PRACTICE EXAM 7: RED SEAL AUTOMOTIVE SERVICE TECHNICIAN SIMULATION (125 QUESTIONS)

1. A technician is using a floor jack to raise a vehicle and notices the jack's hydraulic ram is leaking fluid from the piston seal area. The vehicle is partially raised. What is the correct immediate action?

A. Continue raising the vehicle to full height quickly before the jack loses all pressure, then immediately place jack stands under the vehicle support points

B. Lower the vehicle slowly on the leaking jack and ask a co-worker to place jack stands under the vehicle as it descends to catch the vehicle at a safe height

C. Hold the jack handle in the raised position to maintain pressure while a co-worker places jack stands under the vehicle to catch the weight before the jack fails

D. Lower the vehicle slowly and completely to the ground immediately using the leaking jack, then remove the jack from service and obtain a functional replacement

2. A technician is working in the pit underneath a vehicle. What is the unique hazard associated with shop pit work compared to working under a vehicle on a hoist?

A. Heavy exhaust gases and solvent vapors can accumulate in the pit because they are denser than air, displacing oxygen and creating an asphyxiation or toxic exposure hazard at pit level

B. The pit walls restrict the technician's ability to move laterally, increasing the risk of musculoskeletal injury from working in confined postures for extended periods during service

C. Pit lighting is typically insufficient for detailed inspection work, and the technician must use a portable trouble light that creates an electrical shock hazard in the damp pit environment

D. Vehicles positioned over the pit can shift on the pit rails if the parking brake is not applied, and the technician has no escape path if the vehicle moves from its original position overhead

3. A technician is draining the fuel tank on a vehicle. What PPE is required for this task beyond standard safety glasses?

A. A full-face supplied-air respirator rated for organic vapor protection, since fuel vapor concentrations during tank draining exceed the NIOSH permissible exposure limit in all cases

B. Flame-resistant coveralls over normal work clothing to prevent the technician's standard polyester-blend uniform from melting against the skin in the event of a fuel vapor ignition

C. Chemical-resistant gloves to prevent prolonged skin contact with gasoline, which can cause dermatitis, skin cracking, and absorption of benzene and other harmful components through the skin

D. An explosion-proof portable ventilation fan positioned at the fuel tank opening to continuously dilute the fuel vapor concentration below the lower explosive limit during the draining procedure

4. A technician notices that a vehicle's battery has a swollen, bulging case. What does this condition indicate, and what is the safety concern?

A. The battery has been discharged below 10.5 volts and the lead plates have sulfated, creating internal expansion that distorts the case walls without any associated gas or explosion hazard

B. The battery has been overcharged or has an internal fault causing excessive hydrogen gas generation, and the swollen case indicates dangerous internal pressure that could cause rupture or explosion

C. The battery has been frozen from exposure to extreme cold while in a discharged state, and the expanding ice inside has distorted the case without creating any explosive gas pressure hazard

D. The battery's electrolyte level is overfilled, and the excess fluid has expanded from heat during normal charging, distorting the case walls without creating any dangerous internal pressure

5. What is the maximum weight a single worker should lift manually without mechanical assistance according to Canadian workplace safety guidelines?

A. Approximately 23 kg (50 lbs) is the generally accepted maximum manual lift weight, with the actual safe weight varying based on lifting height, distance, frequency, and body posture

B. Canadian workplace safety regulations set a fixed maximum of 15 kg (33 lbs) for all manual lifts regardless of the lifting conditions, body posture, or frequency of the lifting task

C. There is no maximum weight limit — Canadian regulations require only that the employer provide mechanical lifting devices and the worker may choose whether to use them for any weight

D. The maximum is 50 kg (110 lbs) for trained workers who have completed the employer's manual lifting certification program and demonstrated proper lifting technique during assessment

6. A technician is working on a vehicle's air conditioning system and accidentally releases refrigerant into the shop atmosphere. What regulation has been violated?

A. The Canadian Motor Vehicle Safety Standards, which require that all refrigerant be contained within the vehicle's sealed A/C system at all times during service operations

B. The provincial workplace safety regulations, which classify refrigerant as a toxic substance that must be handled in a sealed enclosure with continuous air monitoring during service

C. The Automotive Industries Association code of practice, which prohibits any refrigerant release during service as a voluntary industry standard that carries no regulatory enforcement authority

D. The Canadian Environmental Protection Act and related regulations, which prohibit the intentional release of ODS and HFC refrigerants into the atmosphere and require proper recovery procedures

7. A vehicle's exhaust system has a leak at the exhaust manifold-to-downpipe connection. The vehicle is in the shop for another service. Should the technician inform the customer about the exhaust leak?

A. No — the exhaust leak is unrelated to the service the customer requested, and informing them would constitute an unauthorized upsell that violates consumer protection regulations

B. Yes — the technician has a professional and ethical obligation to inform the customer of any safety-related condition discovered during service, and an exhaust leak is a carbon monoxide hazard

C. No — unless the exhaust leak is causing a check engine light or affecting the vehicle's emissions test results, there is no obligation to report it because it does not affect the vehicle's driveability

D. Yes — but only if the leak is producing visible exhaust smoke or noise audible from inside the cabin, since minor exhaust leaks at the manifold connection are considered normal wear conditions

8. A technician receives a chemical burn on the forearm from a concentrated battery acid spill. After flushing with water for the required time, what is the next step?

A. Apply a thick layer of petroleum jelly to the burned area to seal the skin and prevent further acid penetration while the burn is transported to the emergency department for evaluation

B. Apply a baking soda paste to the burned area to neutralize any remaining acid residue, then cover the area with a dry sterile bandage and continue the work shift with periodic monitoring

C. Seek medical attention for the chemical burn even if it appears minor after flushing, because chemical burns can continue to damage tissue beneath the surface and may worsen over time

D. Apply an antibiotic ointment and cover the burn with a sterile adhesive bandage, then document the injury in the shop's first aid log and return to work with the affected area covered

9. A shop is installing a new parts washer that uses a petroleum-based solvent. What fire safety classification must the parts washer meet?

A. The parts washer must have a self-closing lid, a fusible link that closes the lid automatically in a fire, and be listed by a recognized testing laboratory for use with flammable liquids

B. The parts washer requires only a metal construction to contain any fire within the washer basin, since the small volume of solvent does not constitute a significant fire hazard in a ventilated shop

C. The parts washer must be installed inside a dedicated fire-rated enclosure with a minimum one-hour fire resistance rating and an independent exhaust ventilation system for vapor removal

D. The parts washer requires only a class ABC fire extinguisher mounted within two meters and a maximum fill line that limits the solvent volume to prevent overflow during a fire suppression event

10. A technician is diagnosing an engine that runs rough only when the A/C compressor is engaged at idle. Disabling the A/C returns the idle to normal. The idle speed does not increase when the A/C is commanded on, even though the scan tool shows the ECM is commanding idle speed increase. What is the most likely cause?

A. The A/C compressor is mechanically seized and the additional drag on the engine is too great for the ECM's idle speed compensation to overcome at the commanded increase level

B. The A/C clutch relay is stuck in the engaged position and is engaging the compressor before the ECM has time to command the idle speed increase, creating a temporary speed drop

C. The A/C high-pressure switch is signaling the ECM to limit idle speed to prevent excessive compressor head pressure at idle, overriding the normal idle increase command

D. The idle air control system cannot increase airflow as commanded — a carbon-restricted IAC passage, stuck electronic throttle, or restricted idle air bypass prevents the RPM increase

11. An engine has an intermittent misfire that occurs only during the first cold start of the day and clears after approximately 30 seconds. The misfire does not occur during subsequent warm restarts throughout the day. What is the most likely cause?

A. The fuel injectors have a slight leak-down that occurs overnight, and the first start briefly hydrolocks the affected cylinders until the excess fuel burns off during the initial seconds of operation

B. The engine coolant temperature sensor is reporting a slightly warmer temperature than actual during the first cold start, causing the ECM to deliver slightly less cold-start enrichment than needed

C. Cold-soaked ignition coils have reduced output voltage from their cold internal resistance until they warm slightly, and the reduced spark energy causes misfire until they reach operating temperature

D. The crankshaft position sensor signal is erratic during the initial low-voltage cranking at cold temperatures, clearing once the battery voltage rises after the engine starts and the alternator charges

12. A diesel engine equipped with a DPF has a warning light indicating the DPF is approaching maximum soot loading. The vehicle is driven primarily on short urban trips. The technician performs a forced regeneration using the scan tool and the soot level drops to 5%. Two weeks later, the customer returns with the same warning. What underlying issue must be addressed?

A. The DPF has a manufacturing defect that allows soot to bypass the filter wall and accumulate on the downstream side, where the regeneration process cannot reach it for combustion

B. The customer's driving pattern never allows the exhaust temperature to reach the passive regeneration threshold or sustain it long enough for active regeneration to complete during normal driving

C. The diesel exhaust fluid quality has degraded from age, and the reduced urea concentration is preventing the SCR catalyst from reaching the temperature needed to assist DPF regeneration

D. The EGR system is recirculating excessive exhaust gas, creating an over-rich combustion condition that produces soot faster than the DPF regeneration system can burn it off during normal operation

13. An engine has a persistent P0171 (System Too Lean Bank 1) code. The technician performs a propane enrichment test — introducing propane near the intake manifold. The engine RPM increases when propane is introduced near the intake manifold gasket area on bank 1. What does this RPM increase confirm?

A. A vacuum leak exists at the intake manifold gasket on bank 1 — the propane is being drawn into the engine through the leak, enriching the lean mixture and causing the RPM to increase

B. The intake manifold gasket is intact but the propane is entering through the throttle body and reaching bank 1 through the normal intake path, enriching the overall mixture for all cylinders

C. The fuel injectors on bank 1 are restricted and the added propane is supplementing the deficient fuel delivery, but the root cause is injector restriction rather than a vacuum leak

D. The mass airflow sensor is overreporting airflow, and the propane enrichment test is invalid because the additional fuel from the propane confuses the ECM's fuel control algorithm during the test

14. A V8 engine with a dual-plane intake manifold has a P0174 code (System Too Lean Bank 2). Bank 1 fuel trims are normal. The technician discovers that the EGR valve is stuck open. On this engine, the EGR port feeds exclusively into bank 2's intake runners. What is the connection between the stuck EGR and the lean code?

A. The stuck-open EGR dilutes only bank 2's intake charge with inert exhaust gas, reducing the combustible mixture in those cylinders, causing the lean condition that bank 1 does not experience

B. The stuck-open EGR creates a vacuum leak that draws air from the exhaust system backward through the EGR passage into bank 2, introducing unmetered atmospheric air into bank 2 only

C. The stuck-open EGR diverts fuel vapor from the EVAP system into bank 2's intake runners, creating a rich condition that the ECM overcorrects with a lean fuel trim command on that bank

D. The stuck-open EGR reduces the exhaust backpressure on bank 2's exhaust manifold, causing the upstream oxygen sensor to read incorrectly lean from the reduced exhaust flow velocity at the sensor tip

15. A four-cylinder engine has a P0302 misfire code. The technician disables the fuel injector on cylinder 2 using the scan tool. With the injector disabled, the engine RPM does not change. What does this confirm?

A. The fuel injector on cylinder 2 was already delivering zero fuel before it was disabled, confirming the injector or its circuit has failed and was the cause of the misfire from fuel starvation

B. Cylinder 2 was already contributing zero or near-zero power to the engine before the injector was disabled, confirming that a fault on that cylinder prevents effective combustion regardless of cause

C. The scan tool's injector disable function is not working correctly on this vehicle, and the lack of RPM change indicates the command was not executed rather than a diagnostic conclusion

D. The engine has adaptive idle control that immediately compensated for the disabled injector by increasing the contribution from the other three cylinders, masking the expected RPM drop

16. An engine has an oil consumption complaint of 1 liter per 2,000 km. A borescope inspection through the spark plug holes shows normal piston crowns with no unusual carbon patterns. The valve stems show no oil residue. The PCV valve is functioning correctly. Where else could the oil be going?

A. The oil is being consumed through the turbocharger shaft seals into both the intake and exhaust housings, where it burns without leaving visible residue on the pistons or valve stems

B. The oil is leaking externally from a gasket or seal at the rear of the engine where it drips onto the exhaust system and evaporates before reaching the ground, creating no visible puddle

C. The oil is being consumed through the piston ring pack — specifically the oil control rings — in quantities too small to produce visible carbon on the pistons but sufficient to account for the consumption rate

D. The oil is being absorbed by the positive crankcase ventilation system and burned in the intake manifold runner surfaces, where the combustion temperature is too low to produce visible carbon deposits

17. A turbocharged GDI engine has an intake manifold runner control valve that opens and closes the secondary intake runners based on engine speed and load. The valve is stuck closed. What symptoms would this produce?

A. Reduced high-RPM power because the secondary runners that provide additional airflow at high RPM are blocked, limiting the engine's volumetric efficiency above the crossover point

B. Excessive low-RPM torque that causes the engine to surge at idle because the restricted runner cross-section increases air velocity beyond the ECM's idle speed control correction range

C. No noticeable symptoms because the ECM compensates for the restricted airflow by adjusting boost pressure through the turbocharger's wastegate to maintain the target manifold pressure

D. Increased fuel consumption at all speeds because the restricted intake creates a permanent vacuum leak that the ECM compensates for by adding fuel across the entire operating range

18. An engine has a ticking noise that follows engine RPM. The noise changes in intensity when the engine is loaded (under acceleration) versus unloaded (coasting). The technician uses a stethoscope and identifies the noise as originating from the exhaust manifold area. What is the most likely cause?

A. An intake manifold gasket leak on the cylinder closest to the exhaust manifold, creating a vacuum-driven ticking that changes with manifold pressure under load versus coast conditions

B. An exhaust manifold crack or a leaking exhaust manifold gasket that allows pressurized exhaust pulses to escape, producing a ticking sound that intensifies under load when exhaust pressure increases

C. A worn exhaust valve guide that allows the valve to oscillate laterally in the guide bore, producing a ticking sound as the valve contacts the guide walls during each opening and closing cycle

D. A loose heat shield on the exhaust manifold that vibrates at specific frequencies corresponding to engine RPM and changes its resonance pattern based on the manifold's thermal expansion under load

19. A vehicle has a P0420 code. The technician graphs the upstream and downstream oxygen sensor voltages. The upstream switches rapidly between 0.1V and 0.9V as expected. The downstream holds a steady 0.45V that does not respond to forced rich or forced lean commands. What does the steady downstream voltage indicate?

A. The catalytic converter is functioning perfectly, producing a stable downstream signal that indicates complete oxygen storage capacity and efficient catalytic conversion of all exhaust constituents

B. The downstream oxygen sensor is functioning correctly, and the steady 0.45V reading indicates the catalytic converter is maintaining the exhaust at the ideal stoichiometric balance at its outlet

C. The catalytic converter has failed and the downstream sensor is correctly reporting that the converter can no longer store or release oxygen, producing the flat, unresponsive voltage trace

D. The downstream oxygen sensor has failed — it is stuck at its bias voltage (0.45V) and is not responding to the actual exhaust gas oxygen content at the converter outlet, producing a false P0420 code

20. A common rail diesel engine has a DTC for rail pressure below desired — the actual rail pressure is consistently 5,000 psi below the ECM's commanded value at all operating conditions. What should be checked first?

A. The high-pressure pump for internal wear that reduces its output volume, since the pump must generate the pressure and any internal leakage reduces the available pressure to the rail

B. The fuel rail pressure sensor for a calibration drift that causes it to report a lower pressure than actual, creating an apparent pressure deficit that does not reflect the true rail pressure condition

C. The rail pressure control valve (or quantity control valve) for a fault that is venting excess fuel from the rail back to the tank, reducing the pressure below the ECM's commanded target value

D. The fuel filter for a restriction that limits fuel supply to the high-pressure pump inlet, preventing the pump from receiving adequate volume to generate the commanded pressure at the rail

21. A four-cylinder engine has cylinder 1 and cylinder 4 both showing low compression. Cylinders 2 and 3 are normal. On this engine, cylinders 1 and 4 are at opposite ends of the block — not adjacent. What possible causes should be considered?

A. Individual mechanical faults on each cylinder occurring independently — such as worn valve seats, broken rings, or burned valves — since non-adjacent cylinders cannot share a gasket leak between them

B. A cracked engine block that connects the two outermost cylinder bores through an internal crack path, allowing compression to leak between cylinders 1 and 4 through the block structure

C. A warped cylinder head that lifts away from the block at both ends due to the head's thermal bending pattern, causing gasket leaks at the outermost cylinders while the center cylinders seal correctly

D. A timing chain that has jumped two teeth on the camshaft sprocket, retarding all valve events equally — but the reduced volumetric efficiency is only detectable on cylinders 1 and 4 by the compression test

22. An engine is experiencing surge at steady cruise — the RPM oscillates ±100 RPM in a rhythmic pattern. The fuel trims are normal and stable. The throttle position is steady on the scan tool. What system should be investigated?

A. The ignition system for an intermittent misfire that is causing the RPM to oscillate, even though the misfire is too minor to trigger a DTC but sufficient to cause the perceptible surge pattern

B. The fuel pressure for a rhythmic variation caused by a failing fuel pump that alternately speeds up and slows down, creating a pulsating fuel delivery that produces the corresponding RPM oscillation

C. The exhaust gas recirculation system for an EGR valve that is cycling between partially open and closed positions, diluting and undiluting the intake charge in a rhythmic pattern that causes the surge

D. The cruise control system or electronic throttle for a hunting condition where the control algorithm oscillates around the target speed, creating the rhythmic RPM variation without any fuel or ignition fault

23. A technician performs a relative compression test using the scan tool. The results show that cylinder 5 has approximately 30% less crankshaft deceleration during its compression stroke compared to the other seven cylinders on a V8 engine. What does this mean?

A. Cylinder 5 has excessive carbon buildup that has increased its compression ratio above the other cylinders, causing the crankshaft to slow more during its compression stroke than the others

B. Cylinder 5 has significantly less compression than the other cylinders, meaning it offers less resistance to crankshaft rotation during its compression stroke, which registers as less deceleration

C. Cylinder 5's fuel injector is delivering excessive fuel that is hydraulically assisting the piston during its compression stroke, reducing the resistance felt by the crankshaft during that cylinder's event

D. The crankshaft position sensor reluctor ring has a manufacturing tolerance variation at the tooth corresponding to cylinder 5 that produces a false reading unrelated to actual compression values

24. A vehicle's engine has a slight tick at idle that the customer finds annoying. The tick disappears above 1,500 RPM. Oil level and pressure are correct. The technician identifies the noise as coming from the timing chain area. What is the most likely cause?

A. The timing chain tensioner has reached its maximum extension and can no longer compensate for chain stretch, allowing the chain to develop slack that is only audible at the low pulse frequency of idle

B. The timing chain guide material has hardened from heat and age, and the chain rattles against the hardened guide surface at idle but is tensioned against the guide at higher RPM from increased oil pressure

C. The crankshaft sprocket has a worn keyway that allows the sprocket to shift position microscopically at idle, producing a tick as the chain loads and unloads against the worn keyway's free play

D. The chain tensioner's oil supply passage has a minor restriction that limits oil flow at idle pressure, but at higher RPM the increased pump output overcomes the restriction and fully pressurizes the tensioner

25. A diesel engine has a fuel contamination concern — the technician drains a fuel sample from the water separator and the sample has a milky, cloudy appearance. What does this indicate?

A. The fuel has been mixed with engine coolant from a leaking injector cup or injector seal that allows coolant from the cylinder head cooling jacket to enter the fuel return circuit during operation

B. The fuel has been contaminated with urea (DEF) from a misfilled DEF/fuel tank, where the customer accidentally added diesel exhaust fluid to the fuel tank instead of the DEF tank

C. The fuel sample is normal — diesel fuel naturally develops a cloudy appearance when cooled below its cloud point temperature, and the milky appearance will clear as the sample warms to room temperature

D. The fuel has significant water contamination — water has entered the fuel tank through condensation, a damaged tank vent, or a contaminated fuel supply, and has emulsified with the diesel fuel

26. An engine has a P0300 random misfire that occurs intermittently and only at light throttle cruise. The scan tool shows misfire counts distributed evenly across all six cylinders. All ignition and fuel system components have been tested and are functioning correctly. What less obvious cause should be investigated?

A. The exhaust system for a partially restricted catalytic converter or collapsed exhaust pipe that creates intermittent backpressure at the specific load and RPM conditions of light-throttle cruise driving

B. The crankshaft harmonic balancer for separation between the inner hub and outer ring, which causes a timing signal variation that triggers false misfire detection at the specific RPM of light cruise

C. The engine mounts for excessive movement that allows the engine to shift position at cruise, momentarily tensioning and releasing the wiring harness and creating intermittent signal disruptions to multiple coils

D. The transmission torque converter for shudder that is transmitted through the drivetrain and detected by the crankshaft position sensor as misfire-like speed variations during the light-load cruise condition

27. An engine's oil pressure is within specification at all RPMs, but the oil appears to be aerating — there are bubbles visible in the oil when viewed through the oil filler cap while the engine is running. What is the most likely cause?

A. The oil level is overfilled above the maximum mark, and the crankshaft counterweights are contacting and whipping the oil surface, introducing air into the oil through mechanical agitation

B. The oil has been contaminated with coolant from an internal leak, and the water in the oil is boiling at engine operating temperature, producing steam bubbles that appear as aeration in the oil

C. The oil pickup tube O-ring or gasket has deteriorated, allowing the oil pump to draw air from the sump along with oil, introducing air bubbles into the pressurized oil circuit throughout the engine

D. The PCV valve is stuck in the fully open position, creating excessive vacuum in the crankcase that draws air through the dipstick tube seal and introduces it into the oil sump from the atmospheric side

28. A customer complains that the vehicle takes two to three seconds of cranking to start when cold, but starts immediately when warm. The scan tool shows cranking fuel pressure reaches specification within 0.5 seconds of key-on. The glow plug system (if diesel) has been eliminated. What should be checked?

A. The starter motor current draw, which may be borderline high from internal resistance, slowing the cranking speed below the minimum RPM threshold for reliable cold combustion

B. The fuel system's residual pressure holding capability — if the rail pressure bleeds to zero overnight, the pump must repressurize the entire system during cranking before fuel can be injected

C. The battery cold cranking amps rating versus the manufacturer's specification, since a battery with adequate CCA at room temperature may produce insufficient cranking speed at cold soak temperatures

D. The spark plug gap versus the manufacturer's specification, since plugs with gaps at the wide end of the tolerance require more ignition energy to bridge at the higher cylinder pressures of cold cranking

29. A technician is testing a MAP sensor on a vehicle with the engine off and the key on (KOEO). The MAP sensor reads 100 kPa (approximately 29.92 inHg) — which equals atmospheric pressure. The sensor is connected to the intake manifold. Is this reading correct?

A. Yes — with the engine off and not cranking, there is no intake manifold vacuum, so the manifold is at atmospheric pressure, and the MAP sensor correctly reads approximately 100 kPa (atmospheric)

B. No — the MAP sensor should read approximately 70 kPa at KOEO because the throttle plate creates a partial restriction even when the engine is off, reducing the pressure below atmospheric

C. No — the MAP sensor should read 0 kPa at KOEO because without the engine running, there is no pressure in the manifold and the sensor should report the absence of vacuum as zero pressure

D. Yes — but only if the ambient barometric pressure is exactly 100 kPa, which varies with altitude and weather conditions, so the reading should be compared to the local barometric pressure

30. A diesel engine's DEF system has a DTC for "Incorrect DEF Quality Detected." The DEF was recently refilled by the customer. What is the most common cause of this code after a customer refill?

A. The customer used an aftermarket DEF brand that contains a slightly different urea concentration than the OEM specification, and the quality sensor is calibrated only for the OEM brand's exact formulation

B. The customer stored the DEF in a metal container that contaminated the fluid with metallic ions that interfere with the SCR catalyst's chemical reduction process for NOx conversion during operation

C. The DEF quality sensor has a fault unrelated to the refill, and the timing of the code after the refill is coincidental — DEF quality sensors fail at a high rate on this engine platform and require frequent replacement

D. The customer inadvertently added the wrong fluid to the DEF tank — such as windshield washer fluid, water, or coolant — which dilutes or contaminates the urea solution below the required concentration

31. An engine has a P0128 code (Coolant Temperature Below Thermostat Regulating Temperature). The thermostat has been replaced but the code returns. What else should be checked?

A. The coolant mixture ratio for excessive antifreeze concentration that raises the coolant's boiling point but also changes its heat transfer properties, preventing the engine from warming efficiently

B. The radiator for a stuck-open internal bypass that allows coolant to flow through the radiator continuously even when the thermostat is closed, removing heat faster than the engine produces it

C. The ECT sensor for a calibration error that reports a lower temperature than actual, making the ECM believe the engine is not reaching thermostat temperature when it actually is within specification

D. The replacement thermostat's rated temperature — if the replacement has a lower opening temperature than the original (such as a 71°C thermostat installed where a 90°C thermostat is specified), the engine may not reach the ECM's expected operating temperature

32. A vehicle's scan tool can communicate with the ECM but cannot access the airbag control module. All other modules respond normally. What is the most likely explanation?

A. The airbag module is on a separate CAN bus spur, and that spur has a wiring fault, connector problem, or module power/ground issue that prevents it from communicating despite the main bus being healthy

B. The scan tool software does not support the airbag module protocol for this vehicle and requires a software update or a different scan tool platform to access the SRS system for diagnostics

C. The airbag module requires a security access code before it will respond to scan tool requests, and the technician must enter the correct PIN before the module will appear on the network

D. The OBD II DLC is not connected to the airbag module bus on this vehicle, and a separate manufacturer-specific diagnostic connector under the dashboard must be used for SRS communication

33. A vehicle has a "Reduced Engine Power" message and the throttle response is severely limited. The scan tool shows a DTC for "Accelerator Pedal Position Sensor 1 — Signal Voltage Low." The voltage reads 0.18V. The specification is 0.5V to 4.5V. What is the most likely cause?

A. The accelerator pedal position sensor has an internal fault that is pulling the signal voltage below the normal range, or a wiring fault is grounding the signal wire and dragging the voltage to near zero

B. The ECM's internal pull-up resistor for the APP sensor circuit has failed, reducing the reference voltage that the sensor divides to produce its position signal, dragging the output below specification

C. The accelerator pedal has a mechanical fault that prevents it from returning to the full idle position, holding the sensor at a voltage below its designed rest position and triggering the low voltage code

D. The APP sensor is reading correctly at 0.18V because the accelerator pedal is at rest, and the specification of 0.5V minimum applies only when the pedal is pressed — the code is a false detection

34. A vehicle has undergone a major electrical repair that involved disconnecting multiple modules. After reassembly, several modules store "VIN Not Programmed" DTCs. What must be done?

A. Each module must be individually reprogrammed with the vehicle's VIN using the manufacturer's programming tool, since the VIN data was erased when the modules lost power during the repair

B. Only the ECM needs VIN programming, and it will distribute the VIN to all other modules automatically through the CAN bus during the next ignition cycle after the ECM is programmed

C. The VIN programming is automatic and will complete itself after three consecutive ignition cycles where all modules power up together and exchange their stored VIN data across the bus

D. The VIN must be re-entered into each affected module using the manufacturer's diagnostic tool, since each module independently stores the vehicle's VIN and verifies it against the other modules

35. A vehicle's scan tool reads DTCs from the ABS module and finds a C0035 code (Left Front Wheel Speed Sensor Circuit). The technician measures the sensor's resistance at 1,150 ohms. The specification is 800 to 1,200 ohms. What should be checked next despite the resistance being in specification?

A. The wheel speed sensor's mounting for correct air gap distance from the tone ring, since a sensor with correct resistance can still produce an erratic signal if the gap is too wide or the sensor is loose

B. The ABS module's internal input circuit for the left front wheel speed sensor channel, since the correct resistance eliminates the sensor and wiring as possible causes of the circuit fault code

C. The sensor's signal output quality using an oscilloscope during wheel rotation, since a sensor within resistance specification can still have a cracked element or damaged tone ring that produces an erratic AC signal

D. The brake rotor for lateral runout that would cause the tone ring to move in and out of the sensor's detection zone during rotation, producing a signal amplitude variation the ABS module interprets as a fault

36. A vehicle's CAN bus has an intermittent fault that causes random U-codes across multiple modules. The fault occurs more frequently during cold mornings and less frequently as the vehicle warms up. What type of fault does this temperature-dependent pattern suggest?

A. A module with a temperature-sensitive internal CAN transceiver that produces erratic output signals when cold and stabilizes as the component's temperature rises to its normal operating range

B. A CAN bus wiring fault — such as a cracked solder joint, a broken wire strand, or a corroded connector pin — that opens when cold (contracted) and makes contact when warm (expanded)

C. A software timing error in one module's CAN bus controller that is clock-speed dependent, running the clock slightly fast at cold temperatures and producing frame timing errors until warm

D. A battery voltage issue where the cold battery produces lower voltage that drops below the CAN transceiver's minimum operating threshold, causing intermittent communication failures across the network

37. A technician needs to replace a power window motor. After installation, the express-up feature does not work but the window operates normally in manual (hold-to-run) mode. What must be done to restore the express-up function?

A. The window motor initialization procedure must be performed — cycling the window through its full travel range — to re-establish the learned endpoints that the anti-pinch feature requires for express-up operation

B. The BCM must be reprogrammed with the latest software version that includes the window motor's calibration data, since the express-up function requires motor-specific calibration stored in the BCM

C. The window switch must be replaced along with the motor because the express-up control circuit is integrated into the switch assembly and cannot communicate with a replacement motor independently

D. The motor's internal Hall effect position sensor must be separately calibrated using the scan tool's bi-directional control function before the express-up feature can be enabled for that window

38. A vehicle has a parasitic draw of 400 milliamps that remains constant 60 minutes after the ignition is turned off. All modules should be in sleep mode by this time. The technician disconnects modules one at a time. After disconnecting the telematics module, the draw drops to 30 milliamps. What is the most likely cause?

A. The telematics module has a subscription service that maintains a constant cellular data connection, and the module does not enter sleep mode because it must remain active to receive emergency commands

B. The telematics module's power management circuit has failed, and it is drawing active-mode current continuously instead of entering sleep mode when the ignition is turned off and the vehicle is parked

C. The telematics module is functioning correctly, and the 400 milliamps draw is normal for this vehicle because the module must remain active for crash notification and stolen vehicle tracking at all times

D. The telematics module's GPS antenna has a short to ground that is drawing excess current through the antenna cable, bypassing the module's sleep mode power management circuit and draining the battery

39. A vehicle's blind spot monitoring system activates the warning indicator on the left mirror continuously — even when no vehicle is in the left blind spot zone. The right side functions normally. What is the most likely cause?

A. The left blind spot radar sensor has a software fault that has lowered its detection threshold below the minimum, causing it to report the road surface, guardrails, and lane markings as detected objects

B. The left blind spot radar sensor's aim has been disrupted by bumper misalignment from a previous repair, and the sensor is detecting the vehicle's own body panel or exhaust as a constant nearby object

C. The left exterior mirror's BSM indicator light has a short to ground that illuminates the warning LED continuously regardless of the radar sensor's actual output or the BSM module's commands

D. The left blind spot radar sensor has an internal fault or external obstruction that is producing a continuous false detection signal, which the BSM module interprets as a constantly present adjacent vehicle

40. A technician is reading live data on the scan tool and notices that the mass airflow sensor reading is 3.2 g/s at idle on a 3.0L V6. The expected value is approximately 5.5 to 7.5 g/s. The engine runs smoothly. What is the ECM likely doing to compensate?

A. The ECM is adjusting boost pressure through the turbocharger wastegate to increase the actual air entering the engine, compensating for the perceived low airflow reported by the contaminated MAF sensor

B. The ECM is adding positive fuel trim correction because it is delivering fuel for only 3.2 g/s of air when the engine actually ingests much more, resulting in a lean condition that the fuel trim compensates for

C. The ECM is retarding ignition timing to reduce the engine's power output to match the perceived low airflow, preventing the engine from operating at a lean condition that could damage the catalytic converter

D. The ECM is ignoring the MAF sensor and using the MAP sensor as the primary airflow input because it has detected the MAF reading as implausible, effectively switching to a backup fuel calculation mode

41. What is the purpose of a "network management" frame on a CAN bus?

A. Network management frames are used by the gateway module to assign communication priority to each module, ensuring that safety-critical modules always transmit before comfort and convenience modules

B. Network management frames carry the scan tool's diagnostic requests and module responses, separating diagnostic traffic from normal vehicle data to prevent diagnostic sessions from disrupting bus operation

C. Network management frames carry module identification data that allows modules to verify the presence of other modules on the bus and coordinate the transition between active and sleep modes

D. Network management frames coordinate the wake-up and sleep transitions of modules, signaling when the bus should remain active and when all modules can enter their low-power sleep mode for key-off

42. A vehicle's ECM has been replaced. After programming, the engine starts and runs, but the instrument cluster shows an incorrect odometer reading. What is the most likely explanation?

A. The odometer value is stored in the instrument cluster module — not the ECM — so replacing the ECM does not affect the odometer reading, and the incorrect display suggests the cluster has a separate fault

B. The replacement ECM came pre-loaded with a different vehicle's calibration data that included the previous vehicle's mileage, which the cluster is now displaying from the ECM's data broadcast

C. The programming process reset the ECM's internal trip counter to zero, and the instrument cluster is displaying this reset trip counter instead of the cumulative odometer stored in the cluster's memory

D. Federal anti-tampering regulations prevent odometer data from being transferred to a replacement ECM, so the cluster defaults to displaying zero until a dealer-level tool authorizes the mileage transfer

43. A vehicle equipped with adaptive cruise control and automatic emergency braking has a "Forward Sensing System Unavailable" warning. No DTCs are stored. The system was working normally before the vehicle went through a car wash. What is the most likely cause?

A. The car wash chemicals have permanently etched the forward radar sensor's protective coating, reducing its sensitivity below the minimum detection threshold and requiring sensor replacement

B. The car wash damaged the wiring harness connector for the forward camera or radar sensor, creating an intermittent connection that is too brief to set a DTC but sufficient to disable the system

C. The forward camera's lens or the radar sensor's surface behind the bumper is obstructed by water droplets, wax residue, or soap film from the car wash that is attenuating the signal below the operational threshold

D. The car wash's high-pressure spray disrupted the forward camera's internal calibration by physically shifting the lens element, requiring a static recalibration before the system can be re-enabled for operation

44. A rear-wheel-drive vehicle has a vibration that occurs at exactly 60 km/h and exactly 120 km/h but is absent at all other speeds. The vibration is felt through the floor and seat. What does this speed-doubling pattern suggest?

A. The vibration source is a single imbalanced rotating component whose vibration frequency hits the vehicle's structural resonance at 60 km/h (fundamental frequency) and 120 km/h (second harmonic)

B. Two different vibration sources are independently active at 60 km/h and 120 km/h — the drive shaft at the lower speed and the rear differential at the higher speed — creating the two-speed pattern

C. The rear differential ring and pinion gears have a tooth damage pattern that repeats at two specific frequencies corresponding to the gear mesh at those two exact vehicle speeds only

D. The engine mounts have failed asymmetrically, allowing the engine's firing frequency to match the drive shaft's rotational frequency at those two specific speeds and create a resonance amplification

45. A manual transmission vehicle has a slight grinding feel (not a loud grind) when shifting into third gear only. All other gears engage smoothly. The grinding becomes less noticeable as the transmission oil warms up. What does the temperature sensitivity indicate?

A. The third gear set has a damaged tooth that interferes with engagement at cold temperatures when the metal contracts, but the interference clears as the components warm and thermally expand

B. The clutch is not fully releasing at cold temperatures because the thick cold hydraulic fluid reduces the slave cylinder's travel, but the fluid thins and allows full release as it warms during operation

C. The third gear synchronizer has worn friction material that cannot overcome the thick, cold oil's resistance to speed matching, but performs adequately once the oil thins at operating temperature

D. The input shaft bearing is worn and allows the shaft to shift laterally at cold temperatures, misaligning the third gear engagement path until the bearing warms and the clearance normalizes

46. A four-wheel-drive truck has a "Service 4WD" warning light. The scan tool shows a DTC for the front axle disconnect actuator motor circuit open. The actuator is located on the front differential housing. What is the actuator's function?

A. The actuator engages and disengages the connection between the front differential and the front axle shafts, allowing the front wheels to freewheel in 2WD mode and connect to the differential in 4WD mode

B. The actuator controls the front differential's locking mechanism that locks the left and right front wheels together for maximum traction when the driver selects the 4WD Lock position on the selector

C. The actuator adjusts the front differential's gear ratio to match the transfer case's selected range (High or Low), ensuring the front and rear axles rotate at the same speed in all 4WD operating modes

D. The actuator controls the front differential's limited-slip clutch pack preload, adjusting the clamping force based on the 4WD mode selected and the wheel speed differential detected by the ABS sensors

47. An automatic transmission has a P0751 DTC (Shift Solenoid A Stuck Off). The transmission operates in third gear only and will not shift. The technician commands the solenoid using the scan tool — it clicks audibly but the transmission still does not shift. What does this indicate?

A. The solenoid responds electrically (the click confirms the coil energizes and the plunger moves), but the valve it controls in the valve body is stuck — the solenoid's physical output cannot move the valve

B. The solenoid responds electrically, confirming the code is a false detection from a wiring issue that intermittently interrupted the circuit, and the no-shift condition is caused by a separate mechanical fault

C. The scan tool command energized the solenoid, but the solenoid's internal plunger is seized and the click is from the relay, not the solenoid — the solenoid must be replaced along with the valve body

D. The solenoid and valve body are both functioning correctly, and the no-shift condition is caused by a failed output speed sensor that prevents the TCM from calculating the correct gear for the current conditions

48. A customer reports that their vehicle's AWD system engages aggressively — the vehicle lurches when the AWD coupling transfers torque to the rear wheels during acceleration. The AWD system is an electronically controlled multi-plate clutch coupling. What is the most likely cause?

A. The AWD control module is receiving an incorrect wheel speed signal that exaggerates the front-to-rear speed differential, causing the module to command maximum clutch engagement force instantly

B. The AWD coupling's multi-plate clutch pack has contaminated or degraded friction material that causes it to grab abruptly rather than engaging progressively when the control module commands torque transfer

C. The front differential has worn spider gears that create excessive backlash, and the clunk from the differential play is being transmitted to the rear axle through the AWD coupling during engagement

D. The vehicle's traction control system is commanding the AWD coupling to engage aggressively as a stability intervention, and the lurching is the TCS's corrective action rather than an AWD system fault

49. A vehicle with a continuously variable transmission (CVT) has a whining noise that increases with engine RPM. The noise is present in all operating conditions — drive, reverse, and neutral. What does the noise being present in neutral indicate?

A. The CVT belt or chain is not the source because the belt/chain does not transmit load in neutral, and the noise source must be a component that rotates in all transmission positions

B. The torque converter is the source because it remains hydraulically coupled in all positions and produces speed-dependent noise from a failing bearing or damaged internal component

C. The CVT's input shaft bearing or oil pump is the source, since both components rotate whenever the engine is running regardless of whether the transmission is in drive, reverse, or neutral

D. The CVT's variator pulleys are the source because they maintain their position and rotate with the input shaft in neutral, even though no torque is being transmitted through the belt at that time

50. A dual-mass flywheel equipped vehicle has developed a rattle at idle in neutral. The customer also reports a slight shudder during initial clutch engagement from a stop. What is the most likely diagnosis?

A. The dual-mass flywheel's internal spring and damper mechanism has worn, causing both the idle rattle (from the secondary mass oscillating against worn springs) and the launch shudder (from the degraded damping allowing engine pulses to transmit through the clutch)

B. The clutch disc's torsional damper springs have broken, producing the rattle at idle and the shudder during engagement as the disc hub oscillates without the dampening effect of the broken springs

C. The release bearing has developed a rough spot that produces the rattle when the bearing contacts the pressure plate fingers at idle, and the same rough spot causes the shudder during clutch engagement

D. The pressure plate diaphragm spring has a broken finger that produces the rattle from the imbalanced spring force at idle and causes uneven clamping that creates the shudder during clutch engagement

51. A front-wheel-drive vehicle makes a repetitive metallic "clank" noise at low speed during tight turns in parking lots. The noise occurs once per wheel revolution and is louder during left turns than right turns. What is the most likely cause?

A. The right front hub bearing has a broken retainer cage that allows one roller to impact the race once per revolution, and the noise is louder during left turns when vehicle weight loads the right bearing

B. The right front outer CV joint has internal wear — a worn cage, scored inner race, or chipped ball — that produces a single impact per revolution, amplified during left turns when the joint operates at its maximum angle

C. The left front brake pad has a loose anti-rattle clip that contacts the rotor once per revolution, and the noise is louder during left turns because weight transfer to the right unloads the left brake assembly

D. The right front strut mount bearing has a flat spot that produces a single impact per revolution during steering rotation, and left turns produce more noise because the strut rotates further during left steering input

52. An automatic transmission shifts normally when the transmission fluid is cold but develops a 1-2 second delay when engaging drive from park after the fluid reaches operating temperature. What does this hot-engagement delay indicate?

A. The transmission oil pump has worn internal gears that produce adequate pressure with thick cold fluid but cannot maintain pressure when the fluid thins at operating temperature, causing the engagement delay

B. The forward clutch piston seal is the source, since it seals adequately with thick cold fluid but allows bypass leakage when the fluid thins at operating temperature, requiring extra time to build apply pressure

C. The transmission's main pressure regulator valve is sticking at operating temperature due to varnish buildup, delaying the pressure rise needed to engage the forward clutch pack quickly when drive is selected

D. The torque converter's internal check valve is leaking hot fluid back to the sump, requiring the pump to refill the converter before the transmission can engage, creating the delay specifically at operating temperature

53. A four-wheel-drive truck's front axle makes a clicking noise when the 4WD system is engaged and the steering wheel is turned. The noise is not present in 2WD. What is the most likely cause?

A. The front wheel bearings are loaded differently in 4WD mode due to the additional torque through the axle shafts, and the clicking is from a bearing with a cracked inner race that contacts the shaft under load

B. The front axle U-joints or CV joints are worn, and the clicking is produced when the joints operate at the steering angles under the torque loading of 4WD engagement, which does not occur in freewheeling 2WD mode

C. The transfer case shift collar is not fully engaging the front output, creating a partial engagement that produces a clicking sound as the drive spline teeth intermittently contact during steering movement

D. The front differential spider gears are worn and produce a clicking noise when the speed differential between the left and right front wheels during turns is transmitted through the loaded gears in 4WD mode

54. A customer reports that their automatic transmission "slams" into park when the shift lever is moved from drive to park at a stop. What is the most likely cause?

A. The vehicle is still rolling slightly when the shift lever is moved to park, and the parking pawl impacts the rotating park gear, creating the slamming engagement noise that does not occur when fully stationary

B. The park actuator solenoid has high internal resistance that delays the engagement signal, causing the pawl to snap into the gear with a delay rather than engaging smoothly at the moment the lever is moved

C. The transmission mount has worn, allowing the transmission to shift position relative to the shift cable when park is selected, creating a jarring sensation that mimics a harsh park engagement in the drivetrain

D. The park interlock cable has stretched, causing the shift lever's mechanical linkage to overtravel past the park position, which creates excessive force on the park pawl and produces the slamming sensation

55. A vehicle with a torque converter equipped automatic transmission has a shudder between 60 and 80 km/h during light throttle cruising. The shudder disappears with slight acceleration or deceleration. What is the most likely cause?

A. The engine mounts have worn and allow the engine to shift during the specific load conditions of light-throttle cruising at that speed range, creating a vibration transmitted through the chassis to the cabin

B. The exhaust system has a resonance at the specific engine RPM corresponding to 60-80 km/h light-throttle operation, and the exhaust system hangers have deteriorated, allowing the vibration to transmit

C. The front or rear tires have an out-of-round condition that produces vibration at the specific rotational speed corresponding to 60-80 km/h and is dampened by the speed variation of acceleration and deceleration

D. The torque converter clutch is the source — contaminated fluid or a worn clutch surface causes the TCC to shudder at its lockup engagement speed, and the shudder disappears when the speed change unlocks the TCC

56. An electronically controlled all-wheel-drive system distributes torque through an electronically controlled center coupling. Under what normal driving condition does this coupling transfer the most torque to the rear wheels?

A. During steady-state highway cruising at constant speed on dry pavement, where the coupling maintains a fixed 50/50 torque split for optimal high-speed stability and predictable handling characteristics

B. During hard acceleration from a stop on dry pavement, where the front wheels experience brief slip and the coupling rapidly increases rear torque distribution to maintain maximum traction at launch

C. During heavy braking on a slippery surface, where the coupling transfers torque to the rear wheels to provide engine braking assistance that supplements the friction brake system's deceleration force

D. During steady-state highway cruising in rain, where the coupling preemptively increases rear torque distribution to prepare for potential traction loss before any wheel slip is detected by the system

57. A rear-wheel-drive vehicle has a vibration at all speeds that is proportional to vehicle speed (not engine RPM). The technician raises the vehicle and runs the engine in gear with the rear wheels spinning — the vibration is present. Placing the transmission in neutral while the wheels coast to a stop, the vibration continues until the wheels stop. What does this tell us?

A. The vibration source is the engine, since the vibration was present while the engine was driving the wheels and the residual vibration during coast-down is the engine's flywheel spinning down

B. The vibration source is in the transmission, since the input shaft continues to rotate at vehicle speed during the coast-down period and the transmission output bearings are loaded during this deceleration

C. The vibration source is the exhaust system, which resonates at the frequency corresponding to the wheel speed and continues to vibrate sympathetically as the wheels coast down after the engine is disconnected

D. The vibration source is downstream of the transmission — the drive shaft, U-joints, differential, axles, or wheels — since the vibration continues with the engine disconnected and stops only when the wheels stop

58. A manual transmission vehicle has a clutch that chatters (vibrates) during engagement from a stop. The chatter occurs every time regardless of engine RPM or clutch release speed. What should be inspected?

A. The flywheel and pressure plate surfaces for oil contamination from a rear main seal or input shaft seal leak, hot spots, or surface irregularities that prevent smooth, progressive friction contact

B. The clutch hydraulic system for air contamination that causes pulsating release bearing pressure during engagement, creating a vibrating clutch application instead of a smooth progressive contact

C. The engine mounts for excessive movement that allows the engine to oscillate during the critical clutch engagement phase, transmitting the engine's rocking motion through the drivetrain as chatter

D. The transmission input shaft splines for wear that allows the clutch disc hub to rock on the shaft during engagement, creating a vibration as the disc alternately loads and unloads the worn spline surfaces

59. A vehicle with a viscous-coupling center differential AWD system has a customer complaint of "binding" during tight turns in parking lots. The vehicle has been serviced recently and has four matching tires of the same brand, size, and tread depth. What should be checked?

A. The transfer case fluid level and condition, since overfilling or using the incorrect fluid viscosity can cause the viscous coupling to transfer excessive torque during tight turns, creating the binding sensation

B. The viscous coupling itself for degradation — the silicone fluid may have "hardened" from heat and age, causing the coupling to transfer torque continuously instead of only during speed differentials, creating a permanent partial lock

C. The front differential for a worn spider gear that creates excessive backlash during low-speed turns, producing a binding feel that is transmitted through the driveline rather than originating from the center coupling

D. The tire pressures for even a slight imbalance between front and rear that creates a rolling circumference difference, generating a constant speed differential that the viscous coupling interprets as a traction event

60. A vehicle's automatic transmission has a P0730 (Incorrect Gear Ratio) code that sets only in sixth gear (overdrive). The scan tool data shows the input-to-output speed ratio in sixth gear does not match the expected value. What should be checked?

A. The torque converter clutch apply circuit, since many vehicles rely on the TCC being locked in sixth gear to achieve the correct final ratio, and a slipping TCC would cause the ratio error only in that gear

B. The vehicle's tire size, since aftermarket tires with a different rolling circumference than the original equipment change the output speed sensor's calculated vehicle speed relative to the transmission's actual output

C. The sixth-gear clutch pack or band for slippage, since the incorrect ratio indicates the friction element specific to sixth gear is not holding fully under load, allowing the ratio to deviate from specification

D. The transmission output speed sensor for a calibration drift that only becomes apparent at the higher rotational speed corresponding to sixth gear, where the sensor's signal frequency approaches its maximum rated accuracy

61. A vehicle's battery is three months old and tests "Good — Recharge" on a conductance tester. The battery has been repeatedly discharged to the point of requiring a jump start. What concern exists about a repeatedly deep-discharged battery?

A. Repeated deep discharge cycles gradually increase the battery's internal resistance, reducing its CCA capacity even though the conductance test currently shows adequate plate structure

B. Repeated deep discharges have no long-term effect on a battery that currently tests good, and the battery will continue to perform to its original specification once fully recharged to 12.6V or above

C. Repeated deep discharges are beneficial for lead-acid batteries because they exercise the full plate surface area, preventing sulfation buildup that would otherwise reduce the battery's capacity over time

D. Repeated deep discharges cause permanent sulfation of the lead plates that progressively reduces the battery's capacity and CCA rating, even though the current conductance test may still show "Good"

62. A vehicle's blower motor runs when the ignition is off and the HVAC controls are in the off position. What is the most likely cause?

A. The blower motor relay has welded its contacts in the closed position, providing continuous battery power to the blower motor regardless of the ignition state or the HVAC control module's commands

B. The HVAC control module has an internal fault that continues to command the blower motor circuit even when the ignition is off and the module should be in sleep mode with all outputs deactivated

C. The blower motor has developed an internal short that creates a parasitic path from the battery through the motor winding to ground, causing the motor to run slowly even without a relay command

D. The BCM has lost its configuration data for the blower motor control circuit and is defaulting to a continuous-on state that overrides the HVAC control module's off command during all ignition states

63. A vehicle's power window works normally in the down direction but will not move up. The window motor, switch, and wiring have been tested — all are functional. What is the most likely cause?

A. The window regulator's internal balance spring has broken, and the motor can push the glass down with gravity assist but cannot overcome the glass weight plus the broken spring's resistance in the up direction

B. The window channel has accumulated debris or the window glass has shifted in its track, creating resistance that exceeds the motor's capacity in the up direction but not in the gravity-assisted down direction

C. The window motor's internal thermal overload protector has tripped from overheating during extended use and limits the motor's current in one direction while allowing normal current in the other direction

D. The window switch has a faulty directional relay that provides full voltage in the down direction but reduced voltage in the up direction, limiting the motor's torque to a level insufficient to lift the glass

64. A vehicle has a "Check Charging System" warning. The battery voltage reads 12.2V with the engine running. The alternator drive belt is intact and the alternator spins when the engine runs. What is the most likely cause?

A. The battery has a dead cell that creates an internal load that the alternator cannot overcome, pulling the system voltage down to the battery's compromised resting voltage regardless of alternator output

B. The alternator's internal voltage regulator has failed and is not commanding field current, so the alternator rotor has no magnetic field and cannot generate output despite spinning at engine speed

C. The charging system fuse has blown, disconnecting the field current circuit from the ignition switch and preventing the voltage regulator from receiving the signal to begin producing charging output

D. The alternator's serpentine belt is worn smooth and slipping on the pulley at engine speed, preventing the alternator from reaching the minimum RPM needed to produce output voltage above battery level

65. A vehicle's engine cooling fans run only at high speed — the low-speed fan setting does not work. The ECM commands the fans to low speed for normal cooling and high speed for A/C operation or overheating. What is the most likely cause?

A. The low-speed fan resistor, relay, or speed control module has failed, preventing the reduced-voltage or reduced-current supply that normally drives the fans at lower speed during normal cooling demand

B. Both cooling fan motors have internal windings that have partially shorted, reducing their resistance and causing them to draw high-speed current even when the low-speed circuit provides reduced voltage

C. The ECM's low-speed fan output driver has failed open, preventing the ground signal from reaching the low-speed fan relay coil, while the separate high-speed output driver continues to function correctly

D. The coolant temperature sensor has a calibration offset that reports temperatures 10°C above actual, causing the ECM to command high-speed fans for what it perceives as elevated cooling demand

66. A vehicle's headlamp auto-leveling system has a fault code indicating the left front height sensor is out of range. The vehicle was recently lowered with aftermarket springs. What is the connection?

A. The aftermarket springs have changed the vehicle's magnetic field at the left front sensor location, interfering with the Hall-effect sensor's ability to produce an accurate ride height measurement signal

B. The left front height sensor was physically damaged during the spring installation when the suspension was compressed beyond its normal travel range by the spring compressor during the service

C. The aftermarket lowered springs have positioned the suspension below the height sensor's designed measurement range, causing the sensor to report a value outside the system's expected parameters

D. The aftermarket springs have a different spring rate than the originals, and the height sensor is measuring the change in suspension oscillation frequency rather than actual ride height, triggering the out-of-range code

67. A vehicle's scan tool data shows that the A/C compressor is commanded on and the clutch relay is energized, but the compressor clutch does not engage. The technician measures 12.4V at the clutch connector when commanded on. What is the next test?

A. Verify that the A/C system refrigerant charge is at the correct level, since low charge would cause the pressure switch to open and prevent clutch engagement despite the relay providing voltage

B. Measure the compressor clutch coil resistance to determine if the coil has an open circuit that prevents current flow despite the 12.4V supply being present at the connector from the energized relay

C. Replace the compressor clutch relay, since the 12.4V reading at the connector may be phantom voltage from the relay's coil circuit rather than true power being delivered through the relay's load contacts

D. Check the compressor clutch air gap for excessive spacing that prevents the electromagnetic field from pulling the clutch plate against the pulley face, despite the coil being energized with adequate voltage

68. A vehicle's windshield wipers park in the middle of the windshield instead of at the bottom. The wipers operate normally at all speeds but stop mid-wipe when turned off. What is the most likely cause?

A. The wiper motor's internal park switch has failed in a position that signals the motor to stop at the mid-point of its travel instead of continuing to the full down park position when the wiper switch is turned off

B. The wiper linkage has a worn pivot point that allows the wiper arm to overtravel during operation, and the motor parks correctly but the linkage's dead zone positions the arm at mid-windshield instead of bottom

C. The wiper motor's park circuit has failed — the motor stops wherever the wipers happen to be when the switch is turned off rather than completing the cycle to the park position, stopping at a random position

D. The wiper arms have been installed at the wrong position on the motor's output shaft splines, and the arms rest at mid-windshield when the motor correctly reaches its internal park position at the bottom of its travel

69. A technician measures battery terminal voltage during cranking and reads 10.8V. The engine cranks at normal speed and starts without difficulty. Is this cranking voltage acceptable?

A. No — cranking voltage should remain above 11.5V for proper operation of all vehicle systems during the starting event, and 10.8V indicates the battery is degraded and should be replaced immediately

B. No — cranking voltage should not drop below 12.0V during starting, and the 10.8V reading indicates excessive resistance in the starter circuit that must be diagnosed before the vehicle is returned to service

C. Yes — cranking voltage typically drops to 11.5V or slightly above during normal cranking, but 10.8V is marginally below the ideal range and suggests the battery's CCA capacity is declining with age

D. Yes — cranking voltage between 9.6V and 10.5V is the minimum acceptable range, and 10.8V is above this threshold, indicating the battery and starting system are functioning within acceptable parameters

70. A vehicle's dome light stays on after all doors are verified closed. The door jamb switches have been tested and all show open circuits when the doors are closed. What should be checked next?

A. The instrument cluster dimmer control, which on many vehicles has a maximum-brightness position that overrides the door switch inputs and commands the dome light to illuminate continuously

B. The BCM for a fault code that indicates an incorrect door-ajar status from a module on the network that is reporting a false door-open signal to the BCM through the CAN bus communication

C. The headlamp switch for a courtesy light override position that the driver may have inadvertently selected, since some headlamp switches have a detent that activates the interior lights independently

D. The dome light timer relay for a stuck-closed condition that maintains power to the dome light circuit beyond the programmed delay period, overriding the BCM's off command after door closure

71. A vehicle's A/C system produces cold air at the center vents but warm air at the outer (far left and far right) vents. What is the most likely cause in a single-zone HVAC system?

A. The center vents receive air directly from the evaporator while the outer vents receive air that has traveled through longer ductwork past the heater core, picking up residual heat from the core even in full cold mode

B. A partially open blend door is allowing some heated air to mix with the cooled air, and the mixing pattern directs the warm air preferentially toward the outer vents while the center vents receive the purest cold air

C. The evaporator has a partial restriction on one side that reduces its cooling capacity on the outer vent feed, while the unrestricted center section provides full cooling to the center vent feed ductwork

D. The HVAC mode door is partially blocking the outer vent ductwork, forcing the majority of the cold air through the center vents while the reduced airflow to the outer vents picks up heat from surrounding ductwork

72. A vehicle has an intermittent electrical fault that causes the engine to stall. The technician notices that the stalling occurs when the steering wheel is turned to full lock in either direction. What component should be investigated?

A. The power steering pressure switch, which signals the ECM to increase idle speed during full-lock steering, and a faulty switch could send an incorrect signal that causes the ECM to cut fuel or spark

B. The EPS motor's current demand at full lock, which may exceed the vehicle's electrical system capacity and cause a voltage drop below the ECM's minimum operating threshold, triggering a stall

C. The clockspring ribbon cable in the steering column, which may have a damaged conductor that intermittently shorts or opens at full steering lock, disrupting a critical circuit that passes through the clockspring

D. The steering column wiring harness, which may be pinched between the steering column housing and the dash structure at full lock, intermittently shorting a wire that shares a ground with the ECM's power supply

73. A vehicle has a P0480 DTC (Cooling Fan 1 Control Circuit). The fan does not operate. The technician tests the fan relay by swapping it with the horn relay (same part number) — the fan now works. What does this confirm?

A. The original fan relay has failed and needs to be replaced, since the identical horn relay in the same socket position activated the fan circuit, proving the relay is the only failed component

B. The fan motor, its wiring, and the ECM's control signal to the relay are all functional — only the relay itself has failed, since swapping in a known-good relay restored normal fan operation

C. The fan circuit has a wiring fault that was temporarily resolved by the mechanical disturbance of swapping the relays, and the original relay should be reinstalled and the circuit monitored for recurrence

D. Both the fan relay and the horn relay are failing, and the temporary function of the horn relay in the fan position is unreliable — both relays should be replaced with new components for safety

74. A vehicle's A/C performance is adequate during the day but the customer reports the system cools poorly during the evening rush hour commute. The system was professionally serviced and charged to the correct weight. What is the most likely explanation?

A. The evening commute involves stop-and-go traffic at idle, where the condenser receives minimal airflow and the cooling fan alone cannot reject enough heat to maintain optimal high-side pressure and cooling performance

B. The ambient temperature drop in the evening causes the A/C pressure to decrease, reducing the refrigerant's ability to absorb heat in the evaporator and resulting in perceived poor cooling performance

C. The vehicle's electrical system is under higher load during evening driving (headlamps, daytime running lamps off, and cabin lights on), reducing the available voltage to the compressor clutch circuit

D. The A/C system has an intermittent fault that correlates with the vehicle's fuel level — the evening commute begins with a lower fuel level that changes the evaporator's mounting angle as the tank lightens

75. A vehicle has a P0562 code (System Voltage Low) that sets intermittently. The battery and alternator have been tested and are both functioning correctly. The charging system produces 14.4V at the alternator and 14.3V at the battery. What should be investigated?

A. The ECM's internal voltage measurement circuit for a fault that intermittently reads a lower voltage than actually present, triggering the code despite the charging system producing adequate output

B. The battery cable connections and grounds for intermittent high resistance that causes a brief voltage drop below the ECM's threshold during high-current events such as fan activation or A/C clutch engagement

C. The alternator's voltage regulator for an intermittent fault that briefly drops the field current to zero, causing a momentary charging output loss that recovers before the battery voltage drops significantly

D. The vehicle's main fuse box for a loose connection at the battery feed terminal that intermittently increases resistance under vibration, causing a voltage drop detected by the ECM as a system voltage fault

76. A vehicle has headlamps that are aimed too high, blinding oncoming drivers. The customer has not modified the vehicle. What is the most common cause of misaimed headlamps on an unmodified vehicle?

A. The headlamp assemblies' mounting brackets have loosened from vibration, allowing the housings to tilt upward from their factory-set positions over time as the mounting hardware gradually relaxes

B. The headlamp adjuster screws have been accidentally turned during an unrelated service (such as a headlamp bulb replacement) and need to be reset to the correct aim using a headlamp alignment machine

C. A heavy load in the trunk or cargo area has compressed the rear suspension, tilting the vehicle's nose upward and redirecting the headlamp beams higher than their designed aim relative to the road surface

D. The headlamp bulbs were replaced with aftermarket units that have a slightly different filament position than the originals, projecting the beam pattern at a higher angle despite the housing aim being correct

77. A vehicle has an intermittent no-start condition where the starter does not engage. The dash lights come on normally, the battery is good, and occasionally jiggling the shift lever allows the vehicle to start. What is the most likely cause?

A. The neutral safety switch (park/neutral position switch) has an intermittent contact in the park position that opens the starter circuit, and moving the shift lever re-establishes the contact temporarily

B. The ignition switch has worn contacts in the start position that intermittently fail to send the crank signal to the starter relay, and the vibration from moving the shift lever dislodges debris on the contacts

C. The starter solenoid has an intermittent winding fault that occasionally fails to energize, and the vibration from moving the shift lever has no actual effect — the solenoid randomly re-energizes on its own

D. The BCM has an intermittent communication fault with the immobilizer that prevents it from authorizing the start signal, and moving the shift lever triggers a CAN bus message that resets the authorization

78. A vehicle's rear defogger operates but the customer reports that the upper portion of the rear window clears while the lower portion remains foggy. What is the most likely cause?

A. The rear defogger grid has adequate power distribution from the bus bars, but the lower grid lines have higher resistance due to longer conductor length, producing less heat at the bottom of the window

B. The rear window's lower section has a thicker glass composition from the manufacturing process that retains more thermal mass, requiring longer defogger operation to reach the clearing temperature

C. Hot air naturally rises, and the heat generated by the lower grid lines rises and warms the upper portion of the glass, leaving the lower area underheated until the entire glass reaches equilibrium temperature

D. One or more grid lines in the lower section of the rear window are broken, interrupting the current flow through those elements and preventing them from generating heat to clear the fog in that area

79. A vehicle's power mirror adjusts in all directions on the driver's side, but only adjusts up/down on the passenger side — left/right movement does not work. What is the most likely cause?

A. The passenger mirror glass is binding in its housing from a foreign object or mounting clip that prevents the glass from pivoting in the left-right axis while allowing free movement in the up-down axis

B. The left-right adjustment motor inside the passenger mirror assembly has failed while the up-down motor continues to function normally, since each axis of movement uses an independent motor

C. The mirror selector switch on the dashboard has a faulty contact for the passenger left-right function that prevents the control signal from reaching the mirror's left-right motor during adjustment attempts

D. The passenger mirror's wiring harness has a break in the conductor for the left-right motor circuit that prevents current from reaching the motor while the up-down motor circuit remains intact and functional

80. A vehicle's HVAC blend door actuator has been replaced, but the system still delivers air at the wrong temperature. The scan tool shows the actuator moves to the commanded position. What else should be checked?

A. The new actuator's motor may be spinning freely without engaging the blend door's drive pin, creating the appearance of movement on the scan tool without actually repositioning the door within the HVAC case

B. The HVAC control module's temperature calibration may need to be reset after the actuator replacement to re-establish the correct relationship between the commanded position and the actual door position

C. The blend door itself may be broken, separated from its pivot shaft, or have a stripped drive interface that prevents the actuator from moving the door despite the actuator motor rotating to the correct position

D. The heater core may be partially restricted, limiting the heat available to the blend door's hot-air path and producing a lower maximum temperature regardless of how far the blend door opens to the heat position

81. A technician is testing a vehicle's starter draw using a clamp-on ammeter around the battery cable. The reading shows 280 amps during cranking. The specification is 150 to 200 amps. What does the excessive draw indicate?

A. The starter motor has an internal fault — shorted windings, worn brushes making poor contact, seized bushings, or a dragging armature — that increases its current demand above the normal specification

B. The engine has a mechanical condition — such as excessive bearing drag, incorrect valve timing, or a hydrolocked cylinder — that increases the resistance to crankshaft rotation and forces the starter to work harder

C. The battery has a weak cell that produces lower voltage during cranking, causing the starter to draw more current to compensate for the reduced voltage while attempting to produce the same cranking torque output

D. Both the starter motor and the engine should be investigated, since excessive current draw can be caused by either a starter fault (motor drawing more than it should) or an engine fault (engine harder to turn than it should be)

82. A vehicle has a check engine light with a code for "Evaporative Emission System Large Leak Detected" (P0455). The gas cap has been replaced and the code cleared, but it returns. What is the next diagnostic step?

A. Replace the EVAP canister vent valve and the purge valve simultaneously, since these two components account for the majority of large EVAP leaks when the gas cap has been eliminated as the source

B. Visually inspect all EVAP system hoses and connections for obvious disconnections or cracks, since a large leak is often visible without specialized equipment and should be checked before using a smoke machine

C. Perform an EVAP system smoke test to introduce visible smoke into the sealed system and locate the large leak by observing where the smoke exits, which pinpoints the exact location of the leak path

D. Replace the EVAP system pressure sensor, since a faulty sensor is the most common cause of large leak codes after the gas cap has been eliminated, and sensor replacement is faster than smoke testing

83. A vehicle's rear brake lights stay on continuously — even with the ignition off and the brake pedal not depressed. What is the most likely cause?

A. The brake light switch is out of adjustment or has failed in the closed (on) position, keeping the brake light circuit continuously powered regardless of the pedal position or ignition state

B. The BCM has an internal fault that is continuously commanding the rear brake light circuit on through its solid-state output driver, overriding the brake light switch's physical position and the ignition state

C. The rear brake light wiring has a short to a continuous-power source (such as the battery feed) that bypasses the brake light switch and provides direct battery voltage to the brake lamp filaments at all times

D. The tail light relay has welded contacts that are providing continuous power to the tail light and brake light circuits simultaneously, illuminating the brighter brake filaments along with the dimmer tail filaments

84. A vehicle pulls to the left during braking and the technician discovers the right front brake hose has an internal collapse that acts as a one-way valve — fluid passes to the caliper but cannot return. What symptom would this hose condition also produce between braking events?

A. The right front brake would have no braking force because the collapsed hose blocks fluid from reaching the caliper piston, leaving only the left front brake active and causing the leftward pull

B. The right front brake would release normally because the master cylinder compensating port allows pressure equalization regardless of the hose condition, and the pull is from a different cause

C. The right front brake would remain partially applied between braking events because the trapped fluid keeps pressure on the caliper piston, causing brake drag, overheating, and premature pad wear

D. The right front brake would be unaffected between braking events because the rubber hose's elasticity absorbs the trapped fluid pressure, allowing the caliper piston to retract normally after each stop

85. A customer reports that the vehicle's steering is stiff during the first few turns of the steering wheel on a cold morning, then loosens up. The vehicle has hydraulic power steering. What is the most likely cause?

A. The power steering pump's internal bypass is stuck open from overnight cooling and takes several steering inputs to pressurize and close, after which the pump delivers normal operating pressure

B. The power steering fluid viscosity is too thick at cold temperatures due to using the incorrect fluid specification, creating excessive resistance in the system until the fluid warms from pump operation

C. The steering rack's internal piston seals contract when cold and allow fluid bypass that reduces assist, then expand and seal as the fluid warms and heats the rack housing to operating temperature

D. The power steering pump's belt tension decreases overnight from cooling contraction, causing belt slippage during the first few steering inputs until the belt warms and friction increases to prevent slippage

86. A vehicle has a vibration felt through the brake pedal during braking that increases in intensity as the brake pads wear. The rotors were resurfaced 20,000 km ago. What is happening?

A. The rotors are developing warpage from heat because the increasingly thin pads cannot absorb and dissipate heat as effectively, causing the rotors to distort more with each successive braking event

B. The rotors were resurfaced with a slight taper that was undetectable at the time of service but has been amplified by 20,000 km of wear on the pad surfaces, creating a progressively worsening pulsation

C. The rotors have developed corrosion on the unswept edges that is gradually progressing into the friction surface, creating a rough surface that produces a pulsation felt through the pedal during braking

D. Lateral runout in the hub assembly is causing the pads to contact the rotor unevenly with each revolution, gradually wearing a thickness variation into the rotor that worsens as the DTV increases over time

87. A vehicle's left front wheel has a road-force imbalance reading of 35 lbs on a Hunter Road Force balancer. The maximum specification is 18 lbs. The tire has been properly balanced with weights. What does the road-force reading indicate?

A. The tire has a belt irregularity, sidewall stiffness variation, or radial force variation that creates a vibration under load that cannot be corrected with balance weights alone and may require tire replacement

B. The balance weights are positioned at the wrong angular location on the wheel, and re-running the balance procedure with the weights at the machine's recommended positions will reduce the reading

C. The wheel has excessive lateral runout that the road-force measurement is detecting, and replacing the wheel with a new one will bring the road-force reading within the specification without tire changes

D. The tire's tread depth is too low for the road-force measurement to be accurate, and the tire should be replaced based on tread wear rather than road-force data that is unreliable below 4/32" tread depth

88. A vehicle has a front suspension clunk on the passenger side when driving over small bumps. The stabilizer bar end links, ball joints, and strut mounts have been inspected and are tight. What else should be checked?

A. The steering rack mounting bolts for looseness that allows the rack to shift in its mounts when the suspension loads change during bump impacts, producing a clunk from the rack contacting its mount bushings

B. The exhaust heat shield brackets near the passenger side for looseness that allows a shield to contact the subframe or body during bump impacts, producing a metallic clunk that mimics a suspension noise

C. The brake caliper bracket bolts for looseness that allows the caliper and bracket assembly to shift on the knuckle during suspension compression, producing a clunk that is transmitted through the strut

D. The control arm bushings for internal deterioration that allows the arm to shift within the bushing shell during bump impacts, producing a clunk even though the bushing appears intact externally

89. A vehicle's electronic stability control light illuminates and the system deactivates during normal driving on a flat, dry road. The scan tool shows a DTC for yaw rate sensor performance. What does this fault indicate?

A. The yaw rate sensor's output has drifted from its calibrated range, and the ESC module can no longer accurately calculate the vehicle's rotational behavior, so it disables the system as a safety precaution

B. The yaw rate sensor has detected that the vehicle's body structure has a vibration resonance that interferes with the sensor's measurement, and the ESC module disables to prevent false activation

C. The ESC module has a software fault that is misinterpreting the yaw rate sensor's valid output as an out-of-range value, triggering the performance code when the sensor is actually functioning correctly

D. The yaw rate sensor is physically damaged from a previous impact event and is producing a signal that indicates the vehicle is spinning when it is actually driving straight, triggering the performance code

90. A vehicle's rear drum brakes make a scraping noise during the initial few stops after the vehicle has been parked overnight. The noise disappears after several brake applications. What is causing this noise?

A. Light surface rust that forms on the drum's friction surface overnight from moisture exposure, and the brake shoes scrape this rust layer off during the first few applications until the surface is clean and smooth

B. The brake shoe return springs have weakened from age and allow the shoes to drag against the drum as the vehicle begins to move, producing a scraping noise until the shoes retract from heat expansion

C. The drum brake self-adjuster has over-adjusted the shoes against the drum during the overnight cool-down contraction cycle, and the first few brake applications push the adjuster back to the correct position

D. The parking brake cable has not fully released, keeping the shoes in light contact with the drum until the cable stretches from the heat of the first few brake applications and the shoes fully retract

91. A customer reports that the steering wheel vibrates during braking but only after the vehicle has been parked for several days. The vibration is not present during normal daily driving with regular brake use. What is the most likely cause?

A. The brake pad material deposits unevenly on the rotor surface when the vehicle sits with the pads in contact with the hot rotors after a stop, and the uneven deposits create a pulsation that wears off with use

B. Rust builds on the rotor surface during extended parking, creating uneven friction when the brakes are first applied, producing a temporary vibration that disappears as the rust is cleaned off during normal driving

C. The brake fluid absorbs moisture more rapidly when the vehicle sits unused, and the increased moisture content creates spongy, uneven braking that the driver perceives as vibration until the moisture is purged

D. The brake calipers develop a slight seizure from corrosion during extended parking, applying unequal braking force when first used, creating a vibration that resolves as the caliper slides free during repeated use

92. A vehicle has a noise from the rear that sounds like a growling or droning that increases with vehicle speed. The noise does not change when the vehicle corners. What does the absence of noise change during cornering suggest?

A. The noise source is a rear tire with irregular wear rather than a wheel bearing, since a bearing noise typically changes when cornering loads shift weight between the left and right bearings

B. The noise source is the rear differential rather than a wheel bearing, since differential noise is constant regardless of cornering direction while bearing noise changes with directional weight transfer

C. The noise source is a rear wheel bearing that has uniform wear across its entire race, producing constant noise regardless of the direction of the cornering load applied to the bearing during turns

D. The noise source is the exhaust system resonating at a frequency corresponding to the wheel speed, which does not change with cornering because the exhaust system is not affected by lateral vehicle loads

93. A vehicle's brake pedal has a firm, high pedal with no travel when the engine is off, but becomes soft with normal travel when the engine is started. Is this normal?

A. No — the pedal should feel the same regardless of whether the engine is running, and the change indicates a faulty master cylinder that can only build pressure with the assistance of the brake booster

B. No — the pedal should be firmer with the engine running because the booster should increase the driver's pedal force, not soften the pedal feel, and the soft feel indicates a booster leak or check valve fault

C. Yes — the pedal should have more travel and feel softer with the engine running because the brake booster provides vacuum assist, but the braking force is actually greater despite the softer pedal sensation

D. Yes — this is the normal operation of the vacuum brake booster, which provides vacuum assist when the engine is running, allowing the pedal to travel further with less effort while increasing braking pressure

94. A vehicle has excessive play in the steering that is felt as a dead zone at the steering wheel center position. The tie rod ends, ball joints, and steering rack have been inspected and show no detectable play. What should be checked next?

A. The steering column intermediate shaft universal joints for wear that absorbs small steering inputs before they reach the rack, creating a dead zone at the steering wheel center that is not detectable at the rack

B. The front wheel bearings for play that allows the wheels to shift before responding to the rack's lateral input, creating a perceived dead zone in the steering that manifests only at the center position

C. The steering column upper bearing for wear that allows the column shaft to move laterally within the column housing, creating a dead zone where the shaft moves but the rack does not respond

D. The power steering pump for low pressure that delays the rack's response to small steering inputs at the center position, creating a dead zone that feels like mechanical play but is actually hydraulic lag

95. A vehicle's tire has a bulge on the sidewall approximately 3 cm in diameter. The tire is otherwise in good condition with adequate tread depth. Can this tire continue to be used?

A. Yes — small sidewall bulges are a normal cosmetic defect from the tire manufacturing process and do not affect the tire's structural integrity or safety for continued driving at normal speeds

B. Yes — if the bulge is less than 5 cm in diameter and the tire holds pressure normally, it can continue to be used until the next scheduled tire rotation when it should be replaced as a precaution

C. No — a sidewall bulge indicates internal structural damage to the tire's carcass plies, and the tire must be replaced immediately because the bulge can rupture without warning during driving

D. No — but the tire can be temporarily repaired with an internal reinforcement patch applied from the inside of the tire at the bulge location, extending its safe service life by approximately 10,000 km

96. A vehicle has a rear wheel bearing noise that the technician has confirmed by road test and lift inspection. The bearing is a sealed, pressed-in hub unit on a semi-floating axle. What is the correct replacement procedure?

A. The hub unit can be replaced with the axle shaft in place by simply unbolting the hub from the knuckle and pressing in the new unit without removing the axle shaft from the differential housing

B. The axle shaft must be removed from the differential housing first, then the hub unit is pressed out of the axle housing or knuckle and a new unit pressed in, followed by axle shaft reinstallation

C. The entire axle housing and hub assembly must be replaced as a unit because the bearing is pressed into the housing and cannot be separated without specialized dealer-only tooling and facilities

D. The sealed hub unit can be serviced by removing the seals, cleaning the bearing races, repacking with fresh grease, and installing new seals — replacement of the entire unit is not necessary

97. A vehicle's scan tool shows the brake fluid level sensor is reporting "Low" even though the reservoir is filled to the maximum mark. What should be checked?

A. The brake fluid for contamination with petroleum products (power steering fluid, engine oil) that can damage the float sensor's material and cause it to sink even when the fluid level is adequate

B. The brake master cylinder for an internal fault that is pressurizing the reservoir and preventing the float from rising to the correct position, triggering the low-level warning despite adequate fluid volume

C. The brake fluid level sensor connector for corrosion or contamination that is creating a resistance fault in the sensor circuit, causing the BCM to interpret the signal as a low-level condition incorrectly

D. The brake fluid level sensor or its float mechanism for a fault — the float may be stuck in the down position, waterlogged, or disconnected from the sensor element, causing a false low-level reading

98. A vehicle's front-end alignment shows the left front camber at −1.8° and the right front camber at −1.8°. Both are within the specification range of −1.5° to −2.0°. However, both tires show moderate inner-edge wear. What does this indicate?

A. Despite both camber readings being within specification, the specification range allows enough negative camber to produce inner-edge tire wear over time, especially on vehicles driven aggressively or on rough roads

B. The camber readings are within specification but the alignment machine is miscalibrated, and the actual camber is more negative than displayed, causing the inner-edge wear pattern observed on both tires

C. The inner-edge wear is not caused by camber — the toe setting is the more likely cause, since toe misalignment produces a feathered wear pattern that can mimic camber wear on the inner or outer edge

D. The camber readings are correct but the tires are underinflated, causing the tire's contact patch to shift inward and concentrate the wear on the inner edge regardless of the camber angle setting

99. A vehicle's brake caliper has a frozen bleeder screw that breaks off during attempted removal. What is the correct repair?

A. Drill out the broken bleeder screw, tap new threads in the caliper body, and install a slightly larger replacement bleeder screw that fits the newly tapped hole for continued caliper use

B. Replace the brake caliper with a new or remanufactured unit, since a broken bleeder screw cannot be reliably repaired in the caliper body without risking contamination of the hydraulic passages

C. Use a left-hand drill bit to extract the broken bleeder screw from the caliper, then install a new bleeder screw in the original threads after cleaning the bore with compressed air and brake cleaner solvent

D. Drill a new bleeder hole in a different location on the caliper body and install a bleeder fitting, since the caliper's casting has sufficient material thickness to accept an additional port for bleeding purposes

100. A vehicle has been in for a wheel alignment and the technician discovers that the right rear camber is −3.5° on a vehicle with a specification of −1.0° to −2.0° and a non-adjustable rear suspension. What does this out-of-specification camber indicate?

A. The tire on the right rear wheel is the incorrect size, creating an apparent camber reading on the alignment machine that does not represent the actual suspension geometry for that corner of the vehicle

B. A bent or damaged rear suspension component — such as a trailing arm, knuckle, axle, or subframe — has shifted the wheel's geometry beyond the range of normal alignment values

C. The alignment machine's right rear sensor head is miscalibrated and is producing an inaccurate reading that does not match the actual camber angle at that wheel position when measured with a manual gauge

D. The rear springs on the right side have sagged from age, lowering the ride height on that corner and changing the camber angle beyond the specification range that would be achievable with the designed geometry

101. A vehicle's side curtain airbags are located behind the headliner and A/B/C-pillar trim panels. A body shop is repainting the vehicle and needs to mask the interior trim. What precaution is required regarding the SRS?

A. No SRS precaution is required for exterior painting since the interior trim panels are not being removed and the airbag modules behind them will not be disturbed during the masking and painting process

B. The SRS system must be disarmed before any trim panels near airbag modules are removed or disturbed for masking, even if the intent is only to protect the trim during painting and not to service the airbags

C. The headliner and pillar trim can be masked in place without SRS disarming, since the masking tape and paper do not create any electrical hazard to the airbag initiators behind the covered trim panels

D. Only the battery must be disconnected — the full SRS disarming procedure with capacitor discharge wait is not required for painting preparation since no SRS connectors will be physically disconnected

102. A vehicle's rear passenger window will not close and is stuck in the down position. The window switch does not respond in either direction. The child lock is not engaged. The driver's master switch also cannot operate the window. What should be checked first?

A. The window motor for an internal thermal overload protector that has tripped from extended operation, preventing the motor from running until it cools down and the protector resets automatically

B. The window regulator for a mechanical jam or derailed cable that has physically locked the glass in the down position, preventing the motor from moving the glass regardless of the switch or motor condition

C. The BCM for a fault code related to the rear passenger window circuit that indicates a module-level control fault preventing commands from reaching the motor regardless of which switch is used

D. The fuse and power supply circuit for the rear passenger window, since a blown fuse or disconnected power connector would disable the window from all switch locations simultaneously

103. A vehicle's windshield has a long crack that extends from one side of the glass to the other across the driver's line of sight. Is this windshield safe to continue driving with?

A. Yes — laminated windshield glass maintains its structural integrity regardless of crack length because the PVB interlayer holds the glass together and prevents it from separating during normal driving

B. No — the windshield must be replaced because the crack compromises the glass's structural contribution to the vehicle's roof strength, airbag deployment support, and the driver's clear line of sight

C. Yes — as long as the crack does not extend into the critical area directly in front of the driver's eyes (within 30 cm of the steering wheel center), the windshield can continue in service until a convenient replacement

D. No — but a temporary repair can be made by applying clear epoxy along the crack length to prevent it from spreading further, extending the windshield's safe service life until a permanent replacement is scheduled

104. A vehicle's keyless entry system works intermittently. Sometimes all four doors lock and unlock, other times only two doors respond. The key fob battery is new. What should be investigated?

A. The key fob's internal antenna circuit for a cold solder joint that intermittently reduces the transmission power, causing only the nearest door receivers to pick up the weakened signal during some activations

B. The vehicle's body control module for a software fault that intermittently fails to relay the lock/unlock command to all four door lock actuators, processing only a partial command from the keyless entry receiver

C. The individual door lock actuators and their wiring for intermittent electrical faults — such as corroded connectors, worn motor brushes, or damaged wiring — that prevent consistent response at each door

D. The vehicle's battery for a declining state of charge that limits the current available to operate all four door lock actuators simultaneously, causing only the first two actuators to receive adequate power

105. A vehicle's seatbelt warning chime sounds continuously even though the driver's seatbelt is fastened. What should be checked?

A. The seatbelt buckle switch in the driver's seatbelt receptacle, which may have a fault that prevents it from detecting the buckle's insertion and signaling the BCM that the belt is fastened properly

B. The BCM for a software fault that is ignoring the seatbelt buckle switch's signal and commanding the chime to sound regardless of the switch's actual open or closed state during operation

C. The seatbelt retractor for a fault in the pretensioner circuit that is sending a false "unbuckled" signal to the BCM through the SRS system's seatbelt status monitoring network during normal driving

D. The instrument cluster for a faulty chime driver that is generating the seatbelt warning tone continuously from a short in the cluster's internal audio circuit, independent of any BCM command signal

106. A vehicle's automatic dimming interior rearview mirror has stopped dimming at night when headlamps shine into the mirror from behind. The mirror's compass and temperature display functions still work. What is the most likely cause?

A. The mirror's forward-facing ambient light sensor has failed, preventing the mirror from detecting the low ambient light conditions that trigger the auto-dimming function during nighttime driving

B. The mirror's rear-facing glare sensor has failed, preventing the mirror from detecting headlamp glare from following vehicles and preventing the electrochromic gel from darkening in response to the bright light

C. The mirror's electrochromic gel has degraded from UV exposure through the rear window, and the gel can no longer change opacity in response to the electrical signal from the glare detection circuit

D. The mirror's internal voltage regulator has failed at the specific output that feeds the dimming circuit, while the separate voltage rail that powers the compass and temperature display continues to operate normally

107. A hybrid vehicle's high-voltage battery pack has a DTC indicating cell imbalance. The scan tool shows one cell group is 0.5V lower than the others. The BMS is actively balancing the cells but the imbalance persists after multiple balancing cycles. What does this indicate?

A. The low cell group has degraded more than the others and has permanently lost capacity, requiring either individual cell module replacement or the BMS accepting a reduced pack capacity operating range

B. The BMS balancing circuit has a fault on the channel corresponding to the low cell group, preventing it from transferring energy to or from that group despite commanding the balancing operation correctly

C. The HV battery cooling system has a flow restriction near the low cell group that causes it to operate at a higher temperature, accelerating its degradation relative to the cooler cells in the remainder of the pack

D. The pack has a manufacturing defect where one cell group was installed with a slightly different chemistry than the others, creating an inherent voltage mismatch that the BMS cannot correct through balancing

108. A battery electric vehicle has reduced regenerative braking force. The scan tool shows the regenerative braking is limited to 20% of its normal maximum. The battery SOC is at 50% and the temperature is 22°C. No DTCs are stored. What should be investigated?

A. The friction brake system, since the BEV's regenerative braking reduction may be the system compensating for excessive friction brake drag that is providing deceleration force the regen normally supplies

B. The drive motor's temperature, since the motor's continuous current rating may have been exceeded from sustained driving, and the BMS is limiting regen current to prevent the motor from overheating

C. The brake pedal position sensor for a calibration drift that is not sending the correct deceleration demand signal to the motor controller, causing the system to limit regen force despite conditions permitting full recovery

D. The 12V auxiliary battery condition, since a weak 12V battery can prevent the HV contactor control circuits from fully engaging, limiting the regen current path and reducing the available regenerative braking force

109. A plug-in hybrid vehicle's owner asks whether it is safe to charge the vehicle during a thunderstorm. What is the correct answer?

A. No — the vehicle must be unplugged during any thunderstorm because a lightning strike on the electrical grid could travel through the charging cable and damage the vehicle's onboard charger and HV battery

B. Yes — the vehicle's charging system includes multiple protection devices (ground fault interrupters, surge protectors, and galvanic isolation in the onboard charger) that protect against electrical surge events

C. No — while the vehicle itself is protected, the home's electrical panel and EVSE (charging station) are at risk of damage from a lightning-induced surge that could start an electrical fire at the charging station

D. Yes — but only if the EVSE is connected to a circuit with a dedicated whole-house surge protector rated for the maximum surge energy of a direct lightning strike on the service entrance conductors

110. A battery electric vehicle has a warning indicating "Charging System Fault — Visit Dealer." The vehicle drives normally but will not charge from any Level 2 station. It charges normally from a standard 120V household outlet (Level 1). What component is most likely faulty?

A. The Level 2 EVSE charging station at the customer's home, since the vehicle charges normally from Level 1, and the Level 2 station has likely developed a fault in its internal relay or pilot circuit

B. The vehicle's charge port locking mechanism, which fails to engage at the higher-current Level 2 connection but succeeds at the lower-current Level 1 connection, preventing the Level 2 charge session from initiating

C. The charge port connector itself, which has a damaged pin used only for the Level 2 pilot signal but not needed for Level 1 operation, preventing the vehicle from communicating with the Level 2 EVSE

D. The vehicle's onboard charger, which has a fault in its higher-power Level 2 charging circuit that prevents it from accepting the 240V input, while its separate lower-power Level 1 circuit continues to function normally

111. What is the primary purpose of the Battery Management System (BMS) in a hybrid or electric vehicle?

A. The BMS monitors and manages every aspect of the HV battery — cell voltages, temperatures, current flow, state of charge, state of health, cell balancing, and thermal management — to maximize battery life, performance, and safety

B. The BMS controls the vehicle's regenerative braking system, determining how much braking force is generated by the motor versus the friction brakes during every deceleration event throughout the driving cycle

C. The BMS manages the 12V auxiliary system, controlling the DC-DC converter output to maintain the 12V battery at the correct state of charge and distributing power to the vehicle's conventional electrical accessories

D. The BMS controls the electric motor's torque output by managing the inverter's switching frequency, determining how much power the motor produces in both driving and regenerative braking operating modes

112. A hybrid vehicle's AC/DC onboard charger produces a high-pitched whine during Level 2 charging. The charging completes normally and no DTCs are stored. Is this a concern?

A. Yes — the whine indicates the charger's power transistors are failing, and the charger should be replaced before it fails completely during a charging session and potentially damages the HV battery pack

B. Yes — the whine indicates the charger is operating at an incorrect switching frequency that can damage the HV battery cells from the resulting current ripple during the extended charging session

C. No — a high-pitched whine from the onboard charger during charging is normal and is caused by the rapid switching of the power electronics converting AC to DC, which produces audible electromagnetic vibrations

D. No — the whine is from the HV battery cooling fan, which runs at high speed during charging to maintain battery temperature, and the sound is a normal operational characteristic during every charging session

113. A battery electric vehicle has a range of 350 km when new. After three years and 60,000 km, the range has decreased to 320 km. The BMS reports SOH at 91%. Is this degradation within normal parameters?

A. Yes — a 9% capacity loss (91% SOH) after three years and 60,000 km is within the typical degradation range for automotive lithium-ion batteries, and the rate of loss generally decreases after the initial years

B. No — a 9% loss in three years exceeds the industry standard of no more than 5% degradation in the first five years, and the battery should be inspected for a cooling system fault that is accelerating degradation

C. Yes — but only if the vehicle was operated exclusively in moderate climate conditions, since any exposure to temperatures above 35°C or below −10°C would cause the 9% loss to be considered excessive

D. No — the 9% capacity loss indicates a manufacturing defect in the battery cells, since properly manufactured cells should retain 98% or more of their original capacity for the first 100,000 km of service

114. A technician needs to measure the voltage of an individual cell group within a hybrid vehicle's HV battery pack. The pack is rated at 300V total. The technician has a standard automotive DVOM rated for 600V CAT III. Is this meter adequate for the measurement?

A. No — a CAT III rated meter is not sufficient for HV automotive applications, and a CAT IV rated meter must be used for all measurements on HV battery packs in hybrid and electric vehicles

B. Yes — a 600V CAT III meter is adequate for measuring individual cell group voltages within a 300V battery pack, as long as the technician follows the manufacturer's safety procedures and wears appropriate PPE

C. No — only the manufacturer's proprietary battery diagnostic tool can safely measure individual cell voltages, since the pack's internal busbar configuration requires a specific measurement probe geometry

D. Yes — but only if the meter has been calibrated within the past 12 months and bears a current calibration certification sticker, since an uncalibrated meter may produce inaccurate readings on HV circuits

115. A battery electric vehicle's thermal management system uses a heat pump for both cabin heating and battery conditioning. During extremely cold weather (−25°C), the heat pump's heating capacity decreases significantly. What is the technical reason for this limitation?

A. The heat pump's compressor oil becomes too viscous at extremely cold temperatures, reducing the compressor's ability to circulate refrigerant efficiently through the heat pump cycle at the designed flow rate

B. The heat pump's condenser (indoor unit) ices over at extremely cold temperatures, blocking airflow and reducing the heat exchange efficiency until the defrost cycle clears the accumulated ice from the coils

C. The electric compressor motor's permanent magnets lose approximately 15% of their magnetic strength at −25°C, reducing the compressor's ability to generate the pressure differential needed for efficient operation

D. The heat pump extracts thermal energy from the outside air, and at −25°C the available heat energy in the air is significantly reduced, limiting the amount of heat the system can transfer into the cabin and battery

116. A customer brings in a plug-in hybrid vehicle and asks about the maintenance schedule differences compared to their previous conventional vehicle. What is the most significant maintenance interval change?

A. The engine oil change interval is longer because the engine runs less frequently, but the oil must still be changed on a time-based interval even if the mileage threshold is not reached due to reduced engine operation

B. The brake pad replacement interval is significantly longer because regenerative braking handles most deceleration, reducing friction brake usage and dramatically extending the life of the brake pads and rotors

C. The transmission fluid change interval is shorter because the electric motor's high torque output stresses the transmission fluid more than a conventional engine's lower torque, requiring more frequent changes

D. The tire replacement interval is shorter because the electric motor's instant torque delivery causes faster tread wear from the higher acceleration forces applied to the tires during every departure from a stop

117. A hybrid vehicle displays "Check Hybrid System" and enters a reduced power mode during highway driving. The scan tool reveals a DTC for "Inverter Overtemperature." The vehicle was towing a trailer on a steep grade in 35°C ambient conditions. What caused this condition?

A. The HV battery cells exceeded their maximum discharge temperature due to the sustained high-current demand, and the BMS disabled the inverter to prevent further battery thermal stress

B. The engine cooling system's thermostat failed in the closed position, preventing coolant from reaching the inverter's cooling circuit that shares a common loop with the engine radiator

C. The regenerative braking system was operating continuously during the downhill grade, and the excess energy generated by regeneration overloaded the inverter's power transistors thermally

D. The sustained high-power demand of towing on a steep grade in hot ambient conditions exceeded the inverter's continuous thermal capacity, causing the power electronics to overheat beyond safe limits

118. A battery electric vehicle owner reports that the vehicle's range estimate fluctuates significantly during a single drive — the displayed range drops faster than the actual distance driven. What is the most likely explanation?

A. The range estimate algorithm has a software fault that miscalculates the remaining energy and should be recalibrated by the dealer using the manufacturer's diagnostic programming tool

B. The range estimate is a real-time calculation based on current driving conditions — aggressive acceleration, high speed, climate control use, and elevation changes cause the estimate to adjust continuously

C. The HV battery has a failing cell module that intermittently drops its voltage, causing the BMS to recalculate the total available energy downward each time the weak module voltage dips during driving

D. The vehicle's speedometer is reading higher than actual speed, causing the range algorithm to calculate faster energy consumption per kilometer than is actually occurring during the current drive

119. A plug-in hybrid vehicle has been parked for six weeks. When the owner returns, the vehicle will not enter Ready mode. The 12V auxiliary battery is completely dead and the HV battery was at 80% SOC when parked. What is the most likely explanation?

A. The DC-DC converter operates only when the vehicle is in Ready mode, so during extended parking the 12V battery received no charge and was gradually depleted by the vehicle's parasitic module draw

B. The HV battery discharged completely during the six-week parking period from internal self-discharge, and the dead HV pack triggered a protective shutdown that also drained the 12V auxiliary battery

C. The vehicle's security system increased its monitoring frequency after detecting the extended parking period, consuming more 12V current than normal and draining the auxiliary battery prematurely

D. The ambient temperature dropped below the HV battery's minimum operating threshold during the parking period, and the BMS used the 12V battery to power the battery heating system until both were depleted

120. A technician needs to jump-start a hybrid vehicle that has a dead 12V auxiliary battery. The HV battery appears to have adequate charge. What is the correct procedure?

A. Connect jumper cables from a donor vehicle directly to the HV battery terminals to provide the 12V system with power through the DC-DC converter operating in reverse to step down the HV voltage

B. Connect jumper cables to the designated 12V jump-start terminals (which may be under the hood, separate from the 12V battery location), following the manufacturer's specific jump-start procedure

C. The hybrid vehicle cannot be jump-started by any method and must be flat-bed towed to the dealer for a 12V battery replacement before the HV system can be reactivated for normal operation

D. Remove the 12V battery from the hybrid vehicle and charge it on a bench charger for a minimum of four hours before reinstalling it, since jump-starting can damage the hybrid system's sensitive electronics

121. What is the function of the electric A/C compressor on a hybrid or plug-in hybrid vehicle, and why is it different from a conventional belt-driven compressor?

A. The electric compressor runs on 12V DC from the auxiliary battery and provides cabin cooling only during brief engine-off periods at traffic lights, switching to the belt-driven compressor when the engine runs

B. The electric compressor is powered by the HV battery and can operate independently of the engine, providing cabin cooling during EV-only driving, engine-off idle stop events, and plug-in charging

C. The electric compressor serves only to cool the HV battery pack and does not provide cabin cooling — a separate conventional belt-driven compressor handles all cabin air conditioning functions

D. The electric compressor operates as a backup to the belt-driven compressor and only activates when the belt-driven unit fails, providing emergency cooling until the vehicle reaches a repair facility

122. A battery electric vehicle's traction control activates aggressively during normal acceleration from a stop on dry pavement. The tires are the correct size and properly inflated. What is the most likely cause?

A. The regenerative braking calibration has drifted, causing the motor to briefly apply reverse torque during the transition from braking to acceleration, which the traction control interprets as wheel slip

B. The BMS is limiting the motor's torque output due to a battery fault, and the sudden torque reduction triggers the traction control system because it interprets the output change as a traction event

C. The ABS module's wheel speed sensor calibration has an error that causes one sensor to report a different speed than the others during acceleration, triggering false traction control intervention

D. The electric motor delivers maximum torque instantly from zero RPM, and if the traction control calibration is too sensitive or a wheel speed sensor has a fault, it can intervene during the initial torque application

123. A hybrid vehicle's engine runs continuously and never shuts off during city driving, even at stops. The HV battery SOC reads 45% on the scan tool, which is within the normal operating range. No DTCs are stored. What should the technician investigate?

A. The hybrid control module's operating strategy parameters and the conditions required for engine-off operation — including minimum battery SOC threshold, coolant temperature, cabin temperature demand, and any customer-selectable mode settings that may force engine-on operation

B. The HV battery cooling fan for a noise that the hybrid control module is interpreting as a fault condition, causing it to keep the engine running to maintain charging and prevent the battery from deep cycling

C. The transmission fluid temperature, since some hybrid vehicles keep the engine running when the transmission fluid is outside its optimal range to maintain hydraulic pressure for the gear engagement system

D. The exhaust system for a catalytic converter efficiency fault that forces the hybrid system to keep the engine running continuously to maintain catalyst light-off temperature for emissions compliance

124. A battery electric vehicle has reduced DC fast charging speed. The scan tool shows the HV battery temperature at 42°C during charging. The manufacturer's optimal charging temperature range is 20°C to 35°C. What is the relationship between the battery temperature and the charging speed?

A. The BMS detected that the battery temperature was elevated at 42°C before or during charging, and has intentionally reduced the DC fast charging speed to limit additional heat generation that would push the battery further above its optimal range

B. The elevated battery temperature actually improves charging speed because warmer cells have lower internal resistance, so the reduced charging speed must be caused by a different factor unrelated to temperature

C. The battery temperature has no effect on DC fast charging speed because the external cooling system maintains the cell temperature independently of the charging current level during all fast charging sessions

D. The 42°C temperature has triggered an emergency cooling mode that diverts all available electrical power to the battery cooling system fans and pump, leaving less power available for the actual charging process

125. A technician is performing a pre-purchase inspection on a used battery electric vehicle with 95,000 km on the odometer. What BEV-specific item should be included in the inspection beyond standard vehicle checks?

A. The electric motor brush wear, since BEV traction motors use carbon brushes that wear proportionally with mileage and require measurement to estimate remaining motor service life before replacement

B. The HV battery state of health (SOH) reading from the scan tool, which indicates the remaining percentage of the battery's original energy storage capacity and directly affects the vehicle's driving range and resale value

C. The inverter coolant color, since inverter coolant changes from green to brown as the power transistors degrade, providing a visual indicator of the inverter's remaining service life without electronic testing

D. The charge port cycle count, which records the total number of charging sessions and is the primary indicator of HV battery wear, since each charging session removes a fixed percentage of the battery's total lifespan

Practice Exam 7: Answer Key and Explanations

1. D — A leaking hydraulic ram indicates the jack is failing and could collapse without warning. The only safe action is to lower the vehicle completely to the ground immediately using whatever controlled descent the leaking jack can still provide. Once on the ground, the jack must be removed from service, tagged as defective, and replaced before any further lifting operations.

2. A — Shop pits create a confined space below floor level where dense gases accumulate. Exhaust gases (containing carbon monoxide), solvent vapors, and refrigerant (which are heavier than air) settle into the pit, displacing breathable oxygen at the technician's working level. Adequate ventilation and gas monitoring are essential whenever work is performed in a below-grade pit.

3. C — Gasoline contains benzene, toluene, and other aromatic hydrocarbons that are absorbed through the skin and cause both acute dermatitis and long-term health effects. Chemical-resistant nitrile or butyl rubber gloves prevent prolonged skin contact during fuel system work. Standard latex gloves are not adequate because gasoline degrades latex rapidly.

4. B — A swollen, bulging battery case indicates excessive internal gas pressure from overcharging, a shorted cell, or thermal runaway. The hydrogen gas generated inside the battery is flammable and explosive. A bulging battery can rupture violently, spraying corrosive sulfuric acid electrolyte and igniting the accumulated hydrogen gas.

5. A — Canadian workplace ergonomic guidelines generally recommend a maximum manual lift of approximately 23 kg (50 lbs) under ideal conditions. The actual safe lift weight varies based on the vertical height of the lift, the horizontal distance from the body, the lifting frequency, the body posture required, and the grip quality — all factors that can reduce the safe weight below 23 kg.

6. D — The Canadian Environmental Protection Act (CEPA) and its associated regulations (including the Federal Halocarbon Regulations and the Ozone-Depleting Substances and Halocarbon Alternatives Regulations) prohibit the intentional release of ODS and HFC refrigerants. Proper recovery, recycling, and reclamation procedures must be followed during all A/C service operations.

7. B — A technician who discovers a safety-related condition during any service has a professional and ethical obligation to inform the customer, regardless of whether the condition is related to the authorized service. An exhaust leak allows carbon monoxide to enter the cabin — a potentially fatal hazard. The discovery must be documented on the repair order and communicated to the service advisor.

8. C — Chemical burns from strong acids or bases can continue to damage tissue beneath the skin surface even after thorough flushing. The full extent of the burn may not be apparent for hours or days. Medical evaluation is necessary to assess the depth of tissue damage, provide appropriate wound treatment, and monitor for delayed complications regardless of how minor the burn appears after flushing.

9. A — A parts washer using flammable petroleum-based solvent must have a self-closing lid (to limit vapor release and smother a fire), a fusible link that automatically closes the lid if the temperature rises above a threshold (typically 60°C), and be listed or certified by a recognized testing laboratory (such as UL or CSA) for use with the specific class of flammable liquid it will contain.

10. D — The scan tool confirms the ECM commands an idle speed increase when the A/C is engaged, but the actual RPM does not rise. This means the idle air control mechanism — whether an IAC valve, electronic throttle motor, or idle air bypass passage — cannot open far enough to admit the additional air needed to increase the idle speed. Carbon buildup in the idle air passage is the most common restriction.

11. C — An ignition coil's internal insulation (potting compound, wire insulation) contracts when cold and can develop micro-cracks that allow spark energy to leak to ground internally rather than reaching the spark plug electrode. As the coil warms from even a few seconds of operation, the insulation expands and re-seals the cracks, restoring normal spark output and eliminating the misfire.

12. B — The customer's short urban driving pattern is the root cause — not a DPF or aftertreatment fault. Short trips produce exhaust temperatures too low for passive regeneration and too brief for active regeneration to complete its 15-to-30-minute high-temperature cycle. The technician must explain that the driving pattern must include periodic sustained highway driving to allow regeneration, or the DPF will repeatedly reach critical soot loading.

13. A — The propane enrichment test introduces additional fuel at specific locations. When propane is drawn into the engine through a vacuum leak at the intake manifold gasket on bank 1, it enriches the lean mixture entering through the leak, improving combustion and causing the RPM to increase. This RPM response pinpoints the leak location at the manifold gasket area on that specific bank.

14. A — On engines where the EGR port feeds exclusively into one bank's intake runners, a stuck-open EGR valve dilutes only that bank's intake charge with inert exhaust gas. The inert gas displaces combustible air-fuel mixture, reducing the oxygen available for combustion and causing the bank to run lean. Bank 1 is unaffected because it receives no EGR flow.

15. B — The cylinder power balance test disables each injector individually and measures the RPM drop. A healthy cylinder causes a significant RPM drop when its fuel is removed. If disabling cylinder 2's injector produces no RPM change, that cylinder was already contributing no power — confirming a fault on cylinder 2 that prevents effective combustion regardless of whether the cause is ignition, fuel, or mechanical.

16. C — With normal borescope findings (no unusual carbon, no oil residue on valve stems) and a functioning PCV system, the most likely oil consumption path is through the piston ring pack — specifically the oil control rings. Oil control rings that cannot adequately scrape oil from the cylinder walls allow thin oil films to remain and burn during combustion in quantities too small to produce visible carbon deposits.

17. A — The secondary intake runners provide additional cross-sectional area for high-RPM, high-airflow conditions. When the control valve is stuck closed, the secondary runners remain blocked, restricting the engine's ability to ingest the additional air volume needed at high RPM. The engine's power output above the crossover point is limited by the restricted single-runner airflow capacity.

18. B — An exhaust manifold crack or leaking gasket allows pressurized exhaust pulses to escape through the crack or gap, producing a sharp ticking sound that follows engine RPM (one tick per exhaust pulse). Under load, the higher exhaust pressure increases the velocity of gas escaping through the leak, intensifying the ticking. During coasting, the reduced exhaust pressure decreases the intensity.

19. D — A downstream oxygen sensor that reads a steady 0.45V and does not respond to forced rich or forced lean commands has failed. The 0.45V reading is the sensor's bias voltage — the voltage the ECM's reference circuit applies to the sensor when no electrochemical cell output is present. A functional downstream sensor would shift above 0.45V in rich conditions and below 0.45V in lean conditions.

20. C — The rail pressure control valve (or quantity control valve) regulates how much fuel is delivered to the rail or how much is vented back to the tank. If this valve has a fault — stuck partially open, electrically miscalibrated, or mechanically worn — it vents excess fuel from the rail, reducing the actual pressure below the ECM's commanded target value across all operating conditions.

21. A — Cylinders 1 and 4 are at opposite ends of the block and are not adjacent — they cannot share a head gasket leak between them. This means each cylinder has an independent mechanical fault: individually burned valves, broken rings, or valve seat recession. The coincidence of two cylinders

failing simultaneously may indicate a common root cause (such as overheating or detonation) that damaged both cylinders.

22. C — Surge at steady cruise with normal fuel trims, stable throttle position, and no misfire codes points to the EGR system. An EGR valve that oscillates between partially open and closed alternately dilutes and enriches the intake charge rhythmically, creating the RPM variation the driver perceives as surge. The ECM cannot correct for this because the EGR position appears normal in the data stream.

23. B — In a relative compression test, the scan tool measures how much the crankshaft decelerates during each cylinder's compression stroke. A cylinder with good compression strongly resists crankshaft rotation (high deceleration). A cylinder with 30% less deceleration is offering significantly less resistance — meaning it has substantially lower compression than the other seven cylinders.

24. C — A slight timing chain tick at idle that disappears above 1,500 RPM is consistent with a minor slack condition that is only audible at the low-frequency pulse rate of idle. The chain tensioner may be at or near its maximum extension from normal chain elongation, and the remaining slack produces a tick at the low crankshaft speed of idle but is masked by the faster, smoother operation at higher RPM.

25. D — A milky, cloudy appearance in a diesel fuel sample from the water separator is the classic presentation of water contamination. Water enters the fuel tank through condensation (temperature cycling in a partially empty tank), a damaged tank vent that allows rainwater entry, or a contaminated fuel supply. The water emulsifies with the diesel fuel, creating the milky appearance.

26. A — A random misfire distributed evenly across all cylinders during light-throttle cruise — with all ignition and fuel components confirmed good — suggests a restriction in the exhaust system. A partially blocked catalytic converter or collapsed exhaust pipe creates backpressure that becomes significant specifically at the sustained airflow conditions of light-throttle cruise, preventing complete scavenging and causing misfires across all cylinders.

27. B — Visible bubbles in the oil through the oil filler cap indicate air is being introduced into the oil circuit. The most common source is a deteriorated O-ring or gasket on the oil pickup tube, which is submerged in the sump. When the seal fails, the pump draws a mixture of oil and air from around the failed seal, introducing air bubbles into the pressurized oil that are visible at the top of the engine.

28. C — The scan tool confirms cranking fuel pressure reaches specification within 0.5 seconds — eliminating fuel pressure as the cause. However, if the rail bleeds to zero during the overnight shutdown,

the pump must repressurize the rail from empty during each cold start, creating the 2-3 second delay. The system holds pressure when warm because the engine is restarted before the rail bleeds down.

29. A — With the engine off, the intake manifold is not generating vacuum — it is open to atmospheric pressure through the throttle body and idle air passages. The MAP sensor correctly reads atmospheric pressure (approximately 100 kPa at sea level), which is the expected reading at KOEO. When the engine starts and creates vacuum, the MAP reading will drop to approximately 25-40 kPa at idle.

30. D — The most common cause of a DEF quality code immediately after a customer refill is the customer adding the wrong fluid to the DEF tank. Windshield washer fluid (which is also a blue liquid in a similar container) is the most frequent error. Water, coolant, or any non-DEF fluid dilutes the urea solution below the required 32.5% concentration, triggering the quality warning.

31. C — The replacement thermostat was verified as the correct temperature rating. However, the ECT sensor may report a temperature lower than actual, causing the ECM to believe the engine has not reached the thermostat's regulating temperature when it actually has. An ECT sensor with a calibration error or a slightly different resistance curve than the OEM specification can trigger P0128 even with a correct thermostat.

32. A — All other modules communicate normally (proving the CAN bus backbone is healthy). The airbag module is the only module that fails to respond. This isolates the fault to the ACM's individual connection to the bus — its CAN bus spur wiring, its connector, its power supply, its ground, or the module itself. A single module communication loss with all others healthy points to the module's spur circuit.

33. B — APP Sensor 1 reads 0.18V — well below the minimum specification of 0.5V. The low voltage indicates the signal is being pulled toward ground, either by an internal sensor fault or an external wiring fault. A short to ground in the signal wire, a corroded connector that creates a ground path, or a failed internal sensor element all produce this below-minimum voltage pattern.

34. A — The momentary power loss during the repair caused some modules to lose their stored VIN data. Each affected module must be individually reprogrammed with the vehicle's VIN using the manufacturer's diagnostic programming tool. The VIN is a critical identifier that each module stores independently for anti-theft verification and calibration matching.

35. C — Resistance within specification confirms the sensor's coil winding is intact, but resistance alone cannot detect a cracked sensing element, a damaged tone ring, or a signal quality problem. An oscilloscope connected to the sensor output during wheel rotation reveals the actual AC signal waveform — its amplitude, frequency, and pattern — which can expose dropouts, irregular peaks, or waveform distortion.

36. A — Temperature-dependent communication faults that appear when cold and improve when warm are characteristic of a component with a thermal sensitivity — a CAN transceiver inside a module that produces erratic output at cold temperatures and stabilizes as it warms to its normal operating range. This is less common than wiring faults but produces the specific temperature correlation described.

37. A — The express-up/express-close feature requires the window control module to know the window's full travel range (top and bottom endpoints) so the anti-pinch feature can distinguish between an obstruction and normal seal resistance at the top of travel. After any motor or regulator replacement (or battery disconnection), the learned endpoints are lost. The initialization procedure re-establishes these endpoints.

38. C — A parasitic draw of 400 mA that persists 60 minutes after key-off (well past the normal module sleep timeout) from the telematics module indicates the module is not entering sleep mode. While some telematics modules maintain a low-level connection, 400 mA is far above the normal standby draw of a properly functioning telematics module (typically 5-15 mA). The module's power management circuit has failed.

39. B — The left radar sensor produces a continuous detection signal while the right side functions normally. A sensor aimed at the vehicle's own body panel (from bumper misalignment after a previous repair) or at its own mounting bracket constantly detects a "nearby object" at a fixed distance. The right side is unaffected because its aim is correct and it does not detect the vehicle's own structure.

40. B — The ECM calculates fuel delivery based on the MAF reading. With the MAF reporting only 3.2 g/s when the engine actually ingests 5.5+ g/s, the ECM delivers fuel for 3.2 g/s of air, creating a lean condition. The upstream O_2 sensors detect the lean exhaust, and the fuel trim system adds positive correction to compensate — the smooth idle is maintained by the fuel trim correction, not the MAF accuracy.

41. D — Network management frames are specialized CAN bus messages that coordinate the sleep/wake state transitions of all modules on the bus. These frames signal when the bus should remain

active (because a module still needs to communicate) and when all modules can safely transition to their low-power sleep mode after the ignition is turned off, managing the orderly shutdown of the network.

42. A — The odometer value is stored in the instrument cluster module, not the ECM. Replacing the ECM does not affect the cluster's stored mileage. If the cluster displays an incorrect reading after ECM replacement, the cluster itself has a separate fault — the ECM replacement is unrelated to the odometer discrepancy.

43. C — The forward camera lens or radar sensor surface behind the bumper is obstructed by residual water droplets, wax residue, or soap film from the car wash. This contamination attenuates the sensor's signal below the minimum operational threshold. No DTCs are stored because the system recognizes the condition as temporary environmental obstruction rather than a hardware fault.

44. A — A vibration at exactly 60 km/h and exactly 120 km/h (precisely double) indicates a single rotating component whose fundamental vibration frequency hits the vehicle's structural resonance at 60 km/h. At 120 km/h — double the speed — the vibration reaches the second harmonic of the same resonance, producing a second peak at exactly double the first speed.

45. C — A slight grinding specifically in third gear that improves with warm fluid points to the third-gear synchronizer. The synchronizer's worn friction material must overcome the resistance of thick, cold oil to match the input and output shaft speeds. Cold, viscous oil creates more resistance to speed matching than the worn synchronizer can overcome. Warm, thin oil reduces this resistance enough for the weakened synchronizer to function adequately.

46. A — The front axle disconnect actuator engages and disengages the mechanical connection between the front differential and the front axle shafts. In 2WD mode, the front wheels freewheel disconnected from the front differential, reducing parasitic drag and improving fuel economy. When 4WD is selected, the actuator connects the axle shafts to the differential so the front wheels receive torque.

47. C — The solenoid clicks (confirming the electrical circuit energizes the coil and the plunger moves), but the transmission still doesn't shift. This means the solenoid's mechanical output is not moving the valve it controls inside the valve body. The valve is stuck from varnish, debris, or a worn bore — the solenoid can push its plunger but the valve it acts upon will not move.

48. B — An electronically controlled AWD coupling that engages aggressively (lurching) rather than progressively has worn or contaminated friction material in its multi-plate clutch pack. Clean, fresh

friction material allows smooth, modulated torque transfer as the plates progressively engage. Contaminated or worn material grabs abruptly — the clutch either slips or fully locks with no smooth transition between the two states.

49. C — The noise being present in drive, reverse, AND neutral means the source rotates whenever the engine runs, regardless of the transmission's gear state. The CVT's input shaft bearing and the oil pump both rotate with the engine at all times. The belt/chain and variator pulleys would not transmit noise in neutral when no load is being transferred through the CVT.

50. A — A dual-mass flywheel contains internal springs and a damper mechanism between its primary mass (bolted to the crankshaft) and secondary mass (which the clutch attaches to). As the springs wear and lose tension, the secondary mass oscillates against the primary at idle frequencies, producing the rattle. The degraded damping also allows engine combustion pulses to transmit through the clutch during engagement, producing the shudder.

51. B — A metallic clank once per wheel revolution during tight turns on a FWD vehicle is the signature of a worn outer CV joint. The noise is louder during left turns because the right joint operates at its maximum articulation angle, and the worn internal components (cage, inner race, or balls) produce a single impact per revolution. Left turns load the right joint at its steepest operating angle.

52. B — Normal cold engagement (thick fluid seals the worn seal) that becomes delayed at operating temperature (thin fluid bypasses the worn seal) identifies a temperature-sensitive hydraulic leak. The forward clutch piston seal is the specific component because the delay occurs only when engaging drive from park — the clutch unique to forward engagement. Cold, thick fluid temporarily masks the seal's wear.

53. D — The front differential spider gears are only loaded when there is a speed differential between the left and right front wheels — which occurs during turns. In 2WD mode, the front axle shafts freewheel and the differential gears are not loaded regardless of steering angle. In 4WD mode, the differential gears are loaded by the torque passing through them, and worn gears produce clicking during the speed differential of turns.

54. A — The parking pawl is a small metal finger that engages with a gear on the transmission output shaft. If the vehicle is still rolling (even slightly) when the shift lever is moved to park, the pawl contacts the rotating gear teeth with significant force, producing the slamming engagement noise. Coming to a complete stop before selecting park allows the pawl to drop gently into the gear teeth gap.

55. D — A shudder at a specific cruise speed range that disappears with slight speed changes is the classic presentation of TCC shudder. The torque converter clutch engages at the speed corresponding to the shudder range. Contaminated ATF or a worn TCC friction surface causes the clutch to grab and release rapidly. Acceleration or deceleration changes the speed enough to unlock the TCC, eliminating the shudder.

56. B — The electronically controlled coupling transfers maximum torque to the rear wheels when it detects front wheel slip — which is most pronounced during hard acceleration from a stop. The front wheels break traction briefly under the launch torque, and the coupling responds by rapidly directing torque to the rear axle. During steady cruising with no slip, the coupling minimizes rear torque to reduce parasitic losses.

57. D — The vibration continues after the transmission is placed in neutral (disconnecting the engine) and only stops when the wheels stop spinning. This proves the vibration source is downstream of the transmission — somewhere in the drive shaft, universal joints, differential, axle shafts, or wheel/tire assemblies. If the source were the engine or transmission, the vibration would stop when the engine was disconnected.

58. A — Clutch chatter during engagement that occurs regardless of RPM or pedal technique points to a friction surface problem. Oil contamination from a rear main seal or input shaft seal leak, hot spots from overheating, or surface irregularities on the flywheel or pressure plate create uneven friction that causes the disc to alternate between gripping and slipping during engagement rather than engaging progressively.

59. B — The viscous coupling's silicone fluid degrades from heat and age — the fluid's viscosity increases permanently (it "hardens" or becomes more solid-like), causing the coupling to transfer torque continuously rather than only when a speed differential exists. This creates a binding sensation during tight turns where the normal front-to-rear speed differential should allow the coupling to remain transparent.

60. A — Many vehicles' sixth-gear (overdrive) final drive ratio depends on the TCC being locked to achieve the specified overall ratio. If the TCC slips in sixth gear, the actual input-to-output speed ratio differs from the commanded value because the fluid coupling adds slippage that the locked TCC would normally eliminate. The ratio error appears only in the gear where TCC lockup is required for the correct ratio.

61. D — Repeated deep discharge causes lead sulfate crystals on the battery plates to harden into a permanent crystalline structure that resists normal recharging. This progressive sulfation permanently reduces the active plate surface area, decreasing both the battery's capacity (Ah) and its cold cranking performance (CCA) — even though a conductance test may still show "Good" during the early stages of degradation.

62. A — A blower motor that runs with the ignition off and the HVAC controls in the off position has a continuous power supply that bypasses the normal control circuit. A welded relay provides direct battery voltage to the motor regardless of any control signal. The relay contacts have fused together (typically from arcing during a high-current switching event) and cannot open to disconnect the circuit.

63. B — The motor, switch, and wiring are all confirmed functional, yet the window won't move up. The most likely remaining cause is a mechanical obstruction or binding in the window channel — accumulated debris, dried adhesive, a misaligned glass panel, or a bent track creates resistance that exceeds the motor's capacity in the up direction. Gravity assists the down direction, reducing the effective resistance.

64. B — The alternator belt is intact and the alternator spins, but the system voltage is only 12.2V — below battery resting voltage, indicating zero alternator output. Without field current, the rotor has no magnetic field and generates no voltage despite spinning. A failed voltage regulator that does not command field current, or a blown field circuit fuse, produces this zero-output condition.

65. A — The low-speed fan circuit uses a separate relay, resistor, or speed control module that provides reduced voltage or current to the fan motors. A failure of this specific low-speed component disables the lower speed while the separate high-speed circuit — which provides full battery voltage directly through its own relay — continues to function normally when the ECM commands high-speed operation.

66. C — The aftermarket lowered springs have moved the suspension geometry below the height sensor's designed measurement range. Height sensors have a limited angular or linear travel range that corresponds to the factory suspension travel. Lowering the vehicle beyond this range positions the sensor arm at an angle that produces a voltage outside the module's expected input window, triggering the out-of-range code.

67. B — Voltage is present at the connector (12.4V confirmed), so the relay, wiring, and power supply are functional. But the clutch does not engage despite voltage being applied. The clutch coil has an open circuit — a broken wire within the coil winding prevents current from flowing through the electromagnetic coil, so no magnetic field is generated and the clutch plate is not pulled against the pulley.

68. C — The wiper motor's internal park switch circuit has failed. Normally, when the wiper switch is turned off, the park switch maintains power to the motor until it reaches the park position, then opens to stop the motor at the bottom of its travel. A failed park circuit stops the motor immediately when the switch is turned off — wherever the wipers happen to be at that instant.

69. D — Cranking voltage of 10.8V is above the minimum acceptable threshold of 9.6V (at 21°C or above). The engine cranks at normal speed and starts without difficulty, confirming the battery and starting system are performing adequately. Voltage between 9.6V and 10.8V is within the normal cranking range for a healthy battery under the high-current demand of starter motor operation.

70. A — Many vehicles have a dimmer control (rotary wheel, slider, or detent on the headlamp switch) that, when rotated to maximum brightness, activates the interior courtesy lights to full continuous illumination. This override feature allows the driver to illuminate the interior for loading, searching, or other purposes. The driver may have accidentally rotated the dimmer to this override position.

71. B — In a single-zone HVAC system, a partially open blend door allows some heated air from the heater core to mix with the cooled air from the evaporator. The ductwork geometry directs this warm-air-mixed flow preferentially toward the outer vents while the center vents receive air more directly from the evaporator with less mixing, producing a noticeable temperature difference between the vent locations.

72. C — The clockspring ribbon cable carries circuits for the airbag, horn, steering wheel switches, and potentially other functions through the rotating steering column. If a conductor within the clockspring is damaged, it may intermittently short or open at the extreme steering angles of full lock, disrupting whichever critical circuit passes through the damaged conductor — including circuits that can cause stalling.

73. D — Swapping the fan relay with a known-good identical relay (the horn relay) restored fan operation — confirming the relay socket, wiring, fan motor, and ECM control signal are all functional. The only component that changed between the non-working and working states was the relay itself. The original fan relay has failed internally and must be replaced.

74. A — The evening rush hour involves stop-and-go traffic at idle, where the vehicle is stationary and no ram airflow passes through the condenser. The cooling fan alone must reject all the condenser heat. In heavy traffic on a hot day, the fan's airflow may be insufficient to reject the condenser heat load, causing high-side pressure to rise and cooling performance to decrease compared to highway driving.

75. B — The battery and alternator test good, and the charging voltage at both terminals is within specification. The intermittent P0562 code is triggered by a brief voltage dip that occurs during high-current events. The most common cause is an intermittent high-resistance connection — battery cable terminal, ground strap, or fuse box feed — that creates a momentary voltage drop under load.

76. C — A heavy load in the trunk or cargo area compresses the rear suspension, tilting the vehicle's front end upward. This changes the angle of the headlamp beams relative to the road surface, directing them higher than the designed aim. Many vehicles have headlamp leveling systems or manual adjusters to compensate for load conditions — the customer may not be aware of the adjustment.

77. A — The neutral safety switch (also called the park/neutral position switch or transmission range sensor) allows the starter to engage only when the transmission is in Park or Neutral. An intermittent contact in the Park position occasionally opens the starter circuit, preventing the crank signal from reaching the starter relay. Moving the shift lever to Neutral (a different switch contact) or back to Park re-establishes the intermittent contact.

78. D — The rear defroster grid consists of individual parallel heating elements. When one or more grid lines in the lower section are broken (from scratching, impact, or manufacturing defect), current cannot flow through those elements, and that section receives no heat. The upper section's intact grid lines function normally, creating the pattern of cleared glass on top and foggy glass on the bottom.

79. B — Each direction of mirror adjustment (up-down and left-right) uses a separate electric motor inside the mirror housing. When one direction works and the other does not, the motor for the non-working axis has failed while the other motor continues to function. The switch and wiring are eliminated because the working axis proves the control circuit delivers signals correctly.

80. A — The scan tool shows the actuator moves to the commanded position — but this only confirms the actuator's motor is rotating. If the motor's internal gear train has stripped, or the output shaft coupling to the blend door has broken, the motor spins freely without actually moving the blend door. The door remains in a fixed position regardless of the motor's rotation.

81. D — Excessive starter current draw (280A vs. 150-200A specification) can be caused by either a starter motor fault (shorted windings, worn brushes, seized bushing) that makes the motor draw more current than it should, or an engine mechanical fault (tight bearings, incorrect timing, hydrostatic lock) that makes the engine harder to turn than it should be. Both possibilities must be investigated.

82. C — A large EVAP leak (P0455) is often significant enough to be found by smoke testing. The smoke machine pressurizes the sealed EVAP system with visible smoke that exits at the leak point, pinpointing the exact location. For a large leak, smoke testing is the most efficient and definitive diagnostic method after the gas cap has been eliminated.

83. A — The brake light switch is the most common cause of continuously illuminated brake lights. The switch is mounted at the brake pedal and is normally held open (lights off) by the pedal's resting position. If the switch is out of adjustment (too far from the pedal rest stop) or has failed in the closed position, the brake light circuit remains powered continuously regardless of pedal position or ignition state.

84. C — A collapsed brake hose acting as a one-way valve allows fluid to pass to the caliper during braking but traps the fluid after the pedal is released. The trapped fluid maintains pressure on the caliper piston, keeping the brake pads applied against the rotor between stops. This constant application causes brake drag, excessive heat, premature pad and rotor wear, and a pulling sensation during driving.

85. A — Stiff steering only during the first few turns on a cold morning that improves with use points to the power steering pump's internal bypass valve. When cold, the pump's internal tolerances tighten and the bypass may stick in a partially open position, diverting fluid away from the steering gear. After a few turns, the fluid warms and the pump reaches its normal operating clearance.

86. D — Hub assembly lateral runout causes the rotor to wobble slightly as it rotates. With each revolution, the pad contacts the rotor's high spot, gradually wearing a thick-spot/thin-spot pattern into the rotor's friction surface. This rotor thickness variation (DTV) develops progressively and worsens as the pads wear thinner (less thermal mass to absorb the heat), explaining the increasing pulsation over time.

87. A — Road-force variation measures the tire's uniformity under load — belt irregularities, sidewall stiffness variations, and radial force variations that produce vibration under the weight of the vehicle. These defects are internal structural issues that cannot be corrected by adding balance weights, which only correct mass imbalance. A tire with excessive road-force variation requires replacement.

88. D — With end links, ball joints, and strut mounts eliminated, the control arm bushings are the next most common source of front suspension clunks over bumps. Internal bushing deterioration (rubber separating from the metal shell) allows the control arm to shift within the bushing shell during compression, producing a single clunk per bump impact that is not visible during a static inspection.

89. D — The yaw rate sensor measures the vehicle's rotational velocity around its vertical axis. If the sensor's output has drifted from its calibrated range, the ESC module cannot accurately determine whether the vehicle is rotating normally (during a turn) or abnormally (during a skid). The module disables the ESC system as a safety precaution because inaccurate yaw data could cause incorrect interventions.

90. A — Light surface rust forms on the exposed iron friction surface of the brake drum overnight from ambient moisture. During the first few brake applications after starting, the brake shoes scrape this thin rust layer off the drum surface. The rust particles produce the scraping or grinding noise that disappears once the friction surface is cleaned to bare metal by the shoe contact.

91. B — When a vehicle sits for several days, rust develops on the rotor friction surfaces. Unlike the light daily surface rust that clears in one or two stops, extended-parking rust is thicker and more adherent. The initial brake applications remove the rust unevenly, creating temporary thickness variation that produces a vibration felt through the steering wheel until the rotors are fully cleaned by repeated braking.

92. A — Wheel bearing noise characteristically changes during cornering because the weight transfer loads and unloads the affected bearing differently. A noise that does NOT change during cornering suggests the source is not affected by lateral weight transfer — most commonly a tire with irregular wear that produces road noise proportional to speed regardless of cornering direction.

93. D — Without the engine running, there is no vacuum to assist the brake booster. The driver must generate all braking force through leg effort alone, producing a hard, firm pedal with short travel. When the engine starts and creates vacuum, the booster amplifies the driver's effort, allowing the pedal to travel further with less effort while actually generating more hydraulic pressure and braking force.

94. A — The steering column intermediate shaft connects the steering wheel to the rack through one or more universal joints. Worn, dry, or loose joints in this shaft absorb small rotational inputs before transmitting them to the rack. The result is a dead zone at center where the driver turns the wheel slightly but the rack does not respond until the joint's free play is taken up.

95. C — A sidewall bulge indicates the tire's internal carcass plies have separated or broken at that location. The tire's inflation pressure is pushing the rubber outward through the weakened structural layer, creating the visible bulge. This area can rupture without warning during driving, causing a sudden and potentially catastrophic tire failure. The tire must be replaced immediately.

96. B — On a semi-floating axle, the axle shaft must be removed from the differential housing before the hub unit can be accessed. The hub unit is then pressed out of the axle housing or knuckle and a new unit pressed in using a hydraulic press. The axle shaft is reinstalled after the new hub is in place, and the axle nut is torqued to specification.

97. D — With the reservoir confirmed full to the maximum mark, a persistent low-level reading indicates the sensor itself has failed. The float mechanism may be stuck in the down position (from a bent arm or seized pivot), waterlogged (absorbing fluid and sinking), or disconnected from the sensor element. A faulty sensor reports low level regardless of the actual fluid volume.

98. C — Both camber readings are within their specification range (−1.8° is between −1.5° and −2.0°), yet inner-edge wear is present. However, the specification allows values of negative camber that will cause inner-edge wear over time — the wear rate just falls within what the manufacturer considers acceptable. The wear pattern is consistent with the alignment readings; the toe setting should also be verified as a potential contributor.

99. B — A broken bleeder screw in a caliper body creates an unsealed opening into the hydraulic circuit that cannot be reliably repaired in the field. Drilling and tapping the caliper risks introducing metal contamination into the hydraulic passages. The caliper must be replaced with a new or remanufactured unit that has an intact bleeder screw for safe and reliable brake bleeding.

100. B — A non-adjustable rear suspension with a camber reading 1.5° beyond the maximum specification (−3.5° vs. −2.0° maximum) indicates a physical displacement of the suspension geometry. Since no adjustment mechanism exists, the geometry shift must be caused by a bent or damaged component — a trailing arm, knuckle, axle housing, or subframe that has been displaced by impact or fatigue.

101. B — If the trim panels near airbag modules must be removed or disturbed for masking (even if the intent is only to protect them during painting), the SRS system must be disarmed first. Inadvertently disturbing an airbag module's connector or wiring during trim removal can cause deployment. The battery must be disconnected and the capacitor discharge time observed before any SRS-adjacent trim is touched.

102. D — The window does not respond from any switch — neither the rear door switch nor the driver's master switch can operate it. Since both control paths share the same fuse and power supply circuit for that specific window, a blown fuse or disconnected power connector is the most likely single-point failure that would disable the window from all switch locations simultaneously.

103. B — A crack spanning the full width of the windshield compromises the glass's structural integrity. The windshield contributes to the vehicle's roof strength (supporting up to 60% of the roof load in a rollover), supports proper airbag deployment trajectory (the passenger airbag deploys against the windshield), and provides the driver's clear line of sight. The windshield must be replaced.

104. C — The key fob battery is new (eliminating fob power) and sometimes all four doors respond (eliminating the BCM and fob programming). The intermittent nature with varying numbers of doors responding points to individual door lock actuators with degraded electrical connections — corroded connectors, worn motor brushes, or damaged wiring that intermittently prevents specific actuators from responding.

105. A — The seatbelt buckle switch detects whether the buckle tongue is inserted into the receptacle. A faulty switch that cannot detect the buckle's insertion continues to report "unbuckled" to the BCM, causing the warning chime to sound continuously. Testing the switch's continuity when the buckle is inserted and removed verifies its operation.

106. D — The compass and temperature functions work (proving the mirror has power and its display circuit is functional). The auto-dimming function uses a separate circuit that drives the electrochromic gel between the two layers of the mirror glass. A failed internal voltage regulator on the specific rail that powers the dimming circuit disables the auto-dim function while the other rail powers the display.

107. A — A persistent cell imbalance after multiple BMS balancing cycles indicates the low cell group has permanently degraded — its internal capacity has decreased relative to the other groups. Balancing equalizes voltage, not capacity. The weakened group reaches its minimum voltage sooner during discharge, limiting the entire pack's usable range. Individual cell module replacement or reduced-capacity operation is required.

108. C — The battery SOC is at 50% (plenty of capacity to accept regen) and the temperature is a moderate 22°C (within the optimal operating range). With no DTCs stored, the limitation is likely from a sensor input issue. The brake pedal position sensor calibration drift would cause the motor controller to receive an incorrect deceleration demand, limiting the regen force below normal maximum.

109. B — Modern EVSE charging systems include multiple layers of electrical protection — ground fault circuit interrupters (GFCIs) built into the EVSE, surge protection in both the EVSE and the onboard charger, and galvanic isolation between the AC grid and the DC charging circuit within the onboard charger. These protections make charging during thunderstorms safe under normal circumstances.

110. D — The vehicle charges normally from a 120V Level 1 outlet (proving the charge port, locking mechanism, and basic charging circuitry work) but fails from all Level 2 stations. The onboard charger has separate circuits for Level 1 (120V, lower current) and Level 2 (240V, higher current). A fault in the higher-power Level 2 circuit disables Level 2 charging while the lower-power Level 1 circuit continues to function.

111. A — The BMS is the master controller of the HV battery, monitoring individual cell voltages, pack current, cell temperatures, and overall pack state of charge and state of health. It controls cell balancing, thermal management (commanding the cooling pump and heater), contactor operation, and charge/discharge current limits — all designed to maximize battery life, optimize performance, and ensure safety.

112. C — Power electronics (MOSFETs, IGBTs, inductors, and transformers) inside the onboard charger switch at high frequencies (typically 50-200 kHz) to convert AC to DC efficiently. These rapid switching events create electromagnetic vibrations in the components' physical structures that produce an audible high-pitched whine. This is a normal characteristic of high-frequency power electronics operation.

113. A — A 9% capacity loss (91% SOH) after three years and 60,000 km falls within the typical degradation range for automotive lithium-ion battery packs. Most manufacturers warrant batteries to retain 70-80% capacity over 8-10 years. The rate of degradation typically decreases after the first one to two years as the initial SEI (solid electrolyte interphase) layer formation stabilizes.

114. B — A 600V CAT III rated DVOM is adequate for measuring individual cell group voltages within a 300V battery pack. The meter's 600V rating exceeds the pack's total voltage, and CAT III is appropriate for measurements at the equipment level (which is where HV battery service occurs). The technician must wear appropriate HV PPE and follow the manufacturer's safety procedures.

115. D — A heat pump works by extracting thermal energy from the outside air using the refrigerant cycle's evaporator. At −25°C, the outside air contains significantly less thermal energy than at moderate temperatures. The reduced energy differential between the refrigerant and the outside air limits the amount of heat the evaporator can absorb, reducing the heat pump's heating output and coefficient of performance.

116. A — The plug-in hybrid's engine runs less frequently than a conventional vehicle's, accumulating oil-change mileage more slowly. However, the oil still degrades over time from moisture contamination, acid formation, and additive depletion — even when the engine isn't running. The oil change interval

must be followed on a time basis (e.g., every 12 months) even if the mileage threshold hasn't been reached.

117. D — Towing a trailer on a steep grade imposes sustained high power demand on the electric drive system. The inverter's power transistors (IGBTs or MOSFETs) generate heat proportional to the current they switch. In 35°C ambient conditions with sustained heavy load, the inverter's cooling system cannot reject heat fast enough, and the internal temperature rises beyond the safe operating threshold — triggering the overtemperature DTC and reduced power mode.

118. B — The BEV range estimate is not a fixed number — it is a real-time calculation based on the current rate of energy consumption. Aggressive acceleration, highway speed, headwinds, hill climbing, and climate control use all increase energy consumption per kilometer, causing the algorithm to project a shorter remaining range. Gentle driving on flat terrain at moderate speed produces the opposite effect. The fluctuation is normal adaptive behavior.

119. A — The DC-DC converter (which replaces the alternator in a BEV/PHEV) charges the 12V auxiliary battery from the HV system, but it only operates when the vehicle is in Ready mode. During extended parking with the vehicle off, the 12V battery receives no charge from the DC-DC converter. The vehicle's modules continue drawing parasitic current (security, keyless entry receiver, BMS monitoring), and over six weeks this normal draw depletes the 12V battery completely.

120. B — Hybrid vehicles have designated 12V jump-start terminals — often under the hood in a dedicated junction box — that are separate from the 12V battery's physical location (which may be in the trunk or under the rear seat). The technician must follow the manufacturer's specific jump-start procedure using these terminals. Never connect jumper cables to HV components. Once the 12V system has power, the hybrid system can initialize and enter Ready mode.

121. B — The electric A/C compressor is powered directly by the HV battery through its own dedicated inverter. This allows the compressor to operate completely independently of the engine — providing cabin cooling during EV-only driving, during engine-off idle stops at traffic lights, and even while the vehicle is plugged in and pre-conditioning the cabin before departure. A belt-driven compressor can only operate when the engine is running.

122. D — Electric motors produce maximum torque instantly from zero RPM — unlike ICE engines that must build RPM to produce peak torque. This instantaneous torque delivery can overwhelm tire traction during launch, especially on surfaces with marginal grip. If a wheel speed sensor also has a

calibration error or signal fault, the traction control system may intervene even more aggressively than necessary during the initial acceleration from a stop.

123. A — With 45% SOC (within normal range) and no DTCs, the engine should be able to shut off at stops. The technician must investigate the hybrid control module's engine-off enable conditions: the minimum SOC threshold setting, the coolant temperature (engine may run if not at operating temperature), the cabin heating/cooling demand, the 12V battery charge state, and whether the driver has selected an engine-on mode (such as "Charge" mode or "HV" mode on some vehicles).

124. A — The BMS actively manages charging current based on battery temperature. At 42°C — above the 35°C upper limit of the optimal range — the cells are already warm. Adding high-current DC fast charging generates additional internal heat from the cells' resistance. To prevent the temperature from rising further into the danger zone, the BMS reduces the charging current, which directly reduces the charging speed to limit additional heat generation.

125. B — The HV battery state of health (SOH) is the single most important BEV-specific metric for a pre-purchase inspection. SOH indicates what percentage of the battery's original energy storage capacity remains. A 95,000 km vehicle with 88% SOH has significantly more range and value than one with 72% SOH. This reading directly impacts daily driving range, charging frequency, and the vehicle's resale value — information essential for an informed purchase decision.