

PRACTICE EXAM 14: RED SEAL TRUCK AND TRANSPORT MECHANIC SIMULATION (135 QUESTIONS)

1. A technician is replacing a truck's windshield. During removal, the old windshield shatters and pieces of laminated glass fall into the defroster vents on the dashboard. The technician plans to use compressed air to blow the glass fragments out of the ductwork. What is the hazard of this approach?

A. The compressed air will damage the HVAC blend door actuators by forcing the glass fragments into the actuator mechanisms and jamming the door linkage inside the heating and ventilation plenum assembly

B. The compressed air pressure will crack the evaporator core tubes when the glass fragments are propelled through the ductwork at high velocity impacting the delicate aluminum tube-and-fin evaporator surface inside the housing

C. The compressed air will propel glass fragments at high velocity from the vent outlets into the cab interior creating a projectile hazard for the technician or anyone near the open cab during the blowing procedure

D. The compressed air will push glass fragments deeper into the ductwork where they will rattle permanently during driving and the fragments can only be removed by complete disassembly of the HVAC housing

2. A shop has recently hired a new apprentice technician. The apprentice is assigned to assist with a brake job. Before allowing the apprentice to work independently, what training must be verified?

A. The apprentice must demonstrate knowledge of the shop's WHMIS program, the specific hazards of brake dust and cleaning solvents, the correct PPE requirements for brake work, and the proper brake procedures under supervision

B. The apprentice must complete a 40-hour manufacturer-specific brake training course before being allowed to work on any brake system regardless of supervision level or the complexity of the brake task assigned

C. The apprentice only needs to read the brake manufacturer's service manual for the specific truck model because the manual contains all the procedures and safety warnings needed for safe and correct brake service

D. The apprentice can work independently on brake systems immediately because the journeyman technician has overall responsibility for the work quality and will inspect the completed brake job before the vehicle leaves

3. A technician is performing a pre-trip inspection on a tanker truck that carries liquid propane. The inspection reveals a small propane odour near the rear valve assembly. The truck is parked inside the shop bay. What is the immediate action?

A. Apply soapy water to all valve connections and fittings on the rear assembly to identify the leak source before moving the truck and document the leak location for the propane service technician to repair

B. Close the tank's main shut-off valve to stop the propane flow and then ventilate the shop bay with the exhaust fans before continuing with the inspection to determine the leak source and severity

C. Notify the shop supervisor and begin evacuating any non-essential personnel from the shop while opening bay doors for ventilation because propane settles to floor level and can reach ignition sources

D. Move the tanker outside immediately using a tractor to pull it from the bay — do not start the tanker's engine because the starter motor could ignite the propane vapour accumulated around the rear valve assembly

4. A technician needs to weld a bracket onto a truck's frame rail. The weld location is 300 mm from a fuel line and 500 mm from an air brake line. What precautions must be taken before welding?

A. Disconnect only the fuel line and cap both ends — the air brake line is far enough away at 500 mm that the welding heat will not affect the nylon air line material or the rubber hose connections at that distance

B. Protect both the fuel line and the air brake line with fire-resistant blankets or heat shields, ensure adequate fire extinguishment is available, and have a fire watch during and after the welding operation

C. The technician cannot weld within 600 mm of any fuel or air brake line under any circumstances and must design an alternative bracket mounting location that provides the required clearance from both lines

D. Drain the fuel system completely and exhaust all air from the brake system before welding because the heat may cause the fuel to ignite and the air line's pressurized air accelerates any fire from the welding sparks

5. A fleet shop performs diesel fuel transfers from a bulk storage tank to individual trucks using a transfer pump. During a transfer, the technician notices a small fuel spill has occurred — approximately 5 litres of diesel has spilled on the concrete shop floor. What is the correct response?

A. Apply absorbent material to the spill immediately, contain the spill to prevent it from reaching floor drains, clean the area, and dispose of the contaminated absorbent according to the shop's waste management procedures

B. Flush the spill with water and direct the diluted fuel to the floor drain because the oil/water separator connected to the drain system will remove the small amount of petroleum before it reaches the municipal sewer

C. Leave the spill to evaporate naturally because 5 litres of diesel fuel will evaporate from the concrete surface within a few hours and the vapour concentration will remain below the combustible level in the ventilated shop

D. Apply cat litter to the spill and sweep it into the regular shop waste bin because small diesel spills under 10 litres are classified as incidental and do not require special waste handling procedures for disposal

6. A technician is using a bench grinder to sharpen a chisel. The technician notices the grinding wheel has a visible crack on its face. What should the technician do?

A. Reduce the grinding pressure against the cracked wheel to minimize the stress on the crack and complete the chisel sharpening before replacing the wheel at the end of the current work session in the shop

B. Cover the crack with duct tape to hold the wheel together during the current grinding operation and request a replacement wheel from the parts department for installation at the next maintenance interval

C. Stop using the grinder immediately, lock out the power, and replace the cracked grinding wheel — a cracked wheel can explode during use sending fragments at high velocity that can cause severe injury or death

D. Test the wheel by running the grinder at full speed for 30 seconds without contact — if the wheel does not break during the 30-second test it is safe to continue using for the current sharpening job

7. A technician is performing maintenance on a truck's exhaust system. The truck was running 10 minutes ago and the exhaust components are still very hot. The technician needs to remove a clamp near the turbocharger outlet. What is the primary burn prevention measure?

A. Apply water to the exhaust components with a spray bottle to cool them rapidly before beginning work because the water will flash to steam and reduce the surface temperature within 60 seconds of application

B. Wait 10 more minutes for the components to cool to a safe handling temperature because exhaust system components near the turbocharger retain heat longer than downstream components and require extended cooling

C. Wear heavy leather welding gloves during the clamp removal because the gloves provide adequate thermal protection for brief contact with hot exhaust components near the turbocharger outlet during the service procedure

D. Allow sufficient cooling time before working on hot exhaust components near the turbocharger — the surface temperature near the turbo can exceed 500°C and requires adequate cool-down to prevent severe contact burns

8. A fleet maintenance facility conducts daily safety toolbox talks with all technicians before work begins. What is the purpose of these daily safety communications?

A. The daily toolbox talks satisfy the regulatory requirement for weekly safety meetings and by holding them daily the fleet exceeds the minimum compliance standard which reduces the fleet's insurance premiums

B. The toolbox talks reinforce safety awareness, communicate specific hazards for the day's planned work, remind technicians of procedures for high-risk tasks, and provide an opportunity to discuss safety concerns openly

C. The daily talks replace the need for individual task-specific safety training because the repeated exposure to safety topics during the daily talks builds the same level of competency as formal classroom training

D. The toolbox talks are required only for apprentice technicians and new employees during their first 90 days of employment — experienced journeyman technicians are not required to attend after completing probation

9. A heavy-duty diesel engine has a complaint of excessive crankcase pressure. The technician measures the crankcase pressure at 8 kPa. The specification maximum is 3 kPa. The CCV filter has been replaced recently. What is the primary cause of excessive crankcase pressure?

A. Excessive blow-by from worn piston rings, cylinder liners, or valve guides allows combustion pressure to enter the crankcase faster than the ventilation system can evacuate it creating the elevated pressure reading

B. The CCV filter was replaced with an incorrect specification filter that has higher flow restriction than the original creating backpressure in the ventilation system that traps the normal blow-by gases in the crankcase

C. The turbocharger compressor seal has failed and pressurized boost air is entering the crankcase through the seal path faster than the ventilation system can relieve it creating the excessive crankcase pressure reading

D. The crankcase pressure gauge is calibrated incorrectly — 8 kPa is within the normal range for a heavy-duty diesel engine under full-load conditions and the specification of 3 kPa applies only to idle measurement

10. A diesel engine equipped with a common rail fuel system runs rough at idle but smooths out above 1,000 RPM. The scan tool shows the fuel rail pressure is stable at the correct specification at all RPM. The injector contribution test shows cylinders 1 and 4 contributing significantly less than the others. What should be investigated on cylinders 1 and 4?

A. The fuel injector spray holes on cylinders 1 and 4 for blockage or carbon deposits that prevent adequate fuel atomization at the low fuel pressure and flow rate of idle but clear at the higher pressure above 1,000 RPM

B. The glow plugs on cylinders 1 and 4 for failure that prevents adequate cold-cylinder heating at idle where combustion temperatures are marginal — the higher combustion temperatures above 1,000 RPM compensate for the failed plugs

C. The fuel injectors on cylinders 1 and 4 for excessive return flow that reduces the effective fuel delivery at idle — the injectors leak fuel back to the return circuit faster than the rail can supply at the low-RPM fuel demand

D. The compression on cylinders 1 and 4 because low compression manifests primarily at idle where the reduced cranking speed and lower cylinder temperature make marginal compression unable to support reliable combustion

11. A diesel engine's oil analysis report shows a steady increase in silicon over the past four samples: 12, 18, 25, 35 ppm. The normal baseline is 10 to 15 ppm. What does a progressive increase in silicon indicate?

A. The engine oil has been contaminated with silicone-based gasket sealant from a recent repair where the technician used excessive sealant that squeezed into the oil passages during assembly and is gradually dissolving

B. The oil analysis laboratory has changed its testing methodology for silicon and the progressive increase reflects the new test's higher sensitivity rather than an actual increase in the silicon content of the oil samples

C. The engine's piston ring coating is wearing and releasing silicon from the ring face material — the chrome-silicon ring treatment gradually erodes during normal operation and the silicon enters the oil from the ring wear

D. Dirt and dust are entering the engine through a compromised air intake system — silicon is the primary component of dirt and the progressive increase indicates the air filtration is failing to protect the engine from abrasive contaminants

12. A diesel engine has been operating normally but the driver reports a sudden change in exhaust note — the engine sounds different than the other trucks in the fleet. The engine produces rated power and has no fault codes. What should the technician investigate?

A. The turbocharger for a compressor wheel blade that has broken — the missing blade changes the compressor's acoustic signature and the altered airflow pattern changes the exhaust note without necessarily affecting power

B. The exhaust system for a leak, a broken internal baffle, a loose heat shield, or a damaged muffler element that has changed the exhaust flow path or created a resonance that alters the perceived exhaust note

C. The engine's injection timing for a drift that changes the combustion event timing — the altered combustion timing changes the exhaust pulse pattern and frequency creating the perceptible change in exhaust note

D. The VGT actuator position for a calibration shift that changes the turbine housing geometry and alters the exhaust gas velocity through the turbine creating the perceived change in exhaust note and sound character

13. A diesel engine's coolant temperature cycles between 78°C and 92°C during highway driving. The thermostat specification calls for a fully open temperature of 85°C. The normal operating temperature for this engine is 85 to 95°C. What is causing the temperature cycling?

A. The thermostat is opening and closing at the correct temperature but its response time is slow — the sluggish opening and closing creates the temperature overshoot and undershoot cycling between 78°C and 92°C

B. The coolant level is slightly low creating an air pocket in the cooling circuit that intermittently passes the temperature sensor causing the sensor to read the air temperature then the coolant temperature in a repeating cycle

C. The engine's fan clutch is engaging and disengaging at the wrong temperature threshold — the fan overcools the engine below the thermostat's opening temperature and then the thermostat closes allowing the temperature to rise again

D. The radiator has a partial internal blockage that restricts coolant flow through only some of the core tubes creating a temperature stratification that the sensor reads differently as the coolant circulates through the blocked passages

14. A heavy-duty diesel engine has a complaint of a whistling noise from the engine compartment that increases with engine RPM. The noise is not present at idle and becomes audible above 1,200 RPM. The turbocharger produces adequate boost. What is the most common source of an RPM-proportional whistling noise?

A. The turbocharger compressor wheel has a worn bearing that allows the shaft to precess at a frequency proportional to RPM creating the whistling harmonic from the spinning imbalanced compressor wheel at higher speeds

B. The engine's serpentine belt tensioner has a worn bearing that produces a speed-dependent whistle from the failing bearing's internal components spinning at a frequency that becomes audible above 1,200 RPM

C. A boost pressure leak at a hose connection, charge air cooler fitting, or intake manifold gasket — the pressurized air escaping through the small leak creates the whistling noise that increases with boost pressure and RPM

D. The fuel injection pump has a worn internal bearing or timing advance mechanism that produces the whistling noise at frequencies above the idle speed range from the pump's internal components rotating at increasing speed

15. A diesel engine equipped with EGR has a fault code for "EGR flow insufficient — actual flow below commanded." The EGR valve has been cleaned and moves freely through its full range when actuated by the scan tool. What should be investigated next?

A. The EGR cooler for a restriction from excessive soot buildup or internal tube blockage that prevents adequate exhaust gas volume from flowing through the cooler to the intake manifold despite the valve opening correctly

B. The intake manifold pressure for an elevation that reduces the pressure differential between the exhaust and intake sides — the reduced differential limits the EGR flow even with the valve fully open at the commanded position

C. The exhaust backpressure for a reduction from an exhaust leak upstream of the EGR pickup point that reduces the pressure available to push exhaust gas through the EGR circuit to the intake manifold during EGR events

D. The EGR system's flow path for any restriction — the cooler, connecting pipes, gaskets, and the differential pressure between exhaust and intake must all be checked because any flow restriction reduces the actual EGR delivery

16. A diesel engine's fuel system uses a high-pressure common rail with rail pressure up to 2,000 bar. The technician needs to perform an injector replacement. Before loosening any fuel line connections, what critical safety step must be performed?

A. Drain the fuel tank to reduce the system pressure to atmospheric because the fuel tank's hydrostatic pressure provides the base pressure that the high-pressure pump amplifies to the 2,000 bar rail pressure during operation

B. Relieve the fuel rail pressure by following the manufacturer's procedure — typically running the engine and cutting the fuel supply or using the scan tool to command pressure relief before loosening any high-pressure connections

C. Wear heavy leather gloves and a face shield because the residual 2,000 bar fuel pressure in the rail will spray fuel at injection velocity when the line is loosened creating a penetration hazard to exposed skin and eyes

D. Wait 24 hours after engine shutdown for the fuel pressure to naturally decay through the injector nozzle seats before loosening any high-pressure connections because the rail pressure takes this long to fully dissipate

17. A heavy-duty diesel engine's DPF regeneration frequency has increased from every 400 km to every 100 km over the past month. The driver's operating pattern has not changed. The engine has no fault codes. What should the technician investigate first?

A. The engine's soot production rate — check the injector spray patterns, boost pressure, EGR function, and air intake for conditions that produce excess soot because the increased regeneration frequency indicates higher soot loading

B. The DPF differential pressure sensor calibration because a sensor reading higher than actual soot loading would command regeneration events more frequently than the actual soot accumulation warrants during normal driving

C. The DPF substrate for physical damage (cracks, melting) that reduces the filter's soot storage capacity — a damaged substrate cannot hold as much soot before reaching the regeneration threshold at the same accumulation rate

D. The DOC catalyst efficiency because a degraded DOC cannot support passive regeneration during normal driving which previously consumed soot between active regeneration events extending the interval between forced regenerations

18. A diesel engine's coolant system uses an electronically controlled thermostat that the ECM opens based on coolant temperature, ambient temperature, and engine load. The ECM commands the thermostat to open at 82°C during light load and 90°C during heavy load. What is the advantage of this variable opening strategy?

A. The lower opening temperature during light load reduces the NO_x production by lowering the combustion temperature — the cooler combustion produces fewer nitrogen oxides at the expense of slightly higher fuel consumption

B. The higher opening temperature during heavy load prevents the cooling system from being overwhelmed by the increased heat rejection demand — keeping the thermostat closed longer maintains cooling system pressure for efficiency

C. The variable strategy optimizes engine efficiency — cooler operation during light load reduces NO_x while hotter operation during heavy load improves thermal efficiency and reduces particulate emissions from more complete combustion

D. The lower temperature during light load reduces thermal stress on the engine components while the higher temperature during heavy load improves oil circulation by reducing the oil viscosity for better bearing lubrication

19. A diesel engine equipped with an SCR aftertreatment system has a complaint that the DEF tank freezes during cold weather operation. The DEF heater is confirmed operational and the DEF concentration is verified at 32.5%. At what temperature does DEF begin to freeze?

