 80% of the vehicle's battery capacity, and the remaining charge must be completed at a Level 2 station
- C. The vehicle's onboard charger has reached its thermal limit during the fast charging session and has shut down to prevent overheating, requiring a cooldown period before charging can resume to 100%
- D. The BMS has detected a cell imbalance above 80% SOC that requires a slower balancing charge rate, and the DC fast charger cannot deliver the low-current trickle charge needed for cell balancing

113. A technician needs to check the HV battery coolant level on a hybrid vehicle. Where is the HV battery coolant circuit typically separate from?

- A. The HV battery coolant circuit shares the same fluid and reservoir as the engine cooling system, so checking the engine coolant level also verifies the HV battery coolant level simultaneously
- B. The HV battery coolant circuit shares fluid with the cabin heater circuit but has its own separate reservoir, requiring the technician to check the dedicated reservoir for the correct level
- C. The HV battery has its own dedicated cooling circuit with a separate reservoir, pump, and coolant that is independent from the engine cooling system and must be checked and serviced separately
- D. The HV battery uses an air cooling system with fans and ducts rather than liquid coolant, so there is no coolant level to check — the technician should inspect the cooling fans and air filters instead

114. A battery electric vehicle displays a "Reduced Power" warning during sustained highway driving on a hot day. The ambient temperature is 38°C. The battery SOC is at 45%. What is the most likely cause?

- A. The vehicle's aerodynamic drag at highway speed is exceeding the motor's sustained power output capability, and the reduced power mode is the system limiting the motor current to prevent overheating
- B. The HV battery or power electronics temperature has exceeded the optimal operating range due to the sustained high-power demand combined with high ambient temperature, and the BMS is limiting output to protect components from thermal damage

C. The vehicle's traction control system has detected a loss of traction due to the hot road surface and has activated reduced power mode to prevent wheel spin during the sustained highway driving condition

D. The battery SOC at 45% is below the minimum threshold for sustained highway power delivery, and the BMS is limiting the available power to preserve enough energy for the vehicle to reach a charging station

115. What safety feature prevents a battery electric vehicle from being driven away while the charging cable is still connected to the vehicle's charge port?

A. A charge port locking mechanism that physically locks the connector into the port during charging and prevents the vehicle from entering the Ready state until the connector is unlocked and removed

B. The BMS refuses to close the main HV contactors while the charge port detects a connected cable, preventing the drive motor from receiving any power while the vehicle is connected to a charging station

C. The vehicle's transmission or drive mode selector is electronically locked in Park while the charging cable is detected, preventing the driver from selecting Drive or Reverse until the cable is removed

D. The charging station communicates with the vehicle via the pilot signal to maintain the contactor lock, and the vehicle cannot enter Ready mode until the station releases the pilot signal and confirms disconnection

116. A customer asks about the fire risk of a lithium-ion HV battery in a BEV compared to the fuel tank in a conventional vehicle. What is the accurate response?

A. Lithium-ion batteries are inherently fireproof due to their sealed, solid-state construction and pose zero fire risk under any conditions including collision, thermal runaway, or manufacturing defect

B. Lithium-ion batteries can experience thermal runaway under specific conditions (cell damage, manufacturing defect, extreme heat), but extensive safety systems including BMS monitoring, cell separation, and thermal management are designed to prevent and contain such events

C. Lithium-ion batteries pose a significantly greater fire risk than gasoline fuel tanks because the batteries store more total energy and the lithium metal is highly reactive with water used in firefighting

D. Lithium-ion batteries and gasoline fuel tanks have identical fire risk profiles because both store chemical energy and both have equivalent safety systems designed to prevent ignition during all operating conditions

117. A hybrid vehicle's HV battery cooling fan runs at maximum speed continuously, even when the battery temperature reads normal on the scan tool. No DTCs are stored. What is the most likely cause?

A. The HV battery has an internal hot spot that the temperature sensor cannot detect because the sensor is located on the opposite end of the pack from the overheating module

B. The cooling fan motor has an internal short that bypasses the fan speed controller and connects the motor directly to its power supply, running it at full voltage continuously

C. The BMS is commanding maximum cooling as a precautionary response to a recent fast-charging event that elevated the pack temperature above the normal threshold temporarily

D. The battery temperature sensor or its wiring has a fault that reports a falsely low temperature, causing the BMS to command maximum cooling to address the perceived overheating condition

118. A battery electric vehicle has a DTC for "HV Contactor Welded Closed." The vehicle drove normally before the DTC was stored. What is the safety concern with this fault?

A. The welded contactor prevents the HV battery from delivering power to the drive motor, leaving the vehicle stranded without propulsion until the contactor is replaced at the dealer

B. The welded contactor cannot open to disconnect the HV battery from the vehicle's electrical system during shutdown or in an emergency, leaving the HV circuit permanently energized

C. The welded contactor creates a short circuit across the HV battery terminals that will rapidly discharge the battery and generate dangerous heat inside the battery pack enclosure

D. The welded contactor forces the drive motor to operate in regenerative braking mode continuously, preventing the vehicle from accelerating and causing the brake lights to illuminate constantly

119. A plug-in hybrid vehicle's engine starts immediately every time the vehicle is turned on, even when the HV battery is fully charged and the ambient temperature is moderate. The vehicle should operate in EV mode under these conditions. What should the technician investigate?

- A. The hybrid control module and its inputs — including the HV battery voltage, coolant temperature, HVAC demand signals, and the EV mode enable conditions — for a fault that prevents EV-only operation
- B. The 12V auxiliary battery for a low state of charge that triggers the engine to start for charging the 12V system through the conventional alternator rather than through the DC-DC converter
- C. The exhaust system for a leak that triggers a catalyst monitoring fault, since the hybrid control module starts the engine to run the catalyst monitor diagnostic rather than operating in EV mode
- D. The transmission for a fault code that forces the hybrid system into a backup mode where the engine must run continuously to provide hydraulic pressure for the transmission clutch application

120. What happens to a battery electric vehicle's available driving range as the HV battery ages and accumulates charge-discharge cycles over the vehicle's service life?

- A. The range increases slightly as the battery's internal chemistry stabilizes after the initial break-in period, then remains constant for the remainder of the battery's service life
- B. The range remains constant throughout the battery's life because the BMS continuously adjusts the charging algorithm to compensate for any cell degradation and maintain original capacity
- C. The range decreases gradually over time as the battery's total energy storage capacity permanently diminishes from normal electrochemical degradation caused by repeated cycling and calendar aging
- D. The range fluctuates unpredictably throughout the battery's life depending on ambient temperature, with no net decrease over time because the cell chemistry fully recovers between charge cycles

121. A hybrid vehicle is in for routine service. The technician notices an orange HV cable under the vehicle has a small area where the outer insulation is cut and the inner conductor shielding is visible but appears intact. What is the correct action?

- A. Apply electrical tape over the damaged area and note the condition on the repair order for the customer to monitor during future driving until a permanent repair can be scheduled
- B. No action is required because the inner conductor shielding is intact and the outer insulation damage is cosmetic — the HV circuit's electrical safety is maintained by the inner shielding alone
- C. Clean the exposed area with brake cleaner to remove any contamination, then apply heat-shrink tubing over the damaged section to restore the outer insulation protection and prevent further damage

D. Document the damage, inform the customer, and recommend replacement of the cable because the compromised outer insulation reduces the safety margin and exposes the HV circuit to moisture and further damage

122. A battery electric vehicle owner asks why the vehicle's displayed range estimate changes significantly between summer and winter, even when fully charged to 100% both times. What is the accurate explanation?

A. The range estimate algorithm uses historical driving data from the previous season, and the displayed estimate lags behind the actual seasonal capability by approximately one full season of driving

B. Cold temperatures increase the battery's internal resistance (reducing available energy), and the cabin heater draws energy directly from the battery (reducing propulsion energy), both of which reduce the calculated range

C. The range display is calibrated at the factory for a specific ambient temperature, and the vehicle's software does not adjust the calculation for seasonal temperature variations throughout the year

D. The tire pressure change between summer and winter alters the rolling resistance, and the range estimate algorithm does not account for tire pressure variations in its distance-per-kilowatt-hour calculation

123. A technician is performing a scheduled maintenance inspection on a battery electric vehicle. Which of the following maintenance items is specific to BEVs and not applicable to conventional vehicles?

A. Inspecting the engine air filter for contamination and replacing it if restricted, since BEVs use an air-cooled battery pack that draws intake air through the same filter as a conventional engine

B. Checking the transmission fluid level and condition, since BEV reduction gear units use specialized fluid that degrades differently than conventional automatic transmission fluid formulations

C. Inspecting the HV battery coolant level, condition, and circuit integrity, and verifying the battery cooling system operates correctly to maintain the pack within its designed temperature range

D. Replacing the spark plugs at the manufacturer's specified interval, since BEVs use a small auxiliary combustion heater for cabin warming that requires conventional ignition system maintenance

124. A hybrid vehicle's scan tool data shows that the HV battery state of health (SOH) is at 68%. The vehicle has 210,000 km on the odometer. What practical effect does the reduced SOH have on daily driving?

- A. The vehicle's electric-only range is reduced, the engine runs more frequently to compensate for the smaller usable battery capacity, and fuel economy decreases compared to when the battery was new
- B. The vehicle's maximum speed is electronically limited to 100 km/h to prevent the weakened battery from being discharged too rapidly during high-speed driving that demands peak motor output
- C. The vehicle's regenerative braking is completely disabled to prevent overcharging the degraded cells, forcing the vehicle to rely exclusively on friction brakes for all deceleration and stopping
- D. The vehicle operates identically to when the battery was new because the BMS compensates for the reduced capacity by increasing the voltage output per cell to maintain the same total pack energy

125. A battery electric vehicle will not charge from any source — Level 1, Level 2, or DC fast charging. The vehicle drives normally and the HV system shows no faults during driving. What should be investigated?

- A. The HV battery pack for an internal cell failure that prevents the BMS from authorizing any charging current while still allowing the remaining healthy cells to power the drive motor for propulsion
- B. The DC-DC converter for a fault that prevents it from powering the 12V circuits needed for charge port communication, since the charge port pilot signal requires 12V system power to initiate the handshake
- C. The drive motor for an internal winding fault that the inverter compensates for during driving but that generates electrical noise detected by the onboard charger as a ground fault during charging
- D. The charge port assembly, its wiring, and the onboard charger for a common fault — since all three charging methods use the charge port as the physical interface, a port-level fault would disable all charging

Practice Exam 5: Answer Key and Explanations

1. C — Catalytic converters routinely reach surface temperatures exceeding 500°C during normal operation. Direct skin contact causes immediate severe burns, and placing the hot converter on or near combustible materials (cardboard, rags, plastic, wood) can cause ignition and fire. The converter must be placed on a non-combustible surface in a clear area and allowed to cool before handling.

2. A — Waste oil recycling requires that the waste oil be free of contamination from other chemicals. Mixing solvents such as brake cleaner into the waste oil contaminates the entire batch, making it

unsuitable for standard recycling and potentially creating a volatile mixture with a lower flash point that increases fire risk. Each waste stream must be collected and disposed of separately.

3. D — Brake dust may contain hazardous particulate matter including metallic fibers and other compounds. When dispersed by compressed air, these particles become airborne and can be inhaled by the technician and anyone nearby. OSHA and Canadian workplace safety regulations require the use of low-pressure wet methods, HEPA-filtered vacuums, or enclosed washing systems rather than compressed air for brake dust removal.

4. B — Section 11 of the Safety Data Sheet is designated for Toxicological Information. It describes the routes of exposure (inhalation, skin contact, eye contact, ingestion), the symptoms associated with each route, and the acute and chronic health effects that can result from exposure to the product. This is the section technicians consult to understand what health risks a product presents.

5. A — The tool rest gap must be maintained at 3 mm (1/8 inch) or less from the grinding wheel face. A 15 mm gap creates a serious entrapment hazard — the workpiece can be caught between the rest and the spinning wheel, pulled from the operator's hands, and launched or fragmented. Adjusting the rest before each use is a mandatory safety check.

6. D — After a frontal collision that deployed the front airbags, other SRS modules throughout the vehicle — side curtain airbags, side torso airbags, knee airbags, and seatbelt pretensioners — may not have deployed and still contain live pyrotechnic initiators. These undeployed devices can deploy if the vehicle sustains additional impact during towing or if the wiring is disturbed, creating a serious injury hazard.

7. C — A flare nut wrench (also called a line wrench) is designed specifically for tube fittings. It wraps around five of the six hex surfaces, providing significantly more contact area than an open-end wrench (which contacts only two surfaces). This additional contact prevents the wrench from spreading and rounding the soft brass or steel fitting, which is especially important on corroded fittings.

8. B — Carbon monoxide is an odorless, colorless, toxic gas that is a primary component of engine exhaust. In an enclosed shop without adequate ventilation or exhaust extraction, CO concentrations can reach lethal levels within minutes. Every running engine must be connected to a functional exhaust extraction hose, and workstations with damaged hoses must not be used until the hose is repaired or replaced.

9. A — Bodily fluids (blood, vomit, other biological material) may contain bloodborne pathogens including hepatitis and HIV. The technician must wear disposable nitrile or latex gloves, eye protection, and potentially a face mask to prevent direct contact with or inhalation of the biological material. Standard shop chemicals are not approved disinfectants for biological hazards.

10. D — The coil swap test is definitive: moving the coil from cylinder 6 to cylinder 3 caused the misfire to follow the coil to its new position. This confirms the coil is faulty — the problem is in the coil itself, not the cylinder, the wiring, the plug, or the fuel system. Whatever fault the coil has (insulation breakdown, shorted windings, cracked housing) moves with it to any cylinder.

11. B — A transient STFT spike to +25% during acceleration that returns to normal at cruise indicates the ECM must add significant fuel during the transition because the mixture goes momentarily lean. This lean spike occurs only during the load change — from a fuel pump that momentarily cannot meet increased demand, a vacuum leak that opens under manifold pressure changes, or an accelerator pump circuit that is insufficient.

12. A — The chain tensioner uses a check valve to maintain hydraulic pressure on the tensioner piston. If the check valve leaks during extended shutdown, oil drains back from the tensioner circuit, the piston retracts, and the chain develops slack. At startup, the chain rattles against the guides until the oil pump rebuilds pressure and re-extends the tensioner piston — typically within 10 to 15 seconds.

13. C — A small boost leak that the turbo can overcome during brief WOT bursts (by spinning faster to compensate for the lost air) becomes significant during sustained operation. The turbo cannot maintain the compensating speed indefinitely — heat builds, efficiency drops, and the leak's cumulative effect exceeds the turbo's ability to compensate, causing the 3 psi shortfall during sustained boost.

14. D — White smoke during cold diesel startup is unburned or partially burned diesel fuel vapor that passes through the cylinders without fully combusting. Cold cylinder walls, cold intake air, and cold glow plugs (if the pre-heat cycle was insufficient) combine to prevent the fuel from reaching its autoignition temperature. As the engine warms, combustion temperatures normalize and the smoke clears.

15. B — Asymmetric fuel trims — one bank significantly positive while the other is near zero — indicate a bank-specific condition. Bank 1 at +12% is adding fuel to compensate for a lean condition affecting only that bank. Common causes include a vacuum leak near bank 1's intake runners, a weak injector on bank 1, or an exhaust leak near bank 1's upstream O₂ sensor that draws in outside air and falsely reports lean.

16. C — In a power balance test, disabling a healthy cylinder causes a noticeable RPM drop because you've removed a significant power contributor. When disabling cylinder 3 causes minimal RPM drop, that cylinder was already contributing very little power — it has a fault (compression, ignition, or fuel) that is reducing its output, so removing it from the firing order makes little difference to the total.

17. D — In port fuel injection, fuel is sprayed into the intake port upstream of the intake valve. The liquid fuel continuously washes across the valve face, dissolving and carrying away carbon deposits before they can accumulate. GDI engines inject fuel directly into the combustion chamber — no fuel ever touches the intake valve surfaces, so crankcase vapors and EGR gases bake onto the hot valves unchecked.

18. A — Elevated silicon in an oil analysis is the signature of dirt and sand ingestion. Silicon dioxide (sand/quartz) is the most common airborne contaminant, and it enters the engine through a compromised air filtration system — a torn filter element, a loose or cracked intake duct clamp, a missing gasket in the air filter housing, or a damaged air intake snorkel. Silicon from other sources (coolant silicates, assembly sealants) is possible but far less common.

19. B — In a returnless fuel system, the ECM commands the fuel pressure through a control module, but the ECM relies on software calculations — it does not have a direct mechanical gauge to verify the actual pressure. A mechanical gauge connected to the fuel rail provides the ground truth. If the commanded pressure and the measured pressure differ, the fuel pressure control module, its wiring, or the fuel pump is at fault.

20. D — Spark and fuel are both confirmed, but the engine will not fire. This indicates the valve events are occurring at the wrong time relative to the piston position — the timing marks were not correctly aligned during the belt installation. On an interference engine, this would also cause valve-to-piston contact and mechanical damage, but on a non-interference engine, the misalignment simply prevents combustion.

21. A — Compression is normal (eliminating ring, valve, and gasket problems). The plug, coil, and injector have been swapped to another cylinder without the misfire following — eliminating all three components. What remains is something specific to cylinder 2's physical location: an intake manifold gasket leak at that runner, a carbon-blocked intake runner, a cracked intake runner, or an exhaust restriction at that port.

22. C — A misfire that appears only under heavy load at high RPM is characteristic of an ignition fault. Cylinder pressure increases dramatically under heavy load, and the spark must bridge the plug gap

against this higher pressure. A coil with weakened insulation or a plug with excessive gap can fire successfully at lower pressures but lacks the energy to overcome the higher resistance at peak cylinder pressure.

23. B — Positive fuel trims on both banks at idle that normalize at cruise point to a vacuum leak affecting both banks. A centrally located leak — at the intake manifold gasket, the brake booster hose, the PCV hose, or a throttle body gasket — introduces unmetered air into both banks. At idle, this leak is a large percentage of total airflow. At cruise, the throttle is open and the leak becomes negligible.

24. D — Forced regeneration requires specific prerequisite conditions before the ECM will allow exhaust temperatures to be raised to the 550–600°C required for soot combustion. If the coolant temperature is below the minimum, the DPF inlet temperature doesn't reach the threshold, or any active fault blocks the regeneration, the ECM aborts the procedure within seconds to prevent damage.

25. A — At low RPM, the VGT vanes should close to narrow the exhaust passage, increasing gas velocity and driving the turbine faster to produce boost. At 45%, the vanes cannot close far enough, so low-RPM torque suffers. At high RPM, the vanes should open wide to reduce exhaust backpressure. At 45%, the vanes are too closed for high RPM, restricting exhaust flow and potentially causing overboost or excessive backpressure.

26. D — Modern common rail diesel ECMs store adaptive learned correction values for each individual injector to compensate for manufacturing tolerances and wear. When an injector is replaced, the old injector's correction values must be reset to zero (cleared) so the ECM can begin learning the new injector's delivery characteristics from baseline. Failing to reset causes the ECM to apply the old injector's compensation to the new one.

27. B — The propane enrichment test adds fuel to the intake. If the engine were running lean, the added fuel would improve combustion and RPM would increase. No RPM increase confirms the engine is not lean — it is already receiving adequate or excess fuel. The –20% LTFT and P0172 code confirm the ECM is subtracting fuel because the mixture is genuinely rich, and the propane test validates that the rich condition is real.

28. C — The EGR valve opens correctly when commanded (eliminating the valve and its actuator). The remaining restriction point is the EGR gas passage between the exhaust manifold and the intake manifold. Carbon deposits accumulate in these narrow passages over time, progressively restricting the exhaust gas flow volume below the level the ECM's flow sensor or monitor expects, triggering the insufficient flow code.

29. A — The noid light is a simple indicator that detects the presence of an electrical pulse at the injector connector. No flash on cylinder 4 means no pulse is arriving at that connector. The fault is upstream of the connector — in the ECM's injector driver circuit, the wiring between the ECM and the injector, or the connector itself. The injector has been eliminated because no signal is reaching it.

30. B — A P0016 crankshaft-to-camshaft correlation code indicates the ECM has detected that the camshaft position does not match the expected relationship to the crankshaft position. The most common mechanical cause is a stretched timing chain that has allowed the camshaft to retard beyond the acceptable window. VVT solenoid faults and cam phaser failures can also cause this code, but chain stretch is the most frequent root cause.

31. C — An erratic idle that hunts between 550 and 1,100 RPM with fluctuating IAC counts indicates the idle control system is chasing a moving target. A vacuum leak that intermittently opens and closes — from a cracked hose that flexes with engine movement, a PCV valve that rattles in its grommet, or a manifold gasket that opens and seals with thermal cycling — creates the constantly changing air supply that the IAC cannot stabilize.

32. D — An intermittent complete blackout of the instrument cluster while all other electrical systems continue to function normally isolates the fault to the cluster's own power supply or ground circuit. A loose connector, a corroded pin, or a damaged wire at the cluster's harness plug momentarily interrupts the voltage or ground, causing the cluster to power down and restart while every other module operates unaffected.

33. B — When a PCM is replaced, the new module must establish its identity to all other modules on the network. The TCM expects to communicate with a specific PCM identifier that matches the vehicle's configuration. After PCM replacement, a reconfiguration procedure updates the vehicle identification data and communication parameters so the new PCM and existing TCM recognize each other as valid network partners.

34. A — Disconnecting the battery during replacement momentarily removes power from all modules. When power is restored, each module performs a power-on self-test and may set DTCs if its expected startup conditions differ from what it stored before the power loss — lost adaptive data, cleared keep-alive memory, or disrupted communication during the re-initialization sequence. These codes typically clear after normal driving cycles.

35. A — Each TPMS sensor has a unique identification code that the TPMS module uses to identify which sensor is at which wheel position. When a sensor is replaced, the new sensor has a different ID

that the module does not recognize. A TPMS relearn procedure registers the new sensor's ID with the module and associates it with the correct wheel position for accurate pressure monitoring.

36. D — The scan tool shows lost communication with the camera module, while the head unit works normally for all other functions. This isolates the fault to the camera module's own circuits — its power supply, ground, video signal wiring, or CAN bus communication connection. The camera is a separate hardware device mounted at the rear of the vehicle with its own electrical connections that must be checked independently.

37. B — A LIN bus checksum error means the data frame received by the master module has been corrupted in transit — the calculated checksum of the received data does not match the checksum value transmitted with the frame. This indicates the slave device is transmitting corrupted data, possibly from a failing internal processor, a wiring fault introducing noise, or a deteriorating connection causing signal degradation.

38. C — An intermittent warning with no stored DTCs means the fault occurs too briefly to meet the DTC storage criteria but is real enough to trigger the warning light. The most effective diagnostic approach is to monitor the specific sensor inputs and system data in real time during a test drive, watching for any dropouts, spikes, or erratic readings that correlate with the warning appearance.

39. D — The remote start activates the engine but the HVAC does not start because the system's last-used settings determine what activates during remote start. If the climate control was set to a temperature between the high and low thresholds when the vehicle was last shut off, many factory remote start systems will not activate the HVAC because the system determines the cabin doesn't need active heating or cooling.

40. A — Both APP sensors read correctly, eliminating the pedal assembly as the cause. The electronic throttle system also includes the throttle body motor (which physically moves the plate) and the throttle position sensor (which confirms the plate's actual position). A fault in the motor, its wiring, or the TP sensor prevents the ECM from accurately controlling or verifying the throttle plate position, triggering reduced power mode.

41. C — Key fob reprogramming for lock and unlock functions is often a separate procedure from enabling the remote start feature. Many vehicles require the remote start function to be specifically enabled or activated as an additional programming step after the basic lock/unlock functions are paired. If the remote start step was not completed during the programming session, the fob pairs for basic functions but remote start remains inactive.

42. B — The gateway module serves as a bridge between different CAN bus networks within the vehicle, controlling which messages pass between buses operating at different speeds. It translates data between the high-speed powertrain bus, the medium-speed chassis bus, and the low-speed body bus, and it filters which data each bus is allowed to receive to prevent unnecessary traffic and potential interference.

43. D — Radar sensors mounted behind the rear bumper cover are precisely aimed during factory calibration. Bumper damage, misalignment, or aftermarket modifications (such as adding a tow hitch, applying a thick bumper wrap, or reinstalling the cover incorrectly after a repair) can shift the sensor aim or introduce reflective surfaces that create false radar returns, triggering phantom object detections.

44. A — A vibration during acceleration that disappears when the throttle is released and is felt through the steering wheel on a FWD vehicle is characteristic of a worn inner CV joint. The inner tripod joint must accommodate plunge and angle under the torque loading of acceleration. A worn tripod roller or tulip housing produces vibration under this loading that ceases immediately when the torque demand is removed.

45. C — A flare during an upshift (engine RPM increases during the shift) indicates a timing overlap problem — the releasing element (second gear) disengaged before the applying element (third gear) fully engaged. This creates a momentary neutral condition where neither clutch pack is holding, allowing the engine to accelerate freely until the applying element catches up and engages, completing the shift with a noticeable RPM spike.

46. D — Unequal U-joint operating angles between the front and rear sections of a two-piece drive shaft create a speed variation that cannot be cancelled by the phasing between joints. Equalizing the angles — typically by adjusting the pinion angle at the rear axle using shims or tapered wedges under the spring U-bolts — brings both sections within the 1-degree tolerance and eliminates the vibration.

47. A — First gear on many manual transmissions is not synchronized (or has a less effective synchronizer than higher gears). When the vehicle is completely stopped and the clutch is not fully releasing (input shaft still spinning slightly), the still-rotating input shaft prevents the unsynchronized first gear from meshing cleanly. Rolling the vehicle slightly or double-clutching allows the gears to mesh because the input shaft speed matches.

48. B — The rear differential ring and pinion always rotate when the rear wheels rotate, regardless of whether the AWD system is engaged or in 2WD mode. The rear wheels drive the ring gear through the axle shafts in both modes. A worn ring and pinion gear set produces a speed-dependent whirring noise proportional to vehicle speed, audible in all drive modes.

49. C — Replacing the TCC solenoid addresses the electrical command component, but the code returned. The next level of the TCC apply system is the valve body — specifically the TCC apply valve. If this valve is stuck, worn, or has a worn bore that allows fluid bypass, it cannot direct hydraulic pressure to the TCC even when the solenoid commands it. Contaminated fluid causing the clutch to slip is also a strong possibility.

50. D — The odd-numbered clutch in a DCT controls first, third, and fifth gears. A shudder only in first gear (the most demanding gear for clutch modulation during low-speed maneuvers) points to the odd clutch having worn friction material. First gear requires the most delicate clutch modulation — slow engagement, partial slip, and precise torque control — and worn material grabs rather than engaging progressively.

51. C — The differential's primary function is to allow the left and right drive wheels to rotate at different speeds during turns (the outside wheel must travel farther and rotate faster than the inside wheel). Without a differential, the inside wheel would scrub and the drivetrain would bind during every turn. The differential distributes torque to both wheels while accommodating the speed difference.

52. B — A pedal that sinks slowly under sustained pressure and returns to normal when released is the hallmark of a master cylinder internal seal bypass. The piston seal is worn and allows fluid to leak past it internally within the bore when steady pressure is applied. Releasing the pedal allows the piston to return and the seal to reseal temporarily. This condition worsens over time until the pedal sinks to the floor.

53. A — Blue heat spots and fine cracks on the flywheel friction surface indicate the metal has been overheated. Overheating changes the metallurgical structure of the surface (hardness, grain structure, and flatness), creating hard spots and surface irregularities that will cause the new clutch disc to engage unevenly, chatter, shudder, or wear prematurely. The flywheel must be resurfaced or replaced.

54. C — The viscous coupling transfers torque between the front and rear drive shafts by shearing a silicone-based fluid between the input and output plates. When the fluid degrades from age, heat, and oxidation, it loses its shearing ability and can no longer transmit torque effectively when a speed differential exists between the front and rear shafts. The coupling becomes functionally transparent, and the vehicle behaves as front-wheel-drive only.

55. B — A whine in one specific gear only indicates the gear set unique to that gear has a tooth surface defect. Worn, chipped, or pitted teeth on either the drive gear or the driven gear of the fifth-gear set produce a whine at the mesh frequency of those specific gears. All other gear sets are unaffected because their tooth surfaces remain in good condition.

56. D — A pressure control solenoid stuck at maximum pressure causes every clutch and band application to occur at full line pressure rather than the gradual, controlled ramp the TCM normally commands. The result is harsh, abrupt engagement of every shift — the clutch packs slam together rather than applying progressively, and the driver feels a pronounced jolt with each gear change.

57. A — The vibration occurs only in 4WD High and only at a specific speed range, which eliminates the transfer case and tires (both would produce symptoms at other speeds or modes too). The front drive shaft only spins under load in 4WD mode. An out-of-balance front drive shaft or incorrect front drive shaft U-joint angles produce a speed-dependent vibration that appears only when the front drive shaft is loaded.

58. B — An open differential always splits torque equally between both axle shafts — this is a fundamental mechanical property. On ice, the spinning wheel needs almost zero torque to spin. Since torque is split equally, the stationary wheel also receives almost zero torque — far too little to overcome the friction of the road surface. Both wheels get equal but tiny torque; one spins freely while the other sits still.

59. C — Modern electronically controlled automatic transmissions use adaptive shift scheduling that varies shift points based on driver demand. At light throttle, the TCM upshifts early for fuel economy. At heavy throttle, the TCM holds each gear longer to keep the engine in its peak power range for acceleration. This is normal, intentional behavior — not a fault.

60. A — A seal that leaks again shortly after replacement despite correct installation indicates the seal is being damaged by the surface it rides against. A worn output shaft with grooves, scoring, or roughness at the seal contact area cuts through the new seal's lip during the first hours of operation. The shaft journal surface must be repaired (using a seal sleeve) or the shaft replaced before installing another seal.

61. B — One window operating sluggishly while all others work normally eliminates the battery, alternator, and BCM as causes. The fault is specific to that window — the regulator mechanism is the most common cause of sluggish operation. Dried-out cable lubrication, a bent track, a worn cable, or corroded regulator arm pivots create mechanical resistance that forces the motor to work harder and move more slowly.

62. D — The maximum acceptable voltage drop for the complete positive charging circuit (alternator B+ to battery positive) is 0.2 to 0.3 volts under load. A 0.7-volt drop is excessive — it reduces the effective charging voltage at the battery from 14.5V to only 13.8V, which may be insufficient for full charging, especially in cold weather or with high electrical loads. The resistance source must be located and repaired.

63. C — A 2.4-volt drop between the battery (12.6V) and the pump connector (10.2V) while the pump is running indicates excessive resistance somewhere in the supply circuit between the battery and the pump. The resistance could be in the fuel pump relay contacts, the wiring, the connectors, the ground path, or a combination. Each connection point must be voltage-drop tested to locate the specific resistance source.

64. A — When a single accessory engagement (the A/C compressor clutch) causes system-wide voltage symptoms (dim headlamps, radio cutout), the power delivery infrastructure cannot support the additional current demand. A poor battery cable connection, a corroded ground strap, or a loose terminal creates a bottleneck that collapses the available voltage when the compressor clutch adds its 3-5 amp demand to the system.

65. D — The turn signal and tail lamp filaments work at the same socket (confirming the ground and socket are functional) but the brake filament does not illuminate. Since a known-good dual-filament bulb was installed, the brake light supply circuit to that specific socket is the remaining suspect — the wire carrying the brake signal, its connector, or a splice in the brake lamp circuit to the left rear.

66. A — Cooling fans running at high speed continuously — even cold with the A/C off — indicates the ECM or fan controller believes the engine is critically overheating. The most common cause is an ECT sensor failure (open circuit or short to ground) that sends a signal the ECM interprets as extreme temperature, commanding maximum cooling fan speed as a protective response regardless of actual conditions.

67. A — The rear window defroster grid consists of multiple parallel conductive lines connected between two bus bars. Each line is a parallel resistance path. When one or more lines break, the remaining lines carry all the current, and the total parallel resistance of fewer paths is higher than the original specification. The 8.5-ohm reading (vs. 1.0–3.0 specification) confirms multiple broken grid lines.

68. B — The high setting works (proving the power supply, ground, and heating element are functional in the full-power circuit) but the low setting does not function. The low setting typically routes power through an additional resistor, relay, or PWM controller circuit that the high setting bypasses. A faulty component in the low-setting circuit path — most commonly the switch contact for that position — prevents the reduced-power mode from functioning.

69. B — In a dual-zone system, each side has an independent blend door actuator that controls the mix of hot (heater core) and cold (evaporator) air for that zone. The passenger-side blend door actuator has

failed in the heat position or has lost its calibration, causing it to route air over the heater core regardless of the temperature setting, while the driver's side actuator responds correctly to its commands.

70. D — Extremely high high-side pressure (2,400 kPa) combined with extremely low low-side pressure (35 kPa) indicates a restriction between the two sides. The compressor is building pressure on the high side but refrigerant cannot flow through to the low side because the liquid line, receiver-drier, or expansion device is blocked. The pressure accumulates on one side and starves the other.

71. D — The solenoid clicks (proving the coil energizes) but the engine does not crank. Jumping the high-current terminals directly bypasses the solenoid's internal contact disc and the engine cranks normally — proving the battery, cables, starter motor, and engine are all functional. The fault is the solenoid's internal contact disc, which is burned or pitted and cannot pass the high current required by the starter motor.

72. C — The driver's side maintains correct temperature (proving the heater core flow, evaporator function, and climate control logic are working) while the passenger side is consistently cooler than the set point. The passenger-side blend door actuator has a calibration error, mechanical restriction, or internal gear fault that prevents it from positioning the door far enough toward the heat position.

73. D — On many vehicles, rotating the instrument panel dimmer wheel or knob to its maximum position (fully clockwise or fully up) activates a courtesy light override that turns the interior lights on continuously regardless of door status. This is an intentional feature designed to provide interior illumination when desired, but drivers often activate it accidentally.

74. A — The evaporator temperature sensor or cycling clutch switch monitors the evaporator surface temperature and cycles the compressor off before the evaporator reaches 0°C. If this sensor or switch is faulty, the compressor runs continuously without cycling off, the evaporator surface drops below freezing, and ice builds on the fins — progressively blocking airflow and reducing cooling output.

75. B — The steering angle sensor (SAS) provides the ADAS system with the reference for the vehicle's intended straight-ahead direction. After an alignment changes the toe settings, the steering wheel's centered position may have shifted slightly. Without SAS recalibration, the ADAS perceives the centered wheel as being slightly turned, and the lane keep assist continuously steers toward what it incorrectly believes is the lane center.

76. A — The battery is confirmed good and the cables are clean and tight, eliminating the power supply side. The remaining component is the starter motor itself. Internal faults — worn brushes that reduce

contact area, a shorted armature winding that increases current draw while reducing torque, or a seized bushing that creates mechanical resistance — cause slow cranking despite a healthy battery and clean connections.

77. C — Normal AC ripple at the alternator output should be less than 0.5V. A reading of 1.8V indicates one or more rectifier diodes inside the alternator have failed open, allowing their phase's AC output to pass unfiltered through the rectifier bridge. The failed diodes reduce the alternator's total DC output capacity and introduce AC content that can cause light flicker, radio interference, and module communication errors.

78. D — Warm air while moving that drops to ambient at idle suggests the heater core flow is adequate only when the coolant flow rate is high (at driving RPM) but drops too low at idle to maintain heating. The most common cause is a deteriorated water pump impeller that has lost vanes or corroded to reduced diameter — it can push enough coolant at higher RPM but produces insufficient flow at idle to keep the heater core supplied.

79. B — Many TPMS systems do not update their pressure readings instantly — the sensors transmit periodically (every 1 to 15 minutes depending on the system), and some systems require the vehicle to be driven above a minimum speed for the module to process updated sensor data. Driving the vehicle for several minutes above 25 km/h allows the sensors to transmit their updated readings and the module to update its display.

80. A — The fan motor runs on direct power (eliminating the motor as the cause). The next link in the control chain is the relay that switches power to the motor and the ECM signal that commands the relay. The ECM provides a ground signal to energize the relay coil when the coolant temperature exceeds the fan activation threshold. Testing the relay and the ECM's control output identifies whether the relay or the ECM signal is the failure point.

81. D — Blind spot detection radar sensors are mounted within or behind the rear bumper cover. Even minor parking lot damage can shift the bumper cover position relative to the sensors, physically reposition the sensors themselves, or crack the sensor housings — any of which alters the sensors' detection pattern and prevents normal operation. The sensors or bumper alignment must be inspected and corrected.

82. C — "Key Detected" confirms the immobilizer has authenticated the fob. The brake is depressed. But nothing happens when the start button is pressed. Battery cable connections with high resistance can pass enough current for the low-demand systems (dash display, key detection, indicator lights) but

collapse when the starter demands 150+ amps. The voltage drops so severely that nothing functions — no click, no crank.

83. A — The scan tool commanded the purge valve open and closed, and the engine responded correctly — RPM dropped when the valve opened (fuel vapor entered the intake, enriching the mixture slightly) and recovered when it closed. This confirms the valve, its solenoid, and the wiring are all functional. The DTC may be from a previous condition that has since resolved, or it may be intermittent.

84. B — Asymmetric wear patterns — inner-edge wear on one side and outer-edge wear on the other — indicate the left and right front wheels are pointing in opposite directions relative to their ideal alignment. The left front has excessive negative camber (tilting inward, wearing the inner edge) while the right has excessive positive camber (tilting outward, wearing the outer edge), suggesting a shifted subframe, bent component, or collision damage.

85. D — Groaning at full lock with slight effort increase indicates the power steering pump is working harder than normal to deliver the high-volume, high-pressure flow demanded at full steering lock. Internal wear of the pump's vanes, rotors, or housing surfaces reduces the pump's efficiency, limiting its ability to meet the extreme flow demands of full-lock turns while still performing adequately at normal steering angles.

86. B — After resurfacing, the new rotor surface has microscopic lathe cutting ridges that create uneven initial contact with the brake pads. During the first several stops, the pads wear down the ridges and establish full-surface contact with the rotor. The initial pulsation is from these ridges — once they wear smooth during break-in, the pulsation disappears and full pad-to-rotor contact is established.

87. A — A worn or dry upper strut mount bearing provides the rotational pivot point for the strut assembly during steering. When the bearing is dry, corroded, or worn, it resists the rotational movement rather than allowing smooth turning. The driver feels this as a catching or binding sensation during steering return, and may hear a clunk or pop as the bearing releases and jumps to the next position.

88. C — A vehicle pulls toward the side with less positive caster. The left front has only $+2.0^\circ$ caster (well below the $+4.5^\circ$ minimum specification) while the right has $+5.5^\circ$ (within specification). The 3.5° side-to-side difference (far exceeding the 0.5° maximum) creates a strong pull toward the left. The reduced caster on the left generates less self-centering force, allowing the vehicle to drift in that direction.

89. D — To correct oversteer (the rear end sliding outward), the ESC brakes the outside front wheel. This creates a yaw moment that opposes the oversteer rotation — the braking force on the outside front wheel pulls the front of the vehicle toward the outside of the turn, counteracting the rear-end slide and straightening the vehicle's path. This is the fundamental ESC oversteer correction strategy.

90. B — The Rubber Manufacturers Association (RMA) and the Tire Industry Association (TIA) both specify that the only industry-accepted permanent repair is an internal patch-plug combination installed from inside the tire after demounting and interior inspection. External plugs alone are considered temporary emergency repairs because they do not seal the inner liner puncture and do not allow interior damage inspection.

91. C — A steering wheel vibration at idle that disappears above 1,000 RPM, felt only through the steering wheel, points to the power steering pump. At idle, the pump's output is at its minimum, and worn internal components produce a pulsating flow that is transmitted through the hydraulic fluid to the steering gear and felt as vibration. At higher RPM, the increased pump speed smooths the flow and the vibration disappears.

92. A — During a front tire blowout, the vehicle will pull strongly toward the side of the blown tire. The safest response is to maintain a firm grip on the steering wheel to counteract the pull, gradually ease off the accelerator (do not brake hard — hard braking shifts weight to the damaged front corner and can cause loss of control), and allow the vehicle to decelerate progressively while steering gently to a safe stopping area.

93. D — The caliper slides freely (eliminating the slide pins), but the piston does not retract. The square-cut piston seal in a floating caliper serves dual functions: it seals the hydraulic pressure and it provides the piston retraction force. When the seal deteriorates, loses its elasticity, or is installed incorrectly, it cannot pull the piston back into the bore when pressure is released, leaving the pad in contact with the rotor.

94. B — The sensor tests good for resistance (eliminating the sensor's internal coil), but the DTC persists. The tone ring (reluctor ring) is the rotating component that the sensor reads. Damaged, missing, cracked, or contaminated teeth on the tone ring produce an erratic or missing signal that the ABS module interprets as a sensor fault. The sensor-to-ring air gap and any debris in the gap must also be inspected.

95. C — A pull to one side only during hard braking (not during light braking or normal driving) indicates one caliper cannot extend fully under the higher pressure demand of hard braking. A partially seized caliper piston moves enough for light braking (lower pressure) but cannot extend fully under the

higher pressure of hard stops, reducing the braking force on that side and creating the pull toward the opposite side.

96. A — Directional tires have a tread pattern designed to rotate in one specific direction for optimal water evacuation, noise reduction, and traction. They can only be rotated front-to-rear on the same side of the vehicle. Moving them to the opposite side would require demounting the tire from the wheel and remounting it facing the other direction to maintain the correct rotational direction.

97. A — As brake pads wear, the caliper pistons extend further into the caliper bores to maintain contact between the pads and the rotor. This extension displaces brake fluid from the master cylinder reservoir into the caliper bores. The fluid is not lost — it has moved from the reservoir to behind the pistons. When new pads are installed and the pistons are retracted, the fluid returns to the reservoir.

98. C — A vibration at all speeds that is not resolved by wheel balancing is most commonly caused by a tire with a defective internal belt (shifted or separated) or a bent wheel that has excessive radial or lateral runout. Runout produces a vibration proportional to wheel speed regardless of balance — the tire physically moves up/down or side-to-side with each revolution in a way that no amount of weight correction can eliminate.

99. B — An off-center steering wheel with straight tracking means the total front toe is correct (which is why the vehicle goes straight) but was set with the steering wheel turned slightly off-center. During the alignment, the toe was adjusted on one side without first centering the steering wheel, creating an unequal left-to-right toe split that totals the correct value but positions the wheel off-center.

100. A — Brake pad wear sensors are single-use, sacrificial components. The sensor wire is embedded at a specific depth in the pad, and when the pad wears to that depth, the wire contacts the rotor and is severed or grounded — triggering the warning. Once triggered, the sensor cannot be reused or reset. It must be replaced with each pad change to restore the wear monitoring function for the new pads.

101. D — The "PASSENGER AIRBAG OFF" indicator means the front passenger airbag module will not deploy in a frontal collision. An adult passenger seated in that position has significantly reduced crash protection — no frontal airbag supplemental restraint — which substantially increases the risk of serious injury in a frontal collision. The OCS fault must be diagnosed and repaired to restore the passenger airbag function.

102. C — The sunroof opens (confirming the motor, track, and electrical circuit are functional) but will not close from the switch, yet closes from the scan tool. The scan tool commands the motor directly, bypassing the switch circuit. This proves the close-direction contact in the sunroof switch is faulty — it does not complete the circuit when the driver presses it in the close direction.

103. B — The fresh air intake plenum sits at the base of the windshield and collects leaves, debris, and water. A drain at the bottom of the plenum normally evacuates water. When the drain is blocked, water pools in the plenum and eventually overflows into the HVAC case through the fresh air intake opening. The water then flows through the case and drains into the driver's footwell through the lowest exit point.

104. A — Without the rear height sensor's input, the system cannot determine the vehicle's rear ride height or its front-to-rear attitude. As a safety default, the system typically positions the headlamps at their lowest (most downward) aim to prevent glare for oncoming drivers, since the system cannot adjust for vehicle loading or attitude changes without the missing sensor data.

105. C — When some doors lock while others intermittently fail, the BCM is sending the lock command (proven by the doors that do lock), and the key fob is transmitting (proven by the consistent partial response). The intermittent failures are at the individual door lock actuators — worn motors, corroded connectors, sticking mechanisms, or failing internal linkages that prevent some actuators from responding consistently.

106. B — The heater element has correct resistance (eliminating the element as faulty), and the switch appears to command the heater on. The next check is whether adequate voltage is actually reaching the element under load. A corroded connector, high-resistance wire, or deteriorated relay contact can drop the voltage below the level needed for the element to generate sufficient heat, even though static resistance tests appear normal.

107. A — A rhythmic clicking that corresponds to wheel speed during deceleration on a hybrid vehicle with a quiet electric drivetrain is most commonly caused by a stone or debris trapped between the brake rotor and the dust shield. The clicking occurs once per wheel revolution as the trapped object contacts the rotor. This mundane cause is especially noticeable during regenerative braking because the absence of engine noise makes it audible.

108. D — For a 400V system, the minimum insulation resistance is $500 \Omega/V \times 400V = 200 \text{ k}\Omega$. The measured value of 200 k Ω is exactly at the minimum threshold — not below it, but at the absolute edge. While technically passing, this indicates the insulation has degraded to the point where any further deterioration will drop below the threshold. The source of degradation must be identified and repaired before the vehicle is returned to service.

109. C — The BMS reports 100% SOC (the battery is fully charged to its current capacity), the temperature is normal, and there are no fault codes. The 60% range reduction directly reflects the battery's diminished total energy storage from normal capacity degradation. 100% of a degraded battery holds less energy than 100% of a new battery, which translates directly to reduced driving range.

110. B — The inverter and motor controller contain large capacitors that must be charged before the main contactors close. If the main contactors closed directly, the sudden inrush of current into the empty capacitors would create an enormous current spike — potentially welding the contactor contacts and damaging the capacitors. The pre-charge circuit uses a resistor to gradually charge the capacitors at a controlled rate before the main contactors close.

111. D — With the HV battery at 72% SOH, its total energy storage capacity is reduced by 28%. The hybrid control module starts the ICE sooner because the battery reaches its minimum charge threshold faster with its reduced capacity — less stored energy means fewer electric-only kilometers before the engine must restart to recharge or assist. More ICE run time directly increases fuel consumption.

112. A — Many BEV manufacturers and BMS strategies intentionally reduce or terminate DC fast charging above 80% SOC to protect battery longevity. Charging lithium-ion cells at high current above 80% SOC accelerates degradation, increases heat generation, and stresses the cell chemistry. The BMS tapers the charging rate dramatically above 80%, making it impractical to fast-charge the remaining 20%.

113. C — Most hybrid and many EV battery packs have a dedicated liquid cooling circuit that is separate from the engine cooling system. This circuit has its own reservoir, pump, and often a dedicated radiator or chiller. The coolant type and mixture ratio may differ from the engine coolant. The technician must identify the correct HV battery cooling reservoir and check its level independently.

114. B — Sustained high-power demand at highway speed combined with 38°C ambient temperature pushes the HV battery and power electronics toward their thermal limits. The BMS and inverter control module progressively reduce the available power output to prevent component temperatures from exceeding their safe operating thresholds, protecting the battery cells, power transistors, and motor windings from thermal damage.

115. A — A physical charge port locking mechanism engages during charging to prevent the connector from being removed while high-voltage charging current is flowing. This lock also prevents the vehicle from entering the Ready state (enabling the drive motor) while the connector is physically present in the charge port. The vehicle cannot be driven until the connector is unlocked and removed.

116. C — Lithium-ion batteries can experience thermal runaway — a self-sustaining, exothermic chain reaction within a cell — under specific conditions such as internal cell damage, manufacturing defects, external crushing, or sustained extreme heat. However, extensive engineering controls including BMS temperature monitoring, cell-level fusing, fire-resistant cell separators, thermal management systems, and reinforced battery housings are designed to prevent and contain such events.

117. D — The cooling fan runs at maximum but the scan tool shows normal battery temperature. If the temperature were truly elevated, maximum fan speed would be appropriate. A faulty temperature sensor or wiring that reports a falsely high temperature to the BMS — while the scan tool reads from a different data path or the sensor intermittently spikes — causes the BMS to command maximum cooling in response to a temperature threat that doesn't actually exist.

118. B — A welded HV contactor is a critical safety fault. The contactor's primary function is to disconnect the HV battery from the vehicle's electrical system during shutdown and in emergency situations. When a contactor welds closed, the HV circuit remains permanently energized even when the vehicle is "off" — meaning lethal high voltage is present on the HV bus at all times, creating a severe shock hazard for technicians and first responders.

119. A — A fully charged battery at moderate temperature should enable EV-only operation. The engine starting every time indicates the hybrid control module is not entering EV mode. The technician must investigate the module's enable conditions: HV battery voltage and SOC signals, coolant temperature readings, HVAC compressor demand, accessory load levels, and any stored DTCs that might force the engine-on strategy.

120. C — Lithium-ion and nickel-metal hydride battery cells degrade gradually and permanently through normal charge-discharge cycling and calendar aging. The total energy storage capacity decreases over time, which directly reduces the distance the vehicle can travel on a full charge. The BMS tracks this degradation as state of health (SOH) and adjusts range estimates accordingly.

121. D — HV cables operate at lethal voltages and require full insulation integrity at all times. A cut in the outer insulation — even when the inner shielding appears intact — reduces the safety margin against moisture intrusion, physical abrasion, and future insulation failure. Tape and heat-shrink are not approved repairs for HV cables. The cable must be replaced to restore full manufacturer-specification insulation protection.

122. B — Two factors combine to reduce BEV range in winter. First, cold temperatures increase the HV battery's internal resistance, reducing the usable energy the battery can deliver per charge cycle. Second, BEVs have no engine waste heat for cabin warming — the cabin heater draws energy directly from the

HV battery, consuming kilowatt-hours that would otherwise be available for propulsion. Together these factors can reduce winter range by 20–40%.

123. C — Inspecting the HV battery cooling circuit — coolant level, fluid condition, electric pump operation, and circuit integrity — is a BEV-specific maintenance item. Conventional vehicles have no HV battery cooling system. The battery cooling circuit is critical for maintaining the pack within its optimal temperature range, and any degradation in cooling capability accelerates cell aging and reduces battery life.

124. A — At 68% SOH, the battery stores only 68% of its original energy capacity. The hybrid control module starts the engine sooner and more frequently because the smaller usable battery capacity reaches its minimum charge threshold faster during driving. More engine run time directly increases fuel consumption, and the reduced electric-only driving capability produces noticeably worse fuel economy compared to when the battery was at 100% SOH.

125. D — All three charging methods — Level 1 (120V AC), Level 2 (240V AC), and DC fast charging — use the charge port as their physical and electrical interface with the vehicle. A fault at the charge port (damaged connector, broken locking mechanism, faulty pilot signal circuit), in the charge port wiring, or in the onboard charger would disable all charging while leaving the drive system unaffected, since the drive system draws power directly from the HV battery through a separate circuit.