A. DEF at 32.5% concentration begins to freeze at approximately 0°C which is the same freezing point as water because the urea concentration does not significantly alter the water-based solution's freezing characteristics

B. DEF at 32.5% concentration begins to freeze at approximately -5°C because the dissolved urea provides a mild antifreeze effect that lowers the freezing point slightly below that of pure water in the DEF storage tank

C. DEF at 32.5% concentration has a higher freezing point than water and begins to freeze at approximately +5°C because the dissolved urea crystals act as nucleation points that promote ice formation above the water freezing temperature

D. DEF at 32.5% concentration begins to freeze at approximately -11°C — the 32.5% urea concentration is specifically formulated to provide the lowest possible freezing point for any urea-water concentration ratio

20. A diesel engine's turbocharger has been removed for inspection. The technician checks the shaft play by gripping the compressor wheel and moving it radially (side to side) and axially (in and out). The radial play is barely perceptible and the axial play is approximately 0.05 mm. The OEM specifications

are: radial play 0.025 to 0.076 mm, axial play 0.025 to 0.076 mm. Should the turbocharger be returned to service?

A. No — the barely perceptible radial play is at the lower end of the specification and indicates the bearings are too tight which will cause the shaft to overheat from insufficient oil film clearance during high-speed operation

B. Yes — both the radial and axial play measurements fall within the OEM specification range indicating the turbocharger bearings have adequate clearance for proper hydrodynamic oil film formation during normal operation

C. No — the specifications represent the maximum allowable play and any measurable play indicates wear that will progress rapidly under the thermal and rotational loads of normal turbocharger operation at full engine output

D. The measurements cannot be accurately taken by hand and require a dial indicator mounted to the turbocharger housing — the feel-based assessment is unreliable and should be replaced with an instrumented measurement

21. A diesel engine has an unusual condition where the exhaust gas temperature on all cylinders reads 50°C higher than the fleet average at the same load and RPM. The engine makes rated power and fuel consumption is normal. All individual cylinder temperatures are equal. What could cause this uniform temperature elevation?

A. The injection timing is slightly retarded on all cylinders — the late combustion produces the same power output but more thermal energy exits through the exhaust because the late burn does not convert as efficiently to mechanical work

B. The exhaust pyrometer probes are all reading 50°C high from a common calibration error — if all cylinders show the same 50°C elevation it is more likely a measurement error than a uniform combustion change across all cylinders

C. The engine's compression ratio has effectively increased from carbon buildup on all piston crowns that reduces the combustion chamber volume creating higher compression and combustion temperatures across all cylinders

D. The turbocharger VGT is positioned slightly more closed than the fleet average creating higher exhaust backpressure that traps more heat in the exhaust manifold at the pyrometer locations raising all readings uniformly

22. A diesel engine has been running on B20 biodiesel (20% biodiesel, 80% petroleum diesel). The engine's fuel filter is plugging every 5,000 km instead of the normal 30,000 km interval. The fuel supply has been consistent for the past year. What has changed to cause the frequent plugging?

A. The fuel supplier has recently increased the biodiesel percentage above B20 without notification and the higher biodiesel content exceeds the fuel system's filter capacity for the biodiesel-specific contaminants

B. The B20 biodiesel has a higher wax content than petroleum diesel and the wax precipitates at temperatures above the cold filter plugging point creating premature plugging from the wax accumulation in the filter media

C. The biodiesel's solvent properties have gradually cleaned deposits from the fuel tank walls and fuel lines — the loosened deposits are now circulating through the system and accumulating in the fuel filter at each pass

D. The fuel filter manufacturer changed the filter media specification and the new media is incompatible with biodiesel blends — the biodiesel's fatty acid methyl esters attack the filter media creating a swelling that restricts flow

23. A diesel engine's air intake system uses a two-stage air filter — a primary (outer) element and a secondary (inner) safety element. During a PM inspection, the technician finds the primary element is loaded and needs replacement. Should the secondary element also be replaced?

A. The secondary element must always be replaced simultaneously with the primary because the two elements are designed as a matched set and the secondary's seal integrity depends on the primary's installation pressure

B. The secondary element should be replaced every second primary change because the secondary captures the fine particles that pass through the primary and its media loading is approximately half the primary's loading rate

C. The secondary element should be inspected but not automatically replaced — it serves as a safety backup for when the primary fails and should only be replaced if it is damaged, excessively dirty, or per the manufacturer's interval

D. The secondary element should be replaced at every primary change because removing the primary element to access it exposes the secondary to contamination from the debris that falls from the primary during removal

24. A diesel engine has been returned to the shop after an in-frame overhaul. The engine has 500 km of post-overhaul operation. During a follow-up inspection, the technician notices a fine oil mist on the exterior of the engine around the crankcase ventilation tube outlet. Is this oil mist normal for a recently overhauled engine?

A. No — any visible oil mist at the CCV outlet indicates excessive blow-by from improperly seated piston rings and the engine should be investigated for ring installation errors before additional mileage damages the components

B. Yes — a newly overhauled engine produces more blow-by during the ring seating period than a fully broken-in engine and the elevated blow-by produces more oil vapour at the CCV outlet during the first 5,000 to 10,000 km

C. No — the oil mist indicates the CCV filter was not installed during the overhaul and the unfiltered blow-by is carrying oil droplets to the outlet instead of separating them through the filter media before discharge

D. Yes — the oil mist is from the assembly lubricant that was applied to the cylinder liners during the overhaul and the lubricant burns off gradually during the first 500 km creating the visible mist at the CCV outlet

25. A diesel engine's scan tool data shows the fuel rail pressure oscillating between 1,750 and 1,850 bar at a commanded pressure of 1,800 bar during steady-state highway cruise. The oscillation frequency is approximately 2 cycles per second. Is this oscillation normal?

A. Yes — common rail fuel systems have inherent pressure oscillations from the pump's compression cycles and the injector opening events — the 50-bar variation around the commanded 1,800 bar is within the normal regulation range

B. No — the pressure should be stable within 10 bar of the commanded value and the 100-bar oscillation range indicates a failing high-pressure pump piston or a worn fuel rail pressure sensor that produces the waveform artifact

C. The oscillation is a scan tool display artifact from the tool's update rate not matching the ECM's data broadcast rate — the actual rail pressure is stable but the scan tool displays stale and current values alternately

D. No — the oscillation indicates one injector has excessive return flow that creates a pressure drop each time it fires — the pump recovers between injections but cannot maintain steady pressure with the leaking injector

26. A diesel engine equipped with a variable-speed cooling fan has the fan running at maximum speed continuously regardless of engine temperature. The coolant temperature is normal at 88°C. The scan tool shows the ECM commanding minimum fan speed but the fan runs at maximum. What is the most likely cause?

A. The fan clutch has seized internally in the fully engaged position and cannot respond to the ECM's reduced-speed command — the mechanical coupling is locked regardless of the electrical command signal from the controller

B. The coolant temperature sensor has a calibration drift that makes the ECM believe the engine is overheating even though the actual temperature is normal — the ECM commands maximum fan to cool the perceived overheating

C. The fan clutch solenoid valve is stuck in the maximum-engagement position — the ECM commands minimum speed but the solenoid cannot move to the reduced-engagement position from contamination or mechanical failure in the valve

D. The A/C system's high-pressure switch has failed in the closed position sending a continuous maximum-fan-speed demand to the fan controller regardless of the ECM's temperature-based fan speed command during all operation

27. A diesel engine's EGR system has been serviced — the EGR valve, EGR cooler, and intake manifold have all been cleaned. After the service, the engine runs correctly but produces a noticeable increase in NO_x emissions compared to the pre-service levels (confirmed by a portable emissions analyzer). What could cause the NO_x increase after the cleaning?

A. The cleaned EGR system now flows more exhaust gas than before cleaning and the increased EGR flow raises the intake temperature above the design threshold increasing the combustion temperature and NO_x formation rate

B. The EGR system is now flowing correctly after cleaning but the ECM's EGR calibration had adapted to the restricted pre-service flow — the ECM still commands the reduced flow rate from its pre-cleaning adaptation producing less EGR than needed

C. The cleaned intake manifold has less thermal insulation from the removed carbon deposits and the cooler manifold surface reduces the intake charge temperature below the designed combustion temperature reducing EGR effectiveness

D. The cleaning process damaged the EGR valve position sensor calibration and the valve does not open to the ECM's commanded position — the restricted valve delivers less EGR gas than commanded after the cleaning service

28. A diesel engine's oil cooler has been replaced. After the replacement, the engine oil temperature is 15°C higher than the fleet average at the same operating conditions. The coolant temperature is normal. What should be checked on the new oil cooler installation?

A. The oil cooler's internal bypass valve for a stuck-open condition that allows oil to bypass the cooler element without being cooled — the bypass valve is designed for cold starts but should close during normal operation

B. The oil cooler's mounting gaskets for a misalignment that restricts the coolant flow through the cooler — the reduced coolant flow limits the heat exchange capacity creating the elevated oil temperature during operation

C. The coolant flow direction through the oil cooler for a reverse connection that reduces the cooler's heat exchange efficiency — counterflow is more efficient than parallel flow and a reversed connection changes the flow pattern

D. The replacement oil cooler for the correct part number and capacity rating — a cooler designed for a smaller engine or different configuration may not have adequate heat exchange capacity for this engine's oil cooling demand

29. A diesel engine's air intake system has been modified with an aftermarket cold air intake kit. After the installation, the engine produces 5% more power on the chassis dynamometer. The fleet manager asks if the modification should be applied to all trucks. What concern should the technician raise?

A. The cold air intake bypasses the manufacturer's air filtration quality standard and may allow larger particles to enter the engine accelerating wear on the turbocharger compressor wheel and the cylinder liner surfaces

B. The increased power from the colder denser air may exceed the engine's structural design limits for cylinder pressure and the additional loading accelerates fatigue on the pistons, connecting rods, and crankshaft bearings

C. The cold air intake may draw air from a location that is exposed to water spray from the front tires during rain and the ingested water can hydraulically lock the engine destroying the connecting rods and pistons instantly

D. The cold air intake increases the air mass flow beyond the ECM's programmed maximum which may exceed the aftertreatment system's calibrated capacity creating elevated emissions that violate the vehicle's certification compliance

30. A truck's air compressor discharge temperature has been measured at 230°C at the compressor outlet. The specification maximum is 200°C. What is the consequence of operating with elevated compressor discharge temperature?

A. The elevated temperature accelerates the degradation of the air dryer's desiccant cartridge and increases the moisture content in the downstream air system because the hot air carries more water vapour than the dryer can absorb

B. The high temperature causes the compressor's discharge valves to warp and leak reducing the compressor's efficiency and requiring more frequent discharge valve replacement than the designed maintenance interval

C. The elevated discharge temperature has no operational consequence because the air dryer is designed to handle temperatures up to 250°C and the 230°C reading is within the dryer's thermal operating range for normal operation

D. The high temperature will melt the nylon air lines connected to the compressor's discharge port because the softening point of the nylon tube material is 210°C and the 230°C discharge air exceeds this material limit

31. A truck's brake application response time has been tested by measuring the time from pedal depression to full brake pressure at each wheel position. The front steer axle response time is 0.3 seconds and the rear drive axle response time is 0.8 seconds. What is the consequence of this response time difference?

A. The time difference is normal because the rear axle is physically further from the foot valve and the longer air line creates a proportionally longer fill time that is within the designed response time specification

B. The response time difference has no braking consequence because the ABS system compensates for the timing difference by delaying the front axle modulation until the rear axle pressure matches during each application

C. The delayed rear axle response means the front brakes bear a disproportionate share of the initial braking force during the first 0.5 seconds of every brake application which increases front brake wear and reduces stability

D. The rear response time of 0.8 seconds exceeds the normal specification and indicates a restriction in the rear brake circuit — the response time should be investigated because excessive delay affects stopping distance

32. A trailer's brakes grab aggressively on one axle during moderate brake applications. The brake adjustment, lining thickness, and drum diameter are all within specification on that axle. The air pressure delivered to the chambers on the grabbing axle is the same as the other axle. What should be investigated?

A. The brake shoe hardware for a missing or broken return spring that does not fully retract the shoes between applications allowing the linings to remain in slight contact with the drum and creating an aggressive initial grab

B. The brake drums on the grabbing axle for an out-of-round condition that causes the linings to contact the drum aggressively at one rotational position per revolution creating the grabbing sensation during moderate applications

C. The relay valve for the grabbing axle for a crack-pressure setting that is lower than the other axle's relay valve — the lower crack pressure delivers air to the chambers earlier during the application creating the aggressive response

D. The brake lining material on the grabbing axle for a friction coefficient that is higher than specification — linings from a different batch, manufacturer, or material compound produce more friction than the other axle's linings

33. A truck's air brake system has been tested. The applied leak rate test (brakes fully applied, engine off) shows a pressure drop of 25 kPa per minute. The specification maximum is 28 kPa per minute for a tractor-trailer combination. The test passes. Should the technician be concerned despite the passing result?

A. No — the test result is within specification and the vehicle meets the regulatory standard for air brake system integrity during the applied leak rate test indicating no action is needed at this time

B. Yes — while technically passing at 25 kPa per minute, this rate is near the failing threshold and indicates multiple small leaks throughout the system that collectively approach the specification limit and should be investigated

C. No — the 25 kPa per minute rate includes the normal seat leakage of the relay valves and foot valve which is accounted for in the 28 kPa specification and the vehicle is operating as designed within normal parameters

D. Yes — the 25 kPa rate indicates the brake system is marginally passing and the collective leakage from all sources (chambers, valves, lines, connections) is approaching failure and should be proactively investigated

34. A truck's front disc brake caliper has been rebuilt with new piston seals. After reassembly, the technician pushes the caliper piston fully into the bore by hand. When the brakes are applied, the pedal must be pumped three times before the brakes engage. After the initial pumping, the brakes function normally. What should have been done after the caliper piston was pushed in?

A. The brake system should have been pumped manually (by pressing the brake pedal) to push the caliper piston back out to its operating position before the road test — this establishes the correct running clearance between the pad and rotor

B. The caliper piston should have been pre-extended to the approximate running clearance position before installation using the scan tool's ABS actuator test to cycle the caliper piston to the correct operating position

C. The brake master cylinder should have been bench-bled before reinstallation because pushing the caliper piston into the bore forced fluid back through the master cylinder and introduced air into the hydraulic circuit

D. The brake hydraulic system should have been bled at the caliper after pushing the piston in because forcing the piston back pushes fluid back through the lines and may have introduced air into the hydraulic circuit

35. A trailer's spring brake chamber has been condemned during inspection because the parking brake does not fully release. Before replacing the chamber, the technician must cage the spring using the caging bolt. What is the critical safety consideration during the caging procedure?

A. The technician must wear safety glasses and keep their body to the side of the chamber — not directly behind the pushrod end — because a failed caging bolt can eject from the chamber with lethal force from the compressed spring

B. The caging bolt must be tightened in quarter-turn increments to gradually compress the spring — over-tightening the caging bolt in a single motion can snap the bolt from the sudden loading and the spring releases violently

C. The spring brake must be fully caged before removing the chamber from the vehicle — never attempt to remove a spring brake chamber without first caging the spring because the stored energy can cause serious injury

D. The technician must verify the spring is completely compressed by checking that the caging bolt has fully seated before removing any mounting hardware — the stored spring energy in an uncaged chamber is approximately 1,200 kg of force

36. A truck's brake system has been diagnosed with a hard pedal — the driver must press harder than normal to achieve adequate braking. The air system pressure is at governor cut-out. No fault codes are present. The brake adjustment is within specification. What should the technician investigate?

A. The brake linings for a material that has glazed from heat exposure — the glazed surface has a reduced friction coefficient that requires more application pressure to achieve the same deceleration rate during each stop

B. The foot valve for restricted delivery ports that limit the flow rate of air from the reservoirs through the valve to the relay valves — the restricted flow creates higher pedal effort to force air through the narrowed passages

C. The brake chamber diaphragms for excessive stiffness from age and temperature cycling — the rigid diaphragms resist the air pressure creating the sensation of a hard pedal because the air must overcome the diaphragm's resistance

D. The relay valves for high crack pressure settings that require more signal pressure from the foot valve before they begin delivering air to the chambers — the elevated crack pressure translates to higher pedal effort for the driver

37. A truck's ABS system has a fault code for the left front wheel speed sensor — SPN 789, FMI 2 (erratic/intermittent). The sensor has been replaced and the air gap verified. The code returns within 100 km. What should be investigated next?

A. The tone ring for contamination with metallic debris from brake wear that adheres to the magnetized ring surface creating signal anomalies as the debris passes the sensor during each wheel revolution at driving speed

B. The hub bearing for excessive play that changes the sensor-to-tone-ring air gap dynamically during driving — the varying gap produces signal amplitude changes that the ABS module interprets as erratic sensor behavior

C. The ABS module's internal input circuit for the left front channel because a damaged input amplifier produces erratic readings regardless of the sensor installed at that position from the module's internal electronic fault

D. The sensor wiring harness from the sensor connector to the ABS module for chafing, pinching, or connector damage that creates an intermittent signal disruption during the vibration and movement of normal driving operation

38. A trailer's automatic slack adjuster has been replaced. The technician adjusts the initial pushrod stroke to the specification and performs a brake application test. The pushrod stroke is within specification during the first application. After 10 applications, the pushrod stroke has decreased by 5 mm from the initial setting. Is this normal?

A. Yes — the automatic slack adjuster takes up any remaining clearance during the first several applications and the 5 mm decrease indicates the adjuster is functioning correctly by tightening the brake to the designed running clearance

B. No — the pushrod stroke should remain constant after the initial adjustment and the 5 mm decrease indicates the automatic adjuster is over-adjusting which will cause the brakes to drag from the excessively tight setting

C. Yes — but only during the break-in period of the new adjuster's internal mechanism and the stroke should stabilize after approximately 50 applications once the adjuster's internal ratchet seats against its wear surface

D. No — the 5 mm decrease indicates the new adjuster has the wrong adjustment ratio for this brake chamber and the incorrect ratio will continue to tighten the brake until the brake drags continuously against the drum

39. A truck's air brake system has a complaint that the brakes release slowly — approximately 3 seconds from pedal release to full brake release instead of the normal 0.5 seconds. All brake adjustments are within specification. What should be investigated?

A. The brake chamber pushrod for corrosion or contamination that creates friction in the chamber's diaphragm plate guide preventing the return springs from quickly retracting the pushrod after the air pressure is released

B. The foot valve's exhaust port for a restriction from contamination or corrosion that slows the release of signal pressure from the relay valves — the restricted exhaust delays the relay valves' release response time

C. The relay valves' exhaust ports for restrictions from contamination, corrosion, or debris that slow the air release from the brake chambers — the restricted exhaust holds residual pressure in the chambers during the release cycle

D. The quick-release valves for internal contamination that prevents the valve from fully opening during the exhaust cycle — the restricted quick-release valve holds air in the brake chambers after the application pressure is removed

40. A truck's parking brake valve (yellow diamond button) has been pulled to apply the parking brake. The spring brakes apply correctly. When the driver pushes the valve back in to release, a loud pop is heard from the rear of the truck. What caused the pop?

A. The air line between the parking brake valve and the spring brake chambers had a moisture-related freeze that blocked the supply air during the parked period — the push to release pressurized the frozen blockage until it burst

B. The spring brake chambers' diaphragms were pressed against the chamber walls during the applied period and the sudden air pressure release created a vacuum pop as the diaphragm separated from the chamber wall during release

C. The parking brake valve's exhaust port had frozen closed from moisture in the air system and the release command pressurized the already-applied circuit creating a sudden pressure surge that produced the pop at the valve

D. The air supply line to one spring brake chamber had a kink that restricted the flow — the sudden air release created a pressure wave in the restricted line that produced the popping noise as the restriction cleared

41. A truck's front air disc brake caliper has a complaint of uneven pad wear — the inboard pad (piston side) is 3 mm thinner than the outboard pad. The caliper is a single-piston floating design. What causes this uneven wear pattern?

A. The caliper piston bore has corrosion that prevents the piston from retracting fully after each application and the inboard pad drags against the rotor between applications wearing faster than the outboard pad

B. The caliper mounting bracket has worn anchor bolt bushings that allow the caliper to shift under braking load concentrating the force on the inboard pad during the initial contact before the caliper floats to equalize

C. The brake rotor has lateral runout that pushes the inboard pad away from the rotor during each revolution creating an intermittent contact pattern that wears the inboard pad faster from the repeated contact and release cycle

D. The caliper slide pins are seized or corroded preventing the caliper from floating freely — the piston pushes the inboard pad against the rotor but the caliper cannot slide to pull the outboard pad into equal contact

42. A truck's air system governor cut-out pressure has been verified at the correct specification of 860 kPa (125 PSI). After the governor unloads the compressor, the system pressure continues to rise slowly by approximately 15 kPa over 2 minutes before stabilizing. Is this normal?

A. Yes — after the governor signals the compressor to unload, the compressor continues to produce a small amount of pressurized air during its unloading transition cycle and this residual output creates the slight pressure rise

B. No — the governor should produce an immediate and complete unload with zero pressure rise after the cut-out signal and the 15 kPa rise indicates the compressor's unloader mechanism is not fully disabling compression

C. Yes — the pressure rise is from thermal expansion of the air already in the tanks as the compressor's residual heat warms the air in the discharge line creating the slight volume expansion that raises the pressure reading

D. No — the continued pressure rise indicates the governor is set too high and continues to command compression above the cut-out point and the governor must be adjusted downward to eliminate the post-cut-out pressure creep

43. A trailer's brakes have been inspected and the technician finds that one brake drum has a network of fine surface cracks (heat checking) covering approximately 30% of the friction surface. The drum diameter is within specification. Can the drum be returned to service?

A. The drum can be returned to service after machining to remove the heat checking — as long as the post-machining diameter does not exceed the discard diameter the machined surface provides a fresh friction surface

B. The drum should be monitored at the next PM interval for crack growth — heat checking is a normal surface condition for commercial vehicle brake drums and does not affect braking performance unless the cracks deepen

C. The drum should be replaced because the heat checking network indicates thermal fatigue of the drum material — the cracks will propagate under continued braking loads and the drum may fracture during a heavy brake application

D. The heat checking is cosmetic and does not affect the drum's structural integrity — the network of fine cracks actually improves brake performance by providing additional surface area for friction material contact during braking

44. A truck's air dryer cartridge has been replaced. After the replacement, the air system builds to governor cut-out normally but the air tanks are accumulating water faster than before the cartridge change. What is the most likely cause?

A. The air dryer heater is not functioning and the cold desiccant cannot absorb moisture as efficiently as warm desiccant — the heater element should be checked for continuity and supply voltage during the compressor load cycle

B. The replacement desiccant cartridge was stored improperly (lid removed or package opened) before installation and the exposed desiccant has already absorbed moisture from the ambient air before being installed in the dryer

C. The replacement cartridge is the incorrect part number and has a smaller desiccant volume or a different desiccant type that cannot absorb the same moisture volume per purge cycle as the correct specification cartridge

D. The replacement cartridge was installed with the desiccant saturated from improper storage — the pre-saturated desiccant cannot absorb moisture from the compressed air and the water passes through to the tanks

45. A truck equipped with electronic stability control (ESC) has the ESC warning lamp illuminated and a fault code for the steering angle sensor. The driver reports the brakes feel normal and the ABS functions correctly during an emergency stop test. What capability has been lost with the ESC fault?

A. The ESC system cannot detect or correct an oversteer or understeer condition because it needs the steering angle input to compare the driver's intended path with the vehicle's actual path for stability intervention

B. The vehicle has lost its electronic stability intervention capability — the ESC cannot apply individual wheel brakes to correct oversteer or understeer because it cannot determine the driver's intended direction from the steering angle

C. The ABS system is operating in a degraded mode that provides basic lockup prevention but cannot optimize the brake pressure modulation for each wheel because the missing steering angle data reduces the ABS algorithm's precision

D. The traction control system has been disabled because the ESC and traction control share the steering angle sensor input and both systems require this data to function correctly during all driving and braking conditions

46. A truck's brake drum has been measured and the maximum diameter reads exactly at the discard diameter stamped on the drum. Can the drum remain in service?

A. The drum can remain in service until the next scheduled brake inspection because the discard diameter is the point at which the drum must be replaced — at exactly the discard diameter the drum has reached but not exceeded the limit

B. The drum cannot remain in service — the discard diameter is the absolute maximum and a drum at this measurement must be replaced because any additional wear during service will exceed the maximum allowable dimension

C. The drum can remain in service if the brake linings are replaced with thinner linings that produce less friction force against the drum surface reducing the wear rate and extending the drum's service life beyond the discard diameter

D. The drum should be measured at multiple points around its circumference because the single measurement may not represent the drum's maximum diameter and additional measurements may reveal the drum has already exceeded discard

47. A truck's engine ECM communicates with the transmission control module through the J1939 CAN bus. The engine starts and runs normally but the transmission does not shift — it remains in the gear that was selected at startup. The scan tool communicates with the engine ECM but cannot connect to the transmission module. What does this indicate?

A. The engine ECM has a failed CAN bus output port that is transmitting to the scan tool but not to the transmission module because the two modules are on different CAN bus segments that connect through the engine ECM

B. The transmission control module has a failed CAN bus transceiver that prevents it from communicating on the bus — the module cannot receive shift commands from the engine ECM or respond to the scan tool's connection requests

C. The transmission module has lost its power supply or ground connection and is completely offline — the module cannot communicate on the CAN bus or control the transmission without its basic power supply circuits functioning

D. The J1939 CAN bus backbone has a fault between the engine ECM and the transmission module — the scan tool connects to the ECM through the functional segment but the data cannot reach the TCM through the damaged backbone section

48. A truck's batteries have been load-tested and both passed. The alternator has been tested and produces 14.4 volts at 160 amps (full rated output). Despite the good test results, the batteries are consistently undercharged in the morning — the driver reports slow cranking on cold starts. What should be investigated?

A. The alternator drive belt for adequate tension because a belt that maintains tension during the brief alternator test may slip under the sustained load of actual driving when the belt heats and stretches beyond its design tension

B. The vehicle's parasitic electrical drain during the key-off period — if the drain exceeds the specification the batteries discharge overnight faster than the alternator can recharge them during the next day's driving cycle

C. The battery cable connections for voltage drop that only manifests under the sustained high-current charging load of driving — the brief test current may not reveal a high-resistance connection that affects sustained charging

D. The battery separator relay for a failure that disconnects the batteries during the key-off period preventing the stored charge from being maintained — the batteries self-discharge normally but cannot maintain their charge in isolation

49. A truck's scan tool retrieves a fault code for the NO_x sensor — SPN 4364, FMI 18 (sub-component calibration). What does FMI 18 indicate?

A. The NO_x sensor's internal calibration data has become corrupted and the sensor must be replaced because FMI 18 indicates the sensor's internal microprocessor has lost its factory calibration parameters permanently

B. The ECM's stored calibration data for the NO_x sensor does not match the installed sensor's specifications — the sensor may be the wrong part number or the ECM's sensor calibration parameters need to be updated

C. The NO_x sensor requires a field recalibration using the scan tool's sensor calibration function — FMI 18 indicates the sensor has drifted from its factory calibration and the drift can be corrected through the recalibration procedure

D. The NO_x sensor's internal heater circuit has a calibration error that heats the sensing element to the wrong temperature — the temperature error causes the sensor to produce readings outside the ECM's expected range

50. A truck equipped with LED headlamps has one headlamp that produces a blue-ish white light while the other produces a warm white light. Both headlamps are the same part number and were installed at the same time. What could cause the colour difference?

A. The LED headlamp producing the blue-ish white light has a failed internal thermal management system that allows the LED array to overheat — overheated LEDs shift their output spectrum toward the blue end of the visible range

B. The two headlamp assemblies have LED arrays from different manufacturing batches with slightly different phosphor coating thicknesses that produce different colour temperatures despite being the same part number designation

C. The headlamp producing warm white light has a degraded lens that has yellowed from UV exposure filtering the blue wavelengths and shifting the perceived output toward the warmer end of the spectrum from the UV-damaged lens

D. The electrical supply voltage to the blue-ish headlamp is slightly higher than the other and the increased voltage drives the LEDs harder producing a higher colour temperature that appears blue-white compared to the normal warm white

51. A truck's engine ECM sets a fault code for the accelerator pedal position sensor (APPS) — SPN 91, FMI 10 (abnormal rate of change). The code sets intermittently during driving. The pedal operates smoothly with no mechanical sticking. What is the most likely cause?

A. The APPS has an internal potentiometer element with a worn track at a specific position and the wiper jumps across the worn section creating a sudden voltage change that exceeds the ECM's rate-of-change threshold during pedal movement

B. The accelerator pedal return spring has weakened allowing the pedal to oscillate from road vibration creating rapid position changes that the APPS accurately reports but the ECM interprets as an abnormal rate of change

C. The APPS signal wire has an intermittent connection at a connector that creates momentary voltage dropouts during driving vibration — the sudden voltage changes from the intermittent contact trigger the rate-of-change fault detection

D. The ECM's internal APPS input filter circuit has a calibration error that sets the rate-of-change threshold too low for the normal pedal movement speed causing the fault to set during normal aggressive pedal inputs by the driver

52. A truck's CAN bus diagnostic test shows the termination resistance at 40 ohms instead of the correct 60 ohms. What does the 40-ohm reading indicate?

A. One of the CAN bus backbone wires (CAN-H or CAN-L) has a short to ground that adds a parallel resistance path alongside the two 120-ohm terminating resistors reducing the total measured resistance below 60 ohms

B. A third terminating resistor has been added to the CAN bus by an aftermarket module installation — the three 120-ohm resistors in parallel produce 40 ohms instead of the two-resistor 60-ohm designed termination

C. The CAN bus backbone has a short between CAN-H and CAN-L at some point along the bus that adds a parallel resistance path reducing the total measured resistance from the designed 60 ohms to the measured 40 ohms

D. One of the two 120-ohm terminating resistors has decreased in value from heat damage to 60 ohms and the 60-ohm damaged resistor in parallel with the remaining 120-ohm resistor produces the measured 40-ohm total

53. A truck's body controller has a complaint that the marker lamps turn on and off randomly during nighttime driving. The headlamp switch is in the ON position and all other lamps controlled by the same switch function correctly. What should be investigated?

A. The headlamp switch internal contacts for an intermittent connection specifically on the marker lamp output that connects and disconnects randomly from vibration during driving while the other switch contacts maintain solid connection

B. The marker lamp circuit wiring for a short to ground that intermittently trips the body controller's internal overcurrent protection — the controller turns the marker output off when the overload is detected and back on when it clears

C. The body controller's CAN bus input for the light switch signal for data corruption that intermittently drops the marker lamp command while all other lamp commands in the same CAN message transmit correctly during driving

D. The body controller's marker lamp output driver for an intermittent thermal fault — the driver overheats and shuts down to protect itself then re-enables when it cools creating the random on-off pattern during nighttime operation

54. A truck's engine ECM has two separate power supply circuits — one for the ECM's internal processor and one for the ECM's output drivers (injectors, solenoids). The engine cranks but does not start. The scan tool communicates with the ECM and shows the ECM commanding injection. The engine produces no exhaust smoke during cranking. What is the most likely cause?

A. The ECM's output driver power supply circuit has lost voltage — the processor receives power (the scan tool communicates) and commands injection, but the output driver stage has no power to energize the injector solenoids

B. The crankshaft position sensor has failed and the ECM cannot determine engine position — the processor functions and the scan tool shows injection commands but without the CKP signal the injectors cannot fire at the correct timing

C. The fuel rail pressure relief valve has stuck open and all the fuel bypasses the rail back to the tank — the ECM commands injection and the injectors fire but no fuel is in the rail to inject into the combustion chambers

D. The camshaft position sensor has failed and the ECM cannot determine which cylinder is at TDC compression — the processor commands injection but cannot direct the fuel to the correct cylinder in the firing order sequence

55. A truck's alternator produces adequate charging voltage and current during normal driving. However, during extended idle periods (engine at 650 RPM), the charging voltage drops to 12.8 volts and the batteries slowly discharge. What is the cause?

A. The alternator's pulley ratio produces insufficient alternator shaft speed at engine idle to generate the minimum field current for adequate charging — the alternator cannot maintain regulation voltage at the low idle RPM

B. The battery temperature sensor commands the voltage regulator to reduce the charging voltage at the perceived idle temperature which is lower than the driving temperature creating an incorrect charge reduction at idle

C. The alternator's internal diodes have a partial failure that allows adequate output at higher RPM but cannot rectify the reduced AC frequency at idle RPM to produce sufficient DC output voltage for battery charging

D. The engine ECM reduces the alternator's field current command during idle to reduce the parasitic load on the engine for emissions compliance — the reduced field current limits the alternator's output below charging voltage

56. A truck's scan tool shows the intake manifold absolute pressure (MAP) sensor reading 101 kPa with the engine off and the key on. The vehicle is at approximately sea level. Is this reading correct?

A. No — the MAP sensor should read approximately 0 kPa with the engine off because the sensor measures the pressure difference between the manifold and atmosphere and with the engine off there is no vacuum or boost present

B. No — the MAP sensor should read approximately 50 kPa with the engine off because the sensor's zero-reference point is calibrated to mid-scale to allow measurement of both vacuum and boost conditions on either side

C. Yes — the MAP sensor reads absolute pressure (referenced to a vacuum) and 101 kPa is standard atmospheric pressure at sea level — the reading confirms the sensor is functioning correctly with the engine off at this altitude

D. Yes — the MAP sensor reads gauge pressure referenced to atmosphere and the 101 kPa reading represents the atmospheric pressure pushing into the open intake manifold with the engine off and the throttle body open

57. A truck's engine ECM has set a fault code for the exhaust gas temperature sensor — SPN 3242, FMI 0 (data above normal range). The sensor is located downstream of the DPF. The engine has just completed a DPF regeneration. Is this code expected?

A. No — the post-DPF temperature should never exceed the sensor's maximum range even during regeneration because the DPF's substrate temperature is controlled by the ECM's regeneration fuel injection strategy to prevent overheating

B. Yes — during DPF regeneration the exhaust temperature downstream of the DPF can momentarily exceed 600°C as the soot burns and this temperature may exceed the EGT sensor's normal measurement range triggering the FMI 0 code

C. No — the regeneration strategy controls the exhaust temperature to a maximum of 500°C downstream of the DPF and any reading above this temperature indicates a runaway regeneration that has exceeded the ECM's thermal control

D. Yes — but only if the regeneration was a forced (service) regeneration rather than an automatic (passive or active) regeneration because forced regenerations produce higher peak temperatures than the ECM-controlled automatic cycles

58. A truck's windshield washer system has been tested. The pump runs when the switch is activated but no fluid reaches the windshield — the nozzles produce no spray. The washer fluid reservoir is full and the fluid is not frozen. What should be checked?

A. The washer pump's discharge port for a disconnected hose fitting that allows the pump to run against no resistance — the pump cavitates with the disconnected hose and no fluid reaches the nozzle feed line from the pump

B. The washer hose from the pump to the nozzles for a disconnection, split, or kink that prevents the fluid from reaching the nozzles — the pump operates but the fluid leaks or is blocked before reaching the spray nozzles

C. The washer pump's check valve for a stuck-closed condition that prevents the pump from drawing fluid from the reservoir — the pump runs against the closed check valve and no fluid is drawn into the pump chamber

D. The washer fluid hose from the pump to the nozzles for a disconnection, kink, blockage, or freeze at a high point — the pump runs and pressurizes the fluid but the flow path to the nozzles is interrupted before reaching them

59. A truck's body controller receives input from multiple door-mounted switches — door ajar, courtesy lamp, and power lock. The driver reports the courtesy lamp stays on continuously even with all doors closed. The scan tool shows the right rear door ajar switch reading "open." What should be checked?

A. The right rear door ajar switch and its wiring for a stuck-closed condition or a wiring short that holds the switch circuit in the "open" position — the body controller illuminates the courtesy lamp because it believes the door is open

B. The body controller's input logic for the door ajar function for a software glitch that interprets the right rear switch signal incorrectly — the switch may be functioning correctly but the controller misreads the signal state

C. The right rear door ajar switch or its wiring for a fault that holds the circuit in the "door open" state — the stuck switch keeps the courtesy lamp on because the body controller reads the constant open signal from that door

D. The right rear door latch mechanism for a misadjusted striker that prevents the door from fully closing even though it appears closed — the ajar switch correctly reads the not-fully-latched door as open and illuminates the lamp

60. A truck's battery disconnect switch is turned to the off position but the batteries continue to discharge overnight. The parasitic drain with the disconnect switch off reads 150 milliamps. What is the most probable cause?

A. A circuit that is wired directly to the batteries upstream of the disconnect switch bypasses the switch — typically a clock, memory keep-alive, or an aftermarket accessory that was connected directly to the battery terminal

B. The battery disconnect switch has developed high internal resistance that allows 150 mA to leak through the switch even in the off position — the switch contacts have corroded to the point where they cannot fully isolate the circuit

C. The batteries are self-discharging at a rate of 150 mA from internal chemical degradation — the disconnect switch is functioning correctly but the batteries' own internal leakage current produces the measured discharge rate

D. The chassis ground strap provides an alternate current path that bypasses the disconnect switch allowing the 150 mA to flow from the positive battery terminal through the vehicle's wiring and return through the frame ground

61. A truck's engine ECM has an output circuit that controls the engine cooling fan. The ECM commands the fan ON through a PWM signal to the fan clutch solenoid. The fan does not engage. The technician measures the ECM's output and finds 12 volts present at the output pin continuously (no PWM signal). What does this indicate?

A. The ECM's internal output driver for the fan circuit has failed in the open (off) state — the 12 volts at the pin is the pull-up voltage from the solenoid coil's supply side and the ECM cannot pull the signal low to create the PWM

B. The ECM is commanding the fan on correctly and the 12-volt continuous output is the ECM's maximum fan engagement command — the fault is downstream of the ECM in the fan clutch solenoid, its wiring, or the clutch mechanism

C. The ECM's PWM output frequency is too high for the multimeter to display and appears as a steady 12 volts — an oscilloscope should be used to verify the actual PWM waveform at the output pin before condemning the ECM

D. The ECM's internal output driver has failed and cannot pull the output low to create the PWM signal — the 12 volts is the solenoid's supply voltage pulled up through the coil winding with no ground-side switching from the ECM

62. A truck's trailer ABS lamp illuminates intermittently during driving. The trailer ABS system functions correctly during controlled braking tests. The lamp goes out after the ignition is cycled off and back on. What is the most likely cause?

A. The trailer ABS module has an intermittent sensor signal fault that sets and clears during normal driving — the lamp illuminates when the fault is active and extinguishes when the ignition is cycled and the module resets its fault memory

B. The PLC communication between the trailer and tractor is intermittent — the tractor's body controller illuminates the trailer ABS lamp when it loses the PLC data from the trailer module during the intermittent communication dropout

C. The trailer ABS module has a marginal power supply voltage from a high-resistance connection on pin 7 that intermittently drops below the module's minimum operating threshold causing the module to reset and illuminate the lamp

D. The tractor-to-trailer electrical connection has an intermittent contact on the ABS power or communication circuit that causes the trailer ABS lamp to illuminate when the connection quality degrades during driving vibration

63. A truck's engine ECM has set a fault code for the turbocharger wastegate position sensor — SPN 2795, FMI 4 (voltage below normal). The sensor is a 5-volt reference type. What does FMI 4 (voltage below normal) indicate?

A. The sensor signal wire has a short to ground that pulls the signal voltage below the ECM's minimum expected range for the wastegate position sensor input creating the low-voltage reading at the ECM's signal input terminal

B. The wastegate actuator has failed in the fully open position and the sensor accurately reports the position as below the normal operating range — the FMI 4 reflects the mechanical position rather than an electrical fault

C. The ECM's 5-volt reference supply has dropped below 5 volts from an overloaded reference circuit and the reduced supply voltage causes all 5-volt sensors to read below their normal ranges including the wastegate position sensor

D. The sensor element has worn and its resistance has increased to the point where the voltage divider output falls below the ECM's minimum threshold — the sensor produces a valid but low signal from the worn potentiometer element

64. A truck's instrument cluster has been replaced with a remanufactured unit. After installation, all gauges work correctly except the fuel gauge which reads empty despite a full tank. The fuel level sender has been verified as functional with the correct resistance range. What is the most likely cause?

A. The remanufactured cluster's fuel gauge driver circuit has a different resistance calibration than the original cluster and the sender's resistance range does not match the replacement cluster's gauge input specification

B. The fuel level sender ground circuit has a different path through the remanufactured cluster's internal wiring than the original creating a ground offset that shifts the gauge reading from its calibrated position to the empty indication

C. The remanufactured cluster requires programming with the vehicle's specific fuel tank size and sender resistance range — without this configuration the cluster's fuel gauge cannot interpret the sender's resistance signal correctly

D. The fuel level sender wire was not connected during the cluster installation and the gauge reads empty because it receives no input signal — the other gauges receive their data through the CAN bus and do not require a direct wire

65. A truck's starter motor has been replaced. After the replacement, the engine cranks faster than before — noticeably faster than other identical trucks. The batteries and cables are the same. What is the most likely explanation?

- A. The replacement starter motor has a higher torque rating than the original from being specified for a different application and the increased torque cranks the engine faster than the designed cranking speed for this engine
- B. The replacement starter has a different gear ratio (pinion-to-ring gear) than the original — the different ratio cranks the engine at a higher RPM than the designed specification producing the noticeably faster cranking speed
- C. The original starter had been gradually losing efficiency from worn brushes, a weak solenoid, or degraded windings — the new starter restores the original cranking speed that the driver had forgotten during the old starter's decline
- D. The replacement starter motor has a lower internal resistance than the original from newer motor winding technology and draws more current from the batteries producing higher torque and faster cranking speed than the specification

66. A truck's scan tool shows the diesel exhaust fluid temperature at -5°C while the ambient temperature is 25°C and the DEF tank feels warm to the touch. What is the most probable cause?

- A. The DEF temperature sensor is reading the temperature of the DEF at the bottom of the tank which remains colder than the surface because the dense cold DEF settles to the bottom and the warm surface DEF floats above
- B. The DEF temperature sensor has a wiring fault that creates a fixed resistance value corresponding to -5°C regardless of the actual fluid temperature — the sensor circuit has an open or short that produces the false cold reading
- C. The DEF tank heater has failed in the ON position and is cooling the DEF through a reversed Peltier effect — the heater's thermoelectric element is pumping heat out of the DEF instead of heating it from the reversed polarity
- D. The DEF temperature sensor has failed and is producing a fixed output that the ECM interprets as -5°C — the sensor does not reflect the actual DEF temperature and should be replaced to restore accurate temperature monitoring

67. A truck's power distribution panel has a fusible link that protects the main power feed from the battery to the fuse panel. The fusible link has blown. After replacement, the new fusible link blows immediately when the battery disconnect switch is turned on. What should the technician do?

A. Disconnect all circuits downstream of the fusible link and reconnect them one at a time to isolate the circuit with the short — the immediate blow indicates a dead short exists on one of the circuits fed through the fusible link

B. Install a higher-rated fusible link because the existing link may have weakened from heat and age and the original circuit load now exceeds the degraded link's reduced current capacity causing the immediate failure on connection

C. Replace the battery disconnect switch because the switch's internal contacts may have developed an arc that creates a current spike when the switch is closed — the inrush current from the arc exceeds the fusible link's rating

D. Disconnect the alternator before reconnecting the battery to prevent the alternator's residual magnetism from creating an inrush current spike that exceeds the fusible link's blow threshold during the initial battery connection

68. A truck equipped with a telematics system has the telematics unit wired into the vehicle's J1939 CAN bus. After the telematics installation, intermittent engine fault codes have appeared that were not present before the installation. What should be investigated?

A. The telematics unit's CAN bus connection for proper impedance matching — an aftermarket module with incorrect bus loading can degrade the signal quality on the J1939 bus causing intermittent communication errors that trigger fault codes

B. The telematics unit's software for a version that is compatible with this truck's J1939 protocol version because an incompatible protocol version can broadcast messages that the engine ECM interprets as fault conditions

C. The telematics unit's CAN bus connection for correct wiring, proper termination, and adequate signal integrity — an improperly connected aftermarket module can load the bus, reflect signals, or introduce noise that degrades communication

D. The telematics unit's power supply for a shared fuse with a critical engine circuit — the telematics unit's current draw may intermittently overload the shared fuse creating voltage fluctuations that trigger the engine fault codes

69. A truck's manual transmission has a complaint of gear noise in all forward gears that increases proportionally with vehicle speed. The noise is not present in neutral with the clutch engaged. The noise disappears when the clutch pedal is depressed (clutch disengaged). What does this noise pattern indicate?

A. The countershaft bearings are worn because the noise is present in all gears where the countershaft carries load and disappears when the clutch is disengaged because the countershaft is unloaded with no input torque

B. The input shaft bearing is worn because the noise is present whenever the input shaft rotates under load and disappears when the clutch is disengaged because the input shaft stops rotating without the clutch disc connection

C. The output shaft bearing is worn because the noise is proportional to vehicle speed (output shaft speed) and the noise changes character when the clutch is disengaged because the loading on the output shaft changes

D. The countershaft gears are worn because the noise is present in all forward gears and disappears when the clutch disengages — the unloaded gears stop meshing under load eliminating the worn gear mesh noise source

70. A truck equipped with an Allison automatic transmission has a complaint that the torque converter lockup clutch shudders during the lockup engagement at highway speed. The fluid level and condition are correct. What is the most probable cause?

A. The lockup clutch disc friction material has glazed from repeated engagement and the glazed surface creates an alternating grab-slip pattern during the engagement transition producing the shudder before the clutch fully locks

B. The torque converter lockup clutch friction material has worn or contaminated to the point where it cannot make a smooth transition from the slipping engagement to the fully locked condition creating the shudder vibration

C. The engine's torsional vibration damper has deteriorated and the undamped engine firing impulses transmit through the locked converter to the driveline creating the shudder that is only perceptible during the lockup transition

D. The transmission output shaft bearing has play that allows the shaft to shift during the lockup engagement transition — the shaft movement creates a vibration that is perceived as shudder during the lockup event specifically

71. A truck's drive axle has been rebuilt with new bearings. During the road test, the technician hears a cyclic humming noise from the rear that changes pitch when the vehicle changes speed but does not change when the engine RPM changes in the same gear. What does this speed-dependent (not RPM-dependent) noise pattern confirm?

A. The noise originates from the drive axle because the axle components rotate at a speed proportional to vehicle speed — changing engine RPM in the same gear does not change the axle speed so the noise pitch remains constant

B. The noise is from the driveshaft because the driveshaft speed is proportional to both vehicle speed and engine RPM — the noise changes with vehicle speed because the driveshaft speed ratio tracks vehicle speed at a constant gear ratio

C. The noise is from the transmission output shaft bearing because the output shaft speed is proportional to vehicle speed and does not change with engine RPM in the same gear ratio during the constant-gear test condition

D. The noise is from the tires because tire noise is proportional to vehicle speed and does not change with engine RPM — the tire rotation speed depends only on the vehicle's forward motion regardless of the drivetrain gear ratio

72. A truck's clutch has been replaced. During the post-service road test, the technician notices a rhythmic vibration in the drivetrain that is present in all gears and at all speeds. The vibration frequency is proportional to engine RPM. The vibration disappears when the clutch pedal is depressed. What component should be checked?

A. The flywheel for excessive runout that pushes the pressure plate off-centre during each revolution — the runout creates a once-per-revolution imbalance that transmits through the clutch to the drivetrain at engine RPM frequency

B. The pressure plate for a balance issue from a manufacturing defect or incorrect installation that creates a once-per-revolution imbalance proportional to engine RPM through the clamped clutch disc to the transmission input shaft

C. The clutch disc for an imbalance from a manufacturing defect, a missing balance weight, or an assembly error — the rotating disc produces a once-per-revolution vibration that transmits through the drivetrain at engine speed

D. The flywheel, pressure plate, or clutch disc for a rotational imbalance — since the vibration is at engine RPM frequency and disappears with the clutch disengaged, the imbalanced component is in the rotating assembly between the engine and transmission

73. A truck's drive axle makes a rhythmic clicking noise that occurs once per wheel revolution. The noise is present during both acceleration and coast. The axle shafts have been inspected and show no visible damage. What should be checked next?

A. The ring gear for a damaged or chipped tooth that contacts the pinion once per ring gear revolution — the click occurs at the damaged tooth's position regardless of the load direction because the damage is on the tooth itself

B. The side gear thrust washers for a wear condition that allows the side gear to shift position once per revolution creating a metallic contact with the differential case at the same position during each wheel revolution

C. The wheel bearing for a damaged roller or race that produces a click once per revolution as the damaged element passes through the loaded zone during rotation — the click frequency matches the wheel rotation speed exactly

D. The ring gear for a chipped or damaged tooth that produces the click as the damaged tooth meshes with the pinion gear — the damage produces the click at the same rotational position once per ring gear revolution regardless of load

74. A truck's automatic transmission has been serviced with a fluid change and filter replacement. After the service, the transmission shifts correctly in all ranges but the shift quality has changed — the shifts feel softer (more slippage during the clutch engagement) than before the service. What has changed?

A. The new transmission fluid has different friction characteristics than the previous fluid that was in the transmission — the fluid's friction modifier properties directly affect the clutch engagement feel during each shift event

B. The new fluid's lower viscosity creates less hydraulic resistance in the valve body passages which reduces the apply pressure rise rate at the clutch packs — the slower pressure rise creates the softer shift engagement feel

C. The new fluid has slightly less friction modifier concentration than the previously worn fluid and the reduced modifier allows more clutch slippage during engagement — the slippage produces the softer shift feel throughout all ranges

D. The new filter has a lower flow restriction than the old restricted filter and the increased flow changes the valve body's internal pressure dynamics — the higher flow creates a different pressure modulation during the shift event

75. A truck equipped with an automated manual transmission (AMT) has a fault code for "gear engagement force too high — 5th gear." The AMT can engage all other gears normally. What is causing the excessive engagement force specifically in 5th gear?

A. The 5th gear synchronizer blocking ring has worn and the reduced friction material cannot slow the gear speed adequately during the shift event — the AMT actuator applies more force to complete the engagement against the unsynchronized speed

B. The shift fork for 5th gear has a bent finger that misaligns the sliding clutch during the engagement creating a mechanical interference that requires more actuator force to push the clutch sleeve past the interfering fork position

C. The AMT actuator motor for the 5th gear position has increased internal friction from wear and the motor's force sensor reads the motor's own internal friction as resistance from the synchronizer requiring a higher force command

D. The 5th gear synchronizer has worn or the shift fork is bent — either condition increases the force required for the AMT actuator to complete the 5th gear engagement and both must be inspected to determine which component has failed

76. A truck's driveshaft has been repaired at a driveshaft shop. The shop welded a new tube section to replace a damaged section. After reinstallation, the truck has a severe vibration at all speeds that was not present before the repair. The U-joints are new and phased correctly. What is the most likely cause?

A. The welded repair has introduced a balance weight distribution error because the new tube section has a different wall thickness than the original — the mass difference creates a rotational imbalance at all speeds during driving

B. The welded tube splice has created an angular misalignment between the two tube sections and the bent shaft rotates eccentrically producing a vibration proportional to driveshaft speed at all vehicle speeds during operation

C. The weld heat has distorted the tube creating a runout condition that produces vibration at all speeds — the shaft should have been rebalanced after the weld repair to compensate for any distortion from the welding process

D. The driveshaft was not dynamically balanced after the welding repair — any welded repair changes the shaft's mass distribution and the shaft must be balanced on a driveshaft balancer to verify the repair did not introduce an imbalance

77. A truck's limited-slip differential has a complaint of excessive noise during tight parking lot turns. The noise is a banging or clunking rather than the typical chatter of a dry clutch pack. What is the most likely cause?

A. The differential spider gears have chipped teeth that produce the banging noise as the damaged teeth mesh during the differential action required for tight turns at low speed in the parking lot turning environment

B. The limited-slip clutch pack preload springs have broken and the loose spring pieces are banging inside the differential case during the speed differential between the left and right axle shafts during tight parking lot turns

C. The differential's spider gear cross shaft has worn its bore in the differential case and the loose shaft shifts and impacts the case during the alternating load direction changes of the tight turn differential action at low speed

D. The ring gear bolts have loosened and the ring gear shifts on the carrier during the high-torque differential action of tight turns — each shift produces a bang as the gear repositions against the carrier mounting surface

78. A truck's transfer case has a complaint of a grinding noise when shifting from 2WD to 4WD while the vehicle is moving at 30 km/h. The transfer case is a part-time system with no synchronizer on the 2WD-to-4WD shift. What should the driver do differently?

A. The driver should match the front axle speed to the rear axle speed before engaging 4WD by briefly accelerating to momentarily spin the front wheels through the wheel hubs before shifting the transfer case into 4WD engagement

B. The driver should slow the vehicle to approximately 5 km/h or stop completely before shifting into 4WD because the non-synchronized transfer case cannot match the front and rear output speeds at 30 km/h without grinding

C. The driver should engage the front hubs first (if equipped with manual hubs) and drive for 30 seconds to allow the front driveshaft to spin up to speed before shifting the transfer case into 4WD at any vehicle speed

D. The driver should shift the transmission to neutral, coast momentarily, then shift the transfer case to 4WD and re-engage the transmission — the neutral coast unloads the driveline and allows the shift collar to engage without grinding

79. A truck's automatic transmission has a condition where it downshifts two gears instead of one during a coastdown at highway speed — the transmission skips from 10th to 8th instead of shifting from 10th to 9th. The skip-shift occurs consistently at the same speed. What is the most likely cause?

A. The vehicle speed sensor has a calibration error that makes the TCM believe the vehicle is traveling slower than actual speed — the TCM commands the downshift to 8th because it calculates the vehicle speed matches 8th gear rather than 9th

B. The 9th gear pressure switch or solenoid has failed and the TCM cannot apply the 9th gear clutch pack — the TCM skips to 8th gear because it detects the 9th gear circuit is unavailable during the coastdown shift event

C. The shift schedule calibration has been updated to skip 9th gear during coastdown for improved engine braking performance — some transmission calibrations intentionally skip gears during deceleration for the driver's driving style

D. The 9th gear clutch pack or its application circuit has a fault that the TCM detects during the downshift — the TCM skips the unavailable 9th gear and shifts directly to 8th to maintain driveline continuity during the coastdown

80. A truck's drive axle pinion seal has been replaced three times in the past year. Each replacement seals correctly for approximately 3 months before leaking again. What underlying condition is causing the repeated seal failure?

A. The pinion yoke has a worn surface at the seal contact area that the new seal cannot maintain contact with — the worn groove provides a leak path that appears after the seal lip wears into the existing groove within 3 months of installation

B. The pinion bearing preload has decreased from worn bearings and the excess shaft play allows the pinion to move axially and radially — the shaft movement destroys the seal lip within 3 months of each installation from the excessive play

C. The pinion yoke has a surface defect (scoring, corrosion, or wear groove) at the seal riding surface — each new seal initially seals against the smooth portion of the yoke but the seal lip wears into the defect within 3 months

D. The axle vent is plugged and the internal pressure from heat expansion forces oil past the seal — the pressure overcomes the seal's lip tension within 3 months of each installation regardless of the seal's condition or the yoke surface

81. A truck's clutch has been adjusted. After the adjustment, the driver reports the clutch engages very low on the pedal — near the floor. What was done incorrectly during the adjustment?

A. The clutch free play was set too large which moves the engagement point further down in the pedal travel — the excessive free play uses most of the pedal's range for the non-functional gap before the release bearing contacts the fingers

B. The clutch was adjusted with too much free play — the large gap between the release bearing and the pressure plate fingers means the pedal must travel further before the bearing contacts the fingers and begins to disengage the clutch

C. The clutch linkage was adjusted with the pedal in the depressed position rather than released and the adjustment reference point was incorrect — the error moves the effective engagement point to the bottom of the travel range

D. The automatic slack adjuster on the clutch linkage was tightened beyond specification creating excessive preload that holds the release bearing against the pressure plate fingers at the bottom of the pedal travel range

82. A truck equipped with a torque converter automatic transmission has a stall test result of 2,400 RPM. The specification is 2,100 to 2,200 RPM. The engine makes rated power on a dynamometer. What does the high stall speed indicate?

A. The torque converter's internal stator has loosened and the impeller cannot redirect the fluid efficiently against the turbine creating less resistance — the engine revs higher before reaching the equilibrium stall point

B. The engine has more power than specification and the additional torque overcomes the converter's designed resistance at a higher RPM creating the elevated stall speed from the excess engine output during the test

C. The transmission has a slipping clutch pack or band that reduces the driveline resistance during the stall test — the reduced load allows the engine to rev higher than the specification before reaching the equilibrium stall point

D. The torque converter's stator one-way clutch is freewheeling in both directions and the stator cannot redirect the fluid for torque multiplication — the resulting fluid coupling produces less resistance allowing the engine to stall at a higher RPM

83. A truck's driveshaft has a two-piece design. The front section has developed a vibration that is proportional to driveshaft speed (vehicle speed dependent). The rear section was replaced 1,000 km ago. The centre bearing was not replaced. What should the technician check first?

A. The centre bearing rubber mount for deterioration that allows the bearing to shift position during rotation — the shifted bearing changes the front section's alignment creating the speed-proportional vibration from the eccentricity

B. The front driveshaft section's U-joints for wear because the U-joints on the front section are original and the vibration may be from worn bearings in the front section's U-joints rather than from any change related to the rear section replacement

C. The rear section's U-joint phasing relative to the front section because the replacement rear section may not have been installed with the correct yoke alignment creating a phasing error that manifests as a front-section vibration

D. The rear section's balance for a manufacturing defect because the replacement shaft may have an imbalance that creates a vibration at the centre bearing junction that the technician perceives as originating from the front section

84. A truck's drive axle differential case has been opened for inspection. The technician finds the ring gear teeth show a normal wear pattern on the drive side but heavy wear on the coast side. What operating condition causes accelerated coast-side gear tooth wear?

A. The truck operates primarily in mountainous terrain with frequent long descents where the engine brake and coast-side gear loading exceed the design capacity — the sustained coast loading accelerates the coast-side tooth wear

B. The differential lubricant has a viscosity that is too low for the operating temperature creating inadequate film thickness on the coast side of the teeth — the drive side receives adequate lubrication from the gear rotation pattern

C. The ring gear backlash is set too tight and the close tooth spacing creates interference on the coast side during deceleration — the interference produces heavy contact that accelerates wear specifically on the coast tooth faces

D. Extended engine braking and frequent coasting downhill loads the gear teeth on their coast sides more heavily than normal highway cruise — trucks operating in mountainous terrain develop this accelerated coast-side wear pattern

85. A truck equipped with a compression brake has a complaint that the brake activates with a noticeable delay — approximately 1 second between pressing the dash switch and feeling the retarding force. The brake produces adequate force once engaged. What is the most likely cause of the delay?

A. The engine oil pressure must build in the compression brake circuit before the slave pistons can actuate the exhaust valves — low idle oil pressure creates a delay as the oil fills the slave piston chambers before reaching actuation pressure

B. The compression brake solenoid valves are slow to respond from contaminated electrical connectors that increase the resistance in the solenoid circuits — the increased resistance delays the magnetic field buildup needed to open the valves

C. The compression brake control module has a programmed engagement delay that ramps the brake force gradually to prevent sudden driveline shock from the abrupt application of the compression brake retarding force at the current engine speed

D. The ECM verifies multiple enable conditions before activating the compression brake (vehicle speed, throttle position, clutch switch, gear selection) and the verification sequence takes approximately 1 second to complete all enable checks

86. A truck's power steering system has been tested. The system produces the correct maximum pressure (12,500 kPa) but the flow rate is 25% below specification at idle. At highway RPM, the flow rate meets specification. What is the most probable cause?

A. The power steering pump's internal flow control valve is stuck partially closed restricting the flow at all pump speeds but the higher RPM output compensates for the restriction and delivers the correct specification at highway speed

B. The power steering pump's internal vanes have worn and cannot maintain adequate sealing at the low RPM of idle — the reduced vane sealing allows internal bypass that reduces the net flow output at the slower pump speed

C. The power steering pump drive belt is slipping at idle where the belt tension is at its lowest — the slippage reduces the pump shaft speed below the minimum needed for full flow output at the engine idle speed

D. The power steering fluid reservoir has a restricted inlet screen that limits the fluid supply to the pump — the restriction produces cavitation at idle where the pump's inlet vacuum is highest and the restriction has the most effect

87. A truck's front axle alignment shows the caster at $+2.0^\circ$ on both sides. The specification calls for $+3.5^\circ$ to $+5.0^\circ$. What symptoms will the low caster produce?

A. The truck will wander at highway speed because the low caster reduces the trail distance which decreases the self-centering force — the reduced centering force allows the tires to follow road imperfections instead of tracking straight

B. The truck will have excessive steering effort because low caster increases the mechanical disadvantage in the steering geometry requiring more effort from the driver to overcome the altered geometry during each steering input

C. The truck will wear the steer tires rapidly on the inner edge because the low caster tilts the tires inward at the contact patch concentrating the ground force on the inner tread edge during straight-line highway driving

D. The truck will have reduced steering returnability and may wander at highway speed — the low caster reduces the geometric trail and the self-centering force that brings the steering to centre after turns and during straight driving

88. A truck's rear air ride suspension has been equipped with new air springs. After installation, the technician adjusts the ride height to specification using the height control valve linkage. During the first loaded trip, the driver reports the ride is excessively harsh — much harsher than with the old springs. What is the most likely cause?

A. The new air springs have not been broken in and the rubber bellows are stiffer than the worn springs they replaced — the stiffness will decrease during the first 5,000 km as the rubber flexes and conforms to the operating cycle

B. The new air springs have a higher spring rate than the old worn springs at the same inflation pressure — the stiffer springs require the shock absorbers to be upgraded to match the new spring rate for proper ride quality

C. The height control valve was adjusted correctly for ride height but the new springs' different volume-to-pressure characteristics create a higher spring rate at the set ride height than the old springs had at the same height

D. The shock absorbers were not replaced simultaneously with the air springs and the worn shocks cannot control the new springs' energy — the mismatch between new springs and old shocks produces the harsh uncontrolled ride

89. A truck's tire has been repaired using a combination plug-patch (mushroom patch) from the inside after a nail puncture. The repair is in the repairable area of the tread crown. During the post-repair

inflation, the technician notices a slight bulge in the tire sidewall approximately 100 mm from the puncture location. Should the tire be returned to service?

- A. The tire can be returned to service because the sidewall bulge is from the internal repair material pushing against the inner liner and the bulge will settle during the first 100 km of driving as the repair material conforms to the tire
- B. The tire should be reinflated to the maximum sidewall pressure to verify if the bulge expands — if the bulge does not grow under maximum pressure the tire is safe for service with the existing repair in the tread crown area
- C. The tire should not be returned to service — the sidewall bulge indicates a separation in the tire's internal structure that was caused by the original nail damage or the repair process and the structural damage creates a blowout risk
- D. The tire can be returned to service if the bulge is on the inboard side of the tire where it is not visible during a walk-around inspection because the regulatory inspection only checks the outboard-visible portion of the tire sidewall

90. A truck's wheel hub assembly has been serviced. During the reassembly, the technician notices the inner wheel seal lip is facing outward (away from the bearing) instead of inward (toward the bearing). The technician installs the seal as-is. What is the consequence of the reversed seal?

- A. The reversed seal lip cannot retain the hub oil inside the hub cavity — the seal's spring-loaded lip is designed to face the fluid it retains and a reversed lip allows oil to leak past the seal under the internal hub oil pressure
- B. The reversed seal has no operational consequence because the seal lip contacts the spindle surface regardless of direction and the sealing contact between the lip and the spindle surface is effective in both orientations
- C. The reversed seal will damage the spindle surface because the seal lip's knife edge contacts the spindle at the wrong angle creating a scoring pattern on the spindle that prevents future seals from sealing regardless of orientation
- D. The reversed seal allows water and road contaminants to enter the hub cavity from the outside because the lip orientation is designed to exclude external contaminants and the reversed lip cannot perform this protection function

91. A trailer's suspension has been converted from a leaf spring tandem to an air ride tandem. After the conversion, the trailer's ride height appears correct but the trailer tracks (steers) to the right during highway driving. The alignment has been checked and the axles are square to the frame. What could cause this tracking error after the conversion?

A. The air ride conversion kit's trailing arm brackets were installed with a slight angular error on one side that positions one axle at a different angle than the other creating a thrust angle error that pushes the trailer to the right

B. The air ride suspension's height control valve linkage was not adjusted equally on both sides and the unequal ride heights create a frame twist that shifts the trailer's tracking direction to the right during highway driving

C. The trailer frame has a pre-existing twist that was compensated by the original leaf spring suspension's different geometry — the air ride conversion exposed the frame twist that the leaf springs masked during their installed period

D. The air ride conversion has changed the trailer's roll centre height which alters the dynamic weight transfer characteristics during highway driving creating an asymmetric tracking force that pushes the trailer to the right

92. A truck's steer tire is wearing evenly across the tread width but the overall wear rate is significantly faster than the same tire brand on other trucks in the fleet with the same alignment specification. The alignment is verified correct and the tire pressure is at the specification. What else should be investigated?

A. The brake system on the steer axle for a drag condition that continuously wears the tread through friction heating and added rolling resistance beyond the normal tire-to-road wear from driving without brake drag

B. The truck's specific operating conditions — route profile, speed, load, braking frequency, and road surface — because these factors significantly affect tire wear rates independently of alignment and inflation pressure settings

C. The steer axle weight for an overloaded condition that exceeds the tire's designed load rating — even with correct alignment and pressure an overloaded tire flexes more and wears faster from the additional contact patch stress

D. The king pin bushings for excessive play that allows dynamic alignment changes during driving — the alignment reads correctly during the static shop measurement but the worn bushings change the geometry during actual driving

93. A truck's fifth wheel coupling has passed the tug test and visual inspection. During driving, the driver hears a rhythmic clicking noise from the fifth wheel area that is proportional to road speed. The noise is not present when driving without a trailer. What should be investigated?

A. The fifth wheel plate surface for a high spot or debris that contacts the trailer upper coupler plate once per revolution of the tires as the tractor and trailer articulate over road surface irregularities during driving

B. The king pin and jaw contact for excessive play that allows the king pin to shift position in the jaw creating a rhythmic click as the pin loads and unloads with each wheel revolution's road surface variation during driving

C. The fifth wheel mounting bolts for looseness that allows the fifth wheel to shift on its mounting frame during each road surface variation — the loose assembly clicks as it moves under the cyclic loading of normal highway driving

D. The trailer upper coupler plate for a wear pattern or debris that contacts the fifth wheel plate surface intermittently during the tractor-trailer's articulation response to road surface irregularities at the driving speed rhythm

94. A truck's front leaf spring has been replaced. After the replacement, the ride height on the replaced side is 20 mm higher than the other side. The new spring has the correct part number. What should be done?

A. The new spring has a slightly higher arch than the worn spring it replaced which is normal for a new spring versus a worn one — the height difference will decrease as the new spring settles during the first 5,000 to 10,000 km of loaded driving

B. The spring U-bolts should be loosened and retightened after the truck has been loaded to its GVW to allow the new spring to settle to its working height under the actual operating load before verifying the ride height

C. The spring was manufactured with an incorrect arch height and should be returned to the supplier for a spring with the correct free arch specification that matches the worn spring on the opposite side of the vehicle

D. Install a shim between the spring and the axle pad on the high side to bring the ride height to match the opposite side because the 20 mm difference will cause uneven tire wear and a steering pull from the camber change

95. A trailer equipped with self-steering axles has a complaint of excessive tire wear on the self-steering position. The wear pattern shows the inner and outer edges worn significantly more than the centre. What is the most probable cause?

A. The self-steering axle tires are chronically under-inflated for the load they carry and the reduced inflation pressure causes the tread to flex inward allowing the edges to contact the road more heavily than the centre during straight driving

B. The self-steering axle tires experience more lateral scrubbing forces than fixed axle tires during turns and the lateral forces concentrate on the tread edges wearing them faster than the centre during every steering event

C. The self-steering axle's centering mechanism is too stiff preventing the axle from returning to centre after turns — the off-centre axle drags the tires sideways during straight driving creating edge wear from the constant scrub

D. The self-steering axle tires are under-inflated for the load — insufficient pressure allows the tread to distort under load and the shoulder edges carry disproportionate weight causing the classic dual-edge wear pattern

96. A truck's hub-piloted wheel has been installed. During the re-torque check at 160 km, the technician discovers that two adjacent wheel nuts have loosened. All other nuts on the same wheel are at the correct torque. What is the most likely cause of the two adjacent nuts loosening?

A. The two wheel studs have thread damage from a previous installation that prevents the nuts from achieving full thread engagement and the partial engagement allows the nuts to loosen under the cyclic loading of driving

B. The hub pilot surface has a localized high spot or debris under the wheel at the location of the two loose studs that prevents the wheel from seating flat — the raised area creates a rocking point that loosens the adjacent nuts

C. The technician used an impact wrench to install the wheel and the impact wrench's torque output is inconsistent — the two adjacent nuts received less torque than the others from the impact wrench's variable output

D. The wheel lug holes at the two adjacent stud positions have become elongated from previous overtightening and the enlarged holes allow the nuts to shift position during driving creating the loosening at those specific positions

97. A truck's rear suspension uses leaf springs. During an inspection, the technician finds the spring centre bolt is sheared on one spring. The spring pack appears to be in the correct position on the axle pad. What is the consequence of the sheared centre bolt?

A. The sheared centre bolt allows the spring leaves to fan out laterally under load creating a wider spring that contacts the frame rails and produces a rubbing noise during suspension travel over bumps during normal driving

B. The axle can shift forward or rearward on the spring pack during braking and acceleration because the centre bolt is the primary locating device that prevents axle movement on the spring during directional load changes

C. The sheared bolt allows individual spring leaves to shift laterally on the axle pad changing the spring's alignment with the frame hangers and creating a thrust angle error that produces a steering pull during driving

D. The sheared centre bolt has no operational consequence because the U-bolts clamp the spring pack to the axle pad with adequate friction to prevent any movement — the centre bolt only positions the pack during initial installation

98. A truck's front steer axle has been rebuilt with new king pins, bushings, and thrust bearings. After the rebuild, the steering effort is noticeably higher than before the service. The power steering system is functioning correctly. What is the most probable cause?

A. The king pin bushings were reamed to a tight tolerance that creates excessive friction between the king pins and bushings during steering — the tight bushings need break-in time to develop the designed running clearance

B. The thrust bearings were installed dry without the correct pre-lubrication and the metal-to-metal contact between the bearing and the knuckle creates friction that the power steering system must overcome during every turn

C. The new king pin bushings have not been properly lubricated after installation and the dry bushings create metal-to-metal friction between the king pins and bushings that exceeds the power steering system's assist capacity

D. The king pin bushing preload was set too tight during the rebuild and the excessive preload creates friction between the king pins and bushings that the power steering system must work against during all steering operations

99. A truck's tire has been balanced using clip-on wheel weights. After 5,000 km, the driver reports a vibration at highway speed that was not present when the tire was initially balanced. The tire has not been dismounted since the balance. What is the most likely cause?

A. The tire has developed an internal structural change from highway driving that has shifted the balance — belt movement, ply separation, or moisture absorption has changed the mass distribution since the original balance

B. The tire tread has worn unevenly from an alignment condition and the uneven wear has changed the tire's mass distribution creating an imbalance that develops progressively over the 5,000 km of driving since the balance

C. A brake component (caliper slide pin, rotor, or pad) has developed a condition that produces a vibration proportional to wheel speed that the driver attributes to the tire balance but is actually a brake-related vibration source

D. One or more of the clip-on wheel weights has fallen off from road debris contact, vibration loosening, or inadequate installation — the lost weight creates an imbalance that produces the vibration at highway speed

100. A truck's air ride suspension has a height control valve that maintains the ride height regardless of load. The driver reports the truck leans to the left when loaded. The ride height is correct when empty. What should be investigated?

A. The left air spring for an internal fabric failure that allows the bellows to stretch under load rather than maintaining its designed shape — the stretched spring sits lower under load but returns to the correct height when empty

B. The height control valve for a fault that does not add adequate air to the left spring under load — the valve may have a restricted supply port or a worn internal seal that limits the air delivery during the loaded condition

C. The left shock absorber for a failure that allows the left suspension to compress further than the right under load — the shock cannot control the spring's compression creating the lean when the truck is loaded on the left side

D. The frame for a twist or deflection that only appears under load — the frame flexes to the left under GVW loading creating the lean that is not present when the frame is unloaded and returns to its unloaded straight position

101. A truck's tire pressure monitoring system (TPMS) shows all tires at the correct pressure except one drive axle tire that reads 0 kPa. The tire is visually inflated and the TPMS for all other positions reads correctly. What is the most probable cause?

A. The tire pressure is correct but the TPMS sensor in that specific tire has a dead battery that prevents it from transmitting its pressure data to the receiver — the sensor cannot communicate without battery power

B. The tire's valve stem is leaking and the TPMS sensor is reading the residual air pressure in the sensor's internal chamber which has equalized to atmospheric — the sensor reads 0 kPa because the gauge reference is atmospheric

C. The TPMS sensor in that tire has failed or has a dead battery — the sensor cannot transmit pressure data to the receiver module and the system displays 0 kPa as the default reading for a non-communicating sensor position

D. The TPMS receiver module has a failed input channel for that tire position and cannot process the sensor's transmitted data — the sensor transmits correctly but the receiver cannot decode the signal for that specific position

102. A truck's front wheel bearing adjustment has been performed using the manufacturer's recommended procedure. The procedure specifies a specific torque for the adjusting nut followed by backing off to the nearest lock position. After the adjustment, the technician checks the end play with a dial indicator and reads 0.000 inches (zero end play). Is this correct?

A. Zero end play indicates the bearing is too tight — the specification requires a measurable end play (typically 0.001 to 0.005 inches) and the zero reading means the bearings are preloaded which will generate excessive heat

B. Zero end play may be correct for some preset bearing designs but for a traditional adjustable bearing the specification requires measurable end play — the technician should verify the specification for this specific application

C. Zero end play is the ideal setting for all wheel bearing types because any measurable play indicates the bearing is too loose and the play will allow hub wobble that produces brake pulsation and accelerated bearing wear

D. Zero end play is incorrect for a traditional adjustable bearing — the manufacturer's specification requires measurable end play to allow for thermal expansion during driving and the zero reading indicates the adjustment is too tight

103. A truck's steer tire has developed a flat spot approximately 50 mm long on the tread surface. The flat spot produces a rhythmic thumping noise during driving. What is the most likely cause of the flat spot?

A. The tire was locked up during an emergency stop and the stationary tire skidded on the pavement creating a flat spot from the friction-induced rubber removal at the contact patch during the slide

B. The tire has a manufacturing defect in the belt structure that created a hard spot in the tread — the hard spot wears differently than the surrounding rubber producing the flat spot during normal driving

C. The tire was parked with the brakes applied for an extended period (several weeks) and the constant pressure at the contact patch deformed the rubber permanently creating the flat spot from the static loading

D. The ABS system failed during a hard braking event and the tire locked up briefly skidding on the pavement — the skid removed rubber from the tread at the contact patch creating the 50 mm flat spot

104. A truck's cab-forward design has the engine accessed by tilting the cab. The cab tilt mechanism uses a hydraulic pump and cylinder with a mechanical safety prop. During a routine engine service, the technician tilts the cab and installs the safety prop. While working under the tilted cab, the technician hears a hydraulic hissing sound from the tilt cylinder area. What should the technician do?

A. Continue working because the safety prop is installed and will hold the cab regardless of the hydraulic cylinder's condition — the prop is the primary safety device and the hydraulic system is only used for the lifting function

B. Stop work immediately and verify the safety prop is fully seated and locked in position — then investigate the hydraulic sound before resuming work because the hissing may indicate a failing cylinder that could overload the prop

C. Evacuate from under the cab immediately because the hissing indicates the hydraulic cylinder is failing and the safety prop may not support the full weight of the tilted cab if the hydraulic system loses all pressure suddenly

D. Continue working but monitor the cab's position visually — if the cab begins to lower the safety prop will catch it and the technician will have time to exit because the hydraulic failure will be gradual rather than sudden

105. A truck's sleeper cab has a 12-volt refrigerator that operates continuously during overnight parking. The refrigerator draws 6 amps during the compressor run cycle. The truck has dual batteries with a combined capacity of 200 amp-hours. If the compressor runs 50% of the time, how many hours of refrigerator operation can the batteries support before reaching a 50% state of charge?

A. The batteries can support the refrigerator for approximately 33 hours because the 50% duty cycle reduces the average draw to 3 amps and the batteries have 100 usable amp-hours before reaching 50% state of charge

B. The batteries can support the refrigerator for approximately 16 hours because the 50% duty cycle reduces the average draw to 3 amps but the batteries' usable capacity at 50% SOC is only 50 amp-hours for overnight use

C. The batteries can support the refrigerator for approximately 66 hours because the dual batteries provide 400 amp-hours total and the 3-amp average draw depletes the batteries at a rate that reaches 50% SOC after 66 hours

D. The batteries can support the refrigerator for approximately 8 hours because the compressor draws 6 amps continuously during the run cycle and the 50% duty cycle only affects the thermodynamic efficiency not the electrical draw

106. A truck's cab door has a persistent wind noise at highway speed that the technician has traced to a gap between the door glass and the window channel seal. The seal appears intact when the window is closed. When does the gap appear?

A. The gap appears at highway speed from aerodynamic pressure pulling the glass outward — the negative pressure zone on the outside of the glass at speed creates a suction force that pulls the glass away from the seal

B. The gap appears when the door is closed because the door latch pulls the door slightly out of alignment which shifts the glass position relative to the fixed window channel seal creating a gap at the top of the glass edge

C. The gap appears at highway speed from aerodynamic pressure on the glass — the wind force deflects the glass inward compressing the inner seal but opening a gap at the outer seal creating the wind noise from the outer gap

D. The gap appears at highway speed because the cab body flexes from aerodynamic loading and the flexed door opening changes shape enough to pull the glass away from the window channel seal at the point of maximum deflection

107. A truck's HVAC system has a musty odour that is most noticeable when the A/C is first turned on. The odour diminishes after 5 minutes of operation. What is causing the odour and what is the recommended corrective action?

A. The evaporator coil has developed microbial growth on its wet surface from moisture condensation during A/C operation — the growth produces the musty odour and the coil should be cleaned with an approved antimicrobial treatment

B. The cabin air filter has absorbed moisture from the A/C system and the damp filter promotes mould growth that produces the musty odour — replacing the filter and treating the HVAC housing with antimicrobial spray corrects the condition

C. The heater core has a micro-leak that deposits coolant on the evaporator surface and the coolant residue promotes bacterial growth that produces the musty odour — the heater core must be replaced to eliminate the moisture source

D. The HVAC drain tube is clogged and standing water in the HVAC housing promotes microbial growth — clearing the drain and treating the evaporator surface with an antimicrobial agent eliminates the odour and prevents recurrence

108. A truck's cab has been involved in a minor front-end collision. The bumper and hood have been replaced. After the repair, the driver reports the cab vibrates more than before the collision at highway speed. The engine and drivetrain are undamaged. What should be investigated?

A. The cab mounting isolators for damage from the collision impact that has compressed or torn the rubber elements — the damaged isolators cannot dampen road vibration as effectively as intact isolators creating the increased vibration

B. The hood and bumper alignment for aerodynamic fit — misaligned body panels create turbulent airflow at highway speed that induces vibration in the cab structure from the aerodynamic buffeting of the misaligned panels

C. The radiator support and front frame cross-member for collision damage that has shifted the engine's position relative to the cab creating a mechanical vibration path that did not exist before the frontal impact altered the geometry

D. The cab mounting isolators, the radiator support, the front cross-member, and the hood/bumper alignment — the collision may have damaged any of these components and all should be inspected for the vibration source

109. A reefer trailer's TRU produces adequate cooling when the trailer is empty but cannot maintain the set-point temperature when loaded with frozen product. The refrigerant charge is correct and the compressor operates normally. What is the most likely cause?

A. The evaporator coil has iced over from the heavy load's moisture content and the ice layer restricts airflow through the coil reducing the TRU's cooling capacity below the level needed for the loaded condition's heat load

B. The loaded trailer's cargo is blocking the airflow pattern from the evaporator to the rear of the trailer — the cargo must be loaded with adequate airflow channels between the pallets and the walls for proper air circulation

C. The TRU's condenser coil is dirty and the reduced heat rejection capacity limits the system's cooling output below the level needed for the loaded condition's higher heat load demand during the temperature pull-down period

D. The trailer's door seals have deteriorated and the warm ambient air infiltration adds heat load that the TRU can handle when empty but cannot overcome when combined with the loaded cargo's thermal mass during the pull-down

110. A trailer's composite sidewall panel has been punctured by a forklift tine. The puncture is 75 mm in diameter and penetrates both the outer skin and the inner liner. The puncture is at a height of 600 mm from the trailer floor. What must be assessed beyond the visible puncture?

A. The structural cross-members behind the puncture location for deformation or fracture from the forklift impact because the tine may have penetrated deep enough to contact and damage the trailer's structural frame members

B. The composite panel's foam core for moisture contamination from rain and washdown water that has entered through the puncture during the period between the damage and the discovery during the inspection

C. The trailer's brake lines and air lines that are routed along the interior wall for damage from the forklift tine penetration because the routing path may pass through the punctured area at the 600 mm height from the floor

D. The structural integrity of the surrounding panel area, any frame members behind the puncture, brake lines or air lines routed in the area, and the foam core for moisture contamination from the breach in the panel's weather seal

111. A trailer's ABS has a complaint that the ABS activates too aggressively during light braking on wet roads — the ABS cycles rapidly and the braking force feels weak. The wheel speed sensors and tone rings have been inspected and are within specification. What should be investigated?

A. The trailer's tire tread depth because worn tires lose traction at a lower deceleration rate on wet surfaces — the ABS correctly detects the impending lockup from the worn tires' reduced traction and intervenes earlier than expected

B. The ABS modulator valve response time because a slow-responding modulator over-modulates during each cycle — the valve stays in the release position too long before reapplying pressure creating the weak braking sensation

C. The trailer tire condition because tires with inadequate tread depth for the road conditions lose traction at lower braking force levels — the ABS correctly modulates at the tires' actual traction limit which produces the weak braking feel

D. The relay valve crack pressure for the trailer brake circuit because a high crack pressure requires more signal pressure before the valve delivers air to the chambers and the resulting delayed application triggers the ABS modulation earlier

112. A trailer equipped with a hydraulic liftgate has the liftgate platform vibrating during the raise cycle. The vibration is rhythmic and proportional to the platform's raise speed. What is the most likely cause?

A. The hydraulic pump has a worn bearing that produces a vibration proportional to pump speed — the pump speed corresponds to the platform's raise speed creating the rhythmic vibration during the raising cycle only

B. The liftgate guide rollers have flat spots from sitting in the lowered position and the flat spots produce a once-per-revolution vibration as the platform raises through the roller guide tracks during the raising cycle operation

C. The hydraulic cylinder has air trapped in the oil that compresses and releases during the raise cycle creating a pulsating force on the platform — the pulsation frequency corresponds to the pump's delivery pulsation at the raise speed

D. The liftgate hinge pins have worn and the loose hinges allow the platform to oscillate during the raise cycle as the hydraulic force alternately loads and unloads the worn hinge joints creating the rhythmic vibration pattern

113. A flatbed trailer's deck has developed a noticeable sag between the cross-members in one section. The deck boards are the original specification. What is the most likely cause of the deck sag?

A. The deck boards have been overloaded by concentrated forklift wheel loads that exceeded the boards' bending strength between the cross-members — the permanent deformation is from the boards yielding under the point loading

B. The deck board material has absorbed moisture and the water-weakened wood has sagged under the normal distributed cargo loading between the cross-member supports — the wet boards cannot maintain their original stiffness

C. The cross-member spacing in the sagging section is wider than the adjacent sections from a frame repair or manufacturing variation — the wider spacing exceeds the deck boards' span capacity at the normal loading

D. The deck boards in the sagging section have deteriorated from moisture absorption, repeated loading cycles, or rot — the weakened boards can no longer support the designed loads between the cross-member spacing

114. A trailer's landing gear (dolly legs) has become increasingly difficult to crank down. The gear ratio seems correct and the mechanism is not visibly damaged. What should be investigated?

A. The internal gear mechanism for worn or damaged teeth that create mechanical interference during the cranking rotation — the worn teeth bind during the meshing cycle creating the resistance the driver feels during cranking

B. The sand shoe pivot for corrosion or debris that prevents the shoe from pivoting freely during deployment — the stuck shoe creates a side-loading force on the leg mechanism as the driver cranks against the misaligned shoe

C. The landing gear cross-shaft bearing for corrosion and contamination that creates friction during rotation — the dry or corroded bearing adds resistance to every crank revolution making the deployment increasingly difficult

D. The landing gear's internal mechanism — gears, shafts, bearings, and pivot points — for corrosion, contamination, lack of lubrication, or mechanical wear that creates the progressive resistance increase during the cranking operation

115. A trailer's marker lamp has failed. The technician replaces the bulb but the lamp still does not illuminate. The technician checks the voltage at the lamp socket and reads 12.4 volts. The ground wire appears connected. What should the technician check next?

A. The ground circuit for adequate conductivity by performing a voltage drop test on the ground wire under load — 12.4 volts at the socket with a non-functioning lamp suggests the ground circuit has excessive resistance

B. The lamp socket for corrosion on the contact surfaces that prevents the electrical connection between the bulb base and the socket even though voltage is present at the socket's power terminal from the supply circuit

C. The replacement bulb for a manufacturing defect by testing it in a known-good socket — the replacement bulb may be defective despite being new from the package creating the continued non-function at the trailer position

D. The socket ground, the socket contacts, and the replacement bulb — voltage is present at the supply terminal but the lamp does not work, so the fault is in the ground circuit, the bulb-to-socket contact, or the bulb itself

116. A trailer's brake drum has been measured during a roadside inspection and the officer documents the drum diameter at 423 mm. The discard diameter stamped on the drum is 422 mm. What is the consequence of this finding?

A. The drum is 1 mm beyond the discard diameter and is out of service — the trailer cannot continue until the drum is replaced because operating beyond the discard diameter creates a risk of drum failure during braking

B. The 1 mm beyond discard is within the measurement tolerance for field inspections and the drum can remain in service until the next shop inspection where a more accurate measurement can be taken under controlled conditions

C. The drum is beyond the discard diameter and must be taken out of service — the trailer must be towed or the wheel must be replaced at the roadside before the vehicle can continue because the over-limit drum is a safety violation

D. The drum at 423 mm has exceeded the 422 mm discard limit by 1 mm — the drum is thinner (larger inside diameter means less material) and weaker than the minimum design standard and must be replaced before the vehicle operates

117. A truck's A/C system has been diagnosed with a compressor that runs continuously without cycling. The evaporator temperature drops to -5°C and frost forms on the evaporator surface. The cooling performance decreases as the frost builds. What component has failed that should cycle the compressor off?

A. The condenser fan relay has failed in the ON position keeping the condenser fan running continuously — the overcooled condenser drops the high-side pressure below the cycling switch's cut-out threshold but the compressor runs anyway

B. The thermostatic switch or evaporator temperature sensor that should signal the compressor clutch to disengage when the evaporator reaches the frost-prevention threshold has failed in the closed (compressor-on) position

C. The low-pressure cycling switch has failed in the closed position and cannot open the compressor clutch circuit when the suction pressure drops to the freeze-prevention threshold — the compressor runs continuously until the evaporator ices over

D. The expansion valve has failed in a position that floods the evaporator with excessive refrigerant and the flooded evaporator cannot warm above the freezing point — the compressor runs continuously trying to maintain the suction pressure

118. A truck's heater core has been bypassed (both hoses disconnected and looped together) because it developed a leak. The driver reports the engine runs 5°C cooler than normal. Why does bypassing the heater core affect the engine temperature?

A. The heater core acts as a secondary heat source that warms the engine compartment air around the thermostat housing — without the core's radiant heat the thermostat housing cools faster opening the thermostat earlier

B. The heater core has a flow restriction that creates backpressure in the coolant circuit — removing the restriction changes the flow path's total resistance allowing faster coolant circulation that reduces the engine temperature

C. The bypassed heater core removes a secondary radiator from the cooling circuit — the core rejects heat from the coolant to the cab air and without this heat rejection path the thermostat compensates by opening slightly earlier

D. The heater core's bypass loop creates a shorter coolant path that circulates coolant faster through the engine — the increased flow rate carries heat away from the engine more efficiently than the longer path through the heater core

119. A truck's A/C system uses R-134a refrigerant. The technician is preparing to recharge the system after a repair. The truck's A/C data plate specifies 1.8 kg of R-134a. The technician has a cylinder of R-1234yf refrigerant available. Can R-1234yf be used as a direct substitute for R-134a in this system?

A. R-1234yf cannot be used as a direct substitute for R-134a in a system designed for R-134a — the two refrigerants have different operating pressures, different oil compatibility, and different system component requirements

B. R-1234yf can be used as a direct substitute because it has similar thermodynamic properties and the two refrigerants are compatible in the same system without any component changes needed for the conversion

C. R-1234yf can be mixed with R-134a in any proportion because both are HFO/HFC refrigerants with the same operating characteristics and the mixed charge will perform identically to a pure R-134a charge in this system

D. R-1234yf can be used but the charge weight must be reduced by 10% because R-1234yf has a higher density than R-134a and the same weight of R-1234yf would overcharge the system beyond its designed capacity limits

120. A truck's cab has dual-zone climate control — the driver and passenger sides have independent temperature controls. The driver's side produces cold A/C air correctly but the passenger side produces only ambient temperature air. The blower operates on both sides. What is the most likely cause?

- A. The passenger-side A/C blend door actuator has failed in the bypass position allowing all air to bypass the evaporator on the passenger side while the driver-side actuator correctly routes air through the evaporator for cooling
- B. The passenger-side evaporator has a refrigerant flow restriction from a kinked tube or debris that prevents refrigerant from flowing through the passenger's evaporator section while the driver's section receives adequate flow
- C. The passenger-side blend door actuator has failed in the full-heat (bypass) position — all air bypasses the evaporator on the passenger side and passes through or around the heater core emerging at ambient temperature
- D. The dual-zone system's refrigerant distribution valve has failed in a position that directs all refrigerant to the driver-side evaporator and blocks flow to the passenger-side evaporator creating the one-side-only cooling condition

121. A truck's A/C compressor has been condemned. Before installing the new compressor, the technician must add the correct type and quantity of refrigerant oil to the new compressor. How does the technician determine the correct oil quantity?

- A. Add the same quantity of oil that drained from the old compressor during removal because the system's total oil charge remains the same and the new compressor only needs to replace what the old compressor contained
- B. Follow the manufacturer's specification for the new compressor's oil charge — the specified amount accounts for the oil that remains in the system components (evaporator, condenser, lines) and adds the correct compressor amount
- C. Add the system's total oil charge to the new compressor because all oil drains from the system when the compressor is removed and the new compressor must contain the entire system's oil for proper distribution during operation
- D. Drain and measure the oil from the old compressor, add the same quantity to the new compressor, then add an additional 30 ml to account for oil that was lost during the removal process and cannot be recovered from the old unit

122. A truck's fuel-fired auxiliary heater (Webasto-type) produces a strong sulphur smell from the exhaust during operation. The combustion flame appears normal. What is the most likely cause?

A. The heater's fuel supply has been contaminated with high-sulphur fuel from a fuel stop that supplied off-road diesel with higher sulphur content than the on-road ULSD specification the heater is designed to burn cleanly

B. The heater's combustion chamber has accumulated carbon deposits that trap sulphur compounds from the fuel and release them as the deposits heat during operation creating the concentrated sulphur smell from the small exhaust

C. The heater's exhaust catalyst has failed and can no longer oxidize the sulphur compounds in the exhaust — the raw sulphur dioxide exits the exhaust untreated and produces the strong sulphur smell during heater operation

D. The heater's fuel metering pump is delivering excess fuel and the rich combustion cannot fully oxidize the fuel's sulphur content — the unburned sulphur compounds exit the exhaust as hydrogen sulphide producing the smell

123. A truck's A/C system has been leak-tested using an electronic leak detector. The detector identifies a leak at the compressor shaft seal. The compressor has 100,000 km of service. Should the shaft seal be replaced independently or should the compressor be replaced?

A. The shaft seal should be replaced independently because it is a maintenance wear item designed to be replaced without condemning the compressor — replacing the seal is significantly less expensive than a full compressor replacement

B. The compressor should be replaced because a leaking shaft seal at 100,000 km indicates the compressor's internal bearings and components have also worn to a similar degree and the compressor is approaching the end of its service life

C. The shaft seal can be replaced independently on some compressor models but many modern compressors do not have field-replaceable shaft seals — the technician must verify if the specific compressor model allows seal-only replacement

D. The compressor must be replaced because removing the clutch assembly to access the shaft seal exposes the compressor's internal components to contamination that cannot be adequately cleaned during the seal replacement procedure

124. A hydraulic system on a garbage truck has a complaint that the packer blade cycle time has increased from 8 seconds to 12 seconds. The hydraulic oil level is correct and the oil appears clean. System pressure is within specification. What is the most likely cause?

A. The packer blade hydraulic cylinder has internal piston seal leakage that allows oil to bypass the piston during the extend stroke — the bypassed oil reduces the effective piston speed without affecting the system pressure reading

B. The hydraulic pump has worn internally and is producing less flow than specification — the reduced flow increases the cylinder cycle time proportionally while the pressure compensator maintains the correct pressure during operation

C. The packer blade's pivot bearings have worn creating additional mechanical resistance that the hydraulic system must overcome — the increased resistance slows the blade movement despite adequate pressure and flow from the pump

D. The directional control valve spool for the packer function has contamination in its bore that restricts the flow through the valve during the extend direction — the restriction reduces the flow delivery to the cylinder at the correct pressure

125. A dump truck's hydraulic system has a complaint that the dump body raises at the correct speed but the body drops immediately when the directional valve is moved to the hold (neutral) position. The body should remain in the raised position when the valve is in neutral. What has failed?

A. The directional valve's neutral position has internal leakage (worn spool or bore) that allows the cylinder's cap-end pressure to drain through the valve to the return line — the leaked fluid allows the body to drop under its own weight

B. The pilot-operated check valve in the raise circuit has a worn seat that allows reverse flow when the directional valve centres — the load pressure pushes oil backward through the leaking check valve allowing the body to descend

C. The counterbalance valve in the lower circuit has failed open allowing the cap-end oil to drain unrestricted to the return line when the directional valve centres — without the counterbalance the body drops under gravity immediately

D. The holding circuit — either the pilot-operated check valve, the counterbalance valve, or the directional valve itself — has an internal leak that allows the pressurized cap-end oil to drain when the control is released to neutral

126. A hydraulic crane's boom telescope cylinder extends and retracts at the correct speed. However, when the boom is extended and loaded, the cylinder slowly retracts approximately 25 mm over a 5-minute period. The directional valve is in neutral. What is the most likely source of the drift?

A. The directional valve has internal spool leakage in the neutral position that allows oil to drain slowly from the cylinder's cap end through the spool clearance to the tank port creating the gradual retraction under load

B. The boom telescope cylinder's piston seal has a slow internal leak that allows oil to bypass from the cap end (loaded side) to the rod end under the sustained load pressure — the bypassed oil changes the piston position slowly

C. The pilot-operated check valve in the telescope circuit has a worn seat and the sustained load pressure slowly pushes oil past the worn check seat creating the gradual drift as the oil drains from the loaded cap end chamber

D. The cylinder drift can originate from the piston seal, the holding valve, or the directional valve — each must be isolated individually to identify the specific leak source because the symptom is identical regardless of which component leaks

127. A hydraulic system's filter housing has a bypass indicator that shows the filter is in bypass. The filter was replaced 50 hours ago — well within the 250-hour change interval. What would cause a new filter to go into bypass prematurely?

A. The system has experienced a contamination event (component failure, seal ingestion, or external contamination entry) that loaded the new filter beyond its dirt-holding capacity within the first 50 hours of service

B. The replacement filter element was the wrong micron rating for the application — a finer micron rating restricts flow more than the designed element and causes the bypass valve to open under normal operating conditions

C. The hydraulic fluid temperature has increased above normal and the thinner hot oil flows faster through the system creating more volume at the filter than the element can pass without exceeding the bypass valve's cracking pressure

D. The filter bypass indicator has a manufacturing defect that trips at a lower differential pressure than designed — the filter is not actually in bypass but the indicator displays the bypass condition from the defective trip mechanism

128. A hydraulic system has two cylinders connected in series — the rod end of Cylinder 1 is connected to the cap end of Cylinder 2. Both cylinders have the same bore size. When Cylinder 1 extends, what happens to Cylinder 2?

A. Cylinder 2 extends at the same rate as Cylinder 1 because the oil displaced from Cylinder 1's rod end directly enters Cylinder 2's cap end providing the flow needed to extend both cylinders simultaneously during the pump delivery

B. Cylinder 2 retracts as Cylinder 1 extends because the oil displaced from Cylinder 1's rod end enters Cylinder 2's cap end — but the rod side of Cylinder 1 displaces less oil than the cap side requires creating a speed reduction

C. Cylinder 2 extends at a slower rate than Cylinder 1 because the rod-end flow from Cylinder 1 is less than the cap-end volume of Cylinder 2 — the rod area displaces less oil per unit of stroke than the cap end requires

D. Both cylinders extend simultaneously at equal rates because the series connection ensures equal flow distribution — the pump supplies Cylinder 1's cap end and the displaced rod-end oil directly fills Cylinder 2's cap end volume

129. A hydraulic crane's outrigger cylinder has been replaced. After the replacement, the outrigger extends fully but will not retract when the retract function is activated. The directional valve shifts to the retract position and oil pressure is present at the cylinder's rod-end port. What is preventing the retraction?

A. The replacement cylinder was installed with the port connections reversed — the retract pressure enters the cap end (extend side) instead of the rod end and the hydraulic force holds the cylinder extended during the retract command

B. The replacement cylinder has a different stroke length than the original and the fully extended piston has reached a position beyond the port's internal flow path preventing oil from entering the rod end for the retraction stroke

C. The counterbalance valve on the outrigger circuit requires pilot pressure from the retract side to open and the replacement cylinder's different bore size changes the pilot pressure ratio preventing the counterbalance from opening

D. The replacement cylinder may have the ports reversed, a seized piston from shipping damage, or a different stroke that positions the piston beyond the internal port — the specific cause requires inspection of the installation

130. A hydraulic system's pump produces a high-pitched whining noise during operation. The noise increases with pump RPM. The system functions correctly and produces adequate pressure and flow. What is the most common cause of this noise?

A. The pump's internal relief valve is chattering at a frequency proportional to pump speed — the valve oscillates between open and closed as the pump output fluctuates around the relief valve's cracking pressure threshold

B. The pump's inlet line has a partial restriction from a kinked hose, clogged strainer, or undersized fitting that limits the oil supply — the pump cavitates at the restricted inlet creating the whining noise proportional to speed

C. The pump's internal gear mesh has worn and the gear teeth produce more noise at the mesh frequency as the worn profiles create a less-smooth engagement pattern during each gear revolution at the pump's operating speed

D. The pump's inlet suction is restricted from a plugged strainer, kinked hose, or high-viscosity fluid that prevents adequate oil from reaching the pump — the cavitation from the restricted inlet creates the speed-proportional whine

131. A truck-mounted hydraulic crane has been load-tested and passes at 100% of its rated capacity. During actual operations, the crane's LMI (load moment indicator) reads 85% while lifting a load that was weighed at 80% of the chart's rated capacity at that radius. What does the 5% discrepancy between the actual load percentage and the LMI reading indicate?

A. The LMI includes the weight of the rigging hardware (slings, shackles, spreader bar) and the hook block in its calculation — these items add weight above the bare load creating the 5% difference between the load weight and the LMI reading

B. The boom angle sensor has a calibration drift that causes the LMI to calculate a shorter radius than actual — the shorter calculated radius corresponds to a higher capacity on the load chart making the percentage appear higher

C. The LMI pressure transducer reads the total hydraulic force in the lift circuit which includes the boom's own weight plus the load — the boom weight adds to the load percentage that the transducer-based LMI calculates

D. The LMI system is designed with a 5% safety margin built into its readings — the system intentionally reads 5% higher than the actual load percentage to provide an early warning before the crane reaches its true rated capacity

132. A battery-electric truck's range has decreased by 30% during winter operation compared to summer operation. The battery SOH has not changed between seasons. What factors contribute to the winter range reduction?

A. The battery cells' internal resistance increases in cold temperatures reducing the energy available for propulsion, and the cabin heater draws significant electrical energy from the battery that would otherwise be used for driving

B. The regenerative braking system is disabled during winter because the cold battery cannot accept the charging current from regenerative braking and all braking energy is wasted as heat through the friction brakes

C. The battery's chemical reactions slow in cold temperatures reducing the available energy, the cabin heater draws significant power, the tire rolling resistance increases in cold weather, and the denser cold air increases aerodynamic drag

D. The electric motor's efficiency decreases in cold temperatures because the motor windings' resistance increases with cold reducing the current flow and the reduced current limits the motor's power output during winter driving

133. A hybrid truck's high-voltage battery pack has been flagged by the BMS for a cell balancing event. The BMS reports that the maximum cell voltage difference across the pack is 150 mV. What does the cell balancing process accomplish?

A. The balancing process discharges the higher-voltage cells to match the lowest cell's voltage — this ensures all cells operate at the same voltage level which prevents the strongest cells from overcharging the weakest cells during charging

B. The balancing process equalizes the voltage across all cells in the pack by either discharging the high cells or charging the low cells to bring all cells to the same voltage — this maximizes the pack's usable capacity and prevents cell damage

C. The balancing process only monitors the cell voltages and alerts the BMS when the imbalance exceeds the threshold — the actual voltage equalization occurs naturally through the cells' self-discharge characteristics over time

D. The balancing process charges the low cells to match the highest cell's voltage using a dedicated balancing charger circuit — this raises all cells to the maximum level maximizing the pack's total energy storage capacity

134. A battery-electric truck equipped with DC fast charging has a complaint that the charging speed has decreased significantly — the truck now charges at 50 kW instead of the original 150 kW on the same DC fast charger. The battery SOH is at 85%. What is the most probable cause?

A. The battery's internal resistance has increased from aging and the BMS limits the charging current to prevent excessive heat generation from the I^2R losses at the higher resistance — the reduced current directly reduces the charging power

B. The DC fast charger has reduced its output capacity from internal component wear and the charger can no longer deliver 150 kW to this specific vehicle even though it may still deliver full power to newer vehicles with lower resistance batteries

C. The battery's thermal management system has a reduced cooling capacity from coolant degradation and the BMS limits the charging current to prevent the cells from overheating during the fast charging process under reduced cooling

D. The BMS has reduced the maximum charging current to protect the aging battery cells — at 85% SOH the cells' increased internal resistance generates more heat during fast charging and the BMS limits current to prevent thermal damage

135. A parallel hybrid truck has an electric motor that provides torque assist during acceleration. The motor is rated at 50 kW continuous and 80 kW peak for 30 seconds. During a chassis dynamometer test, the motor provides 80 kW for 30 seconds and then drops to 50 kW. After 10 minutes at 50 kW, the motor output drops to 35 kW. What is limiting the motor to 35 kW after sustained operation?

A. The motor's thermal management system cannot reject the sustained heat generated at 50 kW continuous operation and the motor controller reduces the output to prevent the motor windings from exceeding their thermal limit

B. The battery SOC has dropped during the 10-minute sustained assist period and the BMS is limiting the discharge current to protect the battery cells from over-discharge — the reduced current limits the motor's power output to 35 kW

C. The inverter's power transistors have reached their thermal limit after 10 minutes of 50 kW continuous operation and the inverter controller reduces the output current to prevent thermal damage to the switching devices

D. The motor's permanent magnets have temporarily demagnetized from the sustained heat of 10 minutes of continuous operation and the reduced magnetic field limits the motor's torque output until the magnets cool and recover

Practice Exam 14: Answer Key and Explanations

1. C — Compressed air propels glass fragments at high velocity from the vent outlets into the cab interior. The fragments become dangerous projectiles that can cause eye injuries, cuts, and lacerations to the technician or anyone near the open cab. Glass debris in HVAC ductwork should be removed by careful vacuuming or manual extraction, not compressed air.
2. A — Before working independently on brake systems, an apprentice must demonstrate knowledge of WHMIS requirements, the specific hazards of brake dust (potential carcinogen) and cleaning solvents, the correct PPE for brake work, and the proper procedures under direct supervision. This ensures the apprentice can work safely before being given independent tasks.
3. D — Propane is heavier than air and settles to floor level where ignition sources (pilot lights, electrical panels, running engines) may be present. Moving the tanker outside immediately eliminates the leak source from the enclosed shop. The tanker's engine must not be started because the starter motor could ignite the accumulated propane vapour near the rear valve assembly.
4. B — Both the fuel line (300 mm away) and the air brake line (500 mm away) must be protected with fire-resistant blankets or heat shields during welding. Welding heat, sparks, and spatter can damage either line at these distances. Fire extinguishing equipment must be staged and a fire watch maintained during and for 30 minutes after the welding operation.
5. A — Diesel fuel spills must be immediately contained with absorbent material to prevent the fuel from reaching floor drains. The contaminated absorbent must be collected and disposed of according to the shop's waste management procedures — not placed in regular waste bins. Even small spills create slip hazards and environmental contamination if they reach the drainage system.
6. C — A cracked grinding wheel can explode during use — the centrifugal force of the spinning wheel opens the crack and the wheel disintegrates, sending fragments at extremely high velocity. Grinding wheel failures can cause severe injuries or death. The grinder must be locked out immediately and the cracked wheel replaced before the grinder is used again.
7. D — Exhaust components near the turbocharger outlet can exceed 500°C during engine operation and retain significant heat for an extended period after shutdown. Brief contact with surfaces at these temperatures causes severe burns through any standard glove material. Adequate cooling time must be allowed before working on these components.

8. B — Daily toolbox talks serve multiple safety purposes: they reinforce safety awareness among all technicians, communicate specific hazards related to the day's planned work, remind the team of procedures for high-risk tasks, and provide an open forum for technicians to discuss safety concerns or near-miss incidents before work begins.

9. A — Excessive crankcase pressure at 8 kPa versus the 3 kPa specification indicates more combustion gases are entering the crankcase than the ventilation system can evacuate. The primary source of blow-by is worn piston rings, cylinder liners, or valve guides that allow combustion pressure to leak past the sealing surfaces into the crankcase.

10. C — Two specific cylinders contributing significantly less than others at idle with stable rail pressure points to those injectors. Excessive return flow from the injectors on cylinders 1 and 4 leaks fuel back to the return circuit. At idle's low fuel demand, the return leak represents a larger percentage of the total delivery, causing the misfiring that resolves at higher RPM.

11. D — Silicon is the primary component of dirt and dust. A progressive increase in silicon over consecutive oil samples indicates a deteriorating air intake system — a torn filter element, loose hose clamp, cracked intake tube, or improperly sealed filter housing is allowing unfiltered air to enter the engine and the abrasive dirt particles are entering the oil.

12. B — A sudden change in exhaust note without power loss or fault codes most commonly indicates a change in the exhaust flow path. An exhaust leak, broken internal muffler baffle, loose heat shield, or damaged resonator changes the exhaust gas flow pattern or creates a resonance that alters the perceived exhaust sound character.

13. A — The thermostat opens at 85°C (correct specification) but its slow response creates overshoot in both directions. The sluggish valve opens too slowly allowing the temperature to rise to 92°C before adequate flow begins, then over-cools to 78°C before the closing response catches up. A healthy thermostat modulates smoothly without these wide temperature swings.

14. C — An RPM-proportional whistling noise that becomes audible above 1,200 RPM is the classic symptom of a boost pressure leak. Pressurized air escaping through a small gap at a hose connection, charge air cooler fitting, or intake manifold gasket creates the whistle. The noise intensity increases with RPM because boost pressure increases with engine speed.

15. D — The EGR valve moves freely through its full range (eliminating the valve as the restriction) but the system delivers insufficient flow. The entire EGR flow path must be investigated — the cooler for soot blockage, the connecting pipes for restrictions, the gaskets for partial blockage, and the pressure differential between the exhaust and intake sides for adequacy.

16. B — Common rail fuel systems operate at up to 2,000 bar (29,000 PSI). Fuel at this pressure can penetrate skin and cause serious injury or death. Before loosening any high-pressure connection, the rail pressure must be relieved following the manufacturer's specific procedure — typically by running the engine and cutting the fuel supply or using the scan tool's pressure relief function.

17. A — Increased regeneration frequency from every 400 km to every 100 km without a change in driving pattern indicates the engine is producing more soot per kilometre. The technician should check the injectors for worn spray patterns, boost pressure for under-delivery, EGR function for over-recirculation, and the air intake for restrictions that reduce combustion air.

18. C — The variable thermostat strategy optimizes the engine for different operating conditions. During light load, lower coolant temperature reduces NO_x formation (cooler combustion). During heavy load, higher temperature improves thermal efficiency and promotes more complete combustion that reduces particulate emissions. The dual strategy addresses both emission types.

19. D — DEF at the standard 32.5% urea concentration freezes at approximately -11°C. This specific concentration was chosen because it provides the lowest freezing point of any urea-water ratio — both higher and lower concentrations freeze at warmer temperatures. The 32.5% formulation is the eutectic point of the urea-water system.

20. B — Both the radial play and axial play measurements fall within the OEM specification range of 0.025 to 0.076 mm. The barely perceptible radial play and the 0.05 mm axial play confirm the bearings have adequate clearance for the hydrodynamic oil film that supports the shaft at operating speed. The turbocharger can be returned to service.

21. A — All cylinders showing a uniform 50°C elevation with normal power and fuel consumption indicates the engine converts the same fuel energy to mechanical work but more thermal energy exits through the exhaust. Slightly retarded injection timing on all cylinders produces this pattern — the late burn generates equal power but more exhaust heat from the reduced thermal efficiency.

22. C — B20 biodiesel has solvent properties that gradually dissolve accumulated fuel system deposits from tank walls, fuel lines, and fittings. After a year of operation, the loosened deposits are now circulating through the system. The fuel filter captures these deposits, and the sudden influx of loosened material from years of accumulation plugs the filter prematurely.

23. D — The secondary element should be inspected but not automatically replaced at every primary change. The secondary serves as a safety backup that protects the engine if the primary element fails or is damaged during removal. It should be replaced only if it is damaged, shows visible contamination, or has reached the manufacturer's specified replacement interval.

24. B — A recently overhauled engine produces more blow-by during the ring seating period because the new rings have not yet conformed to the cylinder bore surface. The elevated blow-by carries more oil vapour to the CCV outlet than a fully broken-in engine. This condition is normal and will decrease progressively as the rings seat during the first 5,000 to 10,000 km.

25. A — Common rail fuel systems inherently have pressure oscillations from the high-pressure pump's piston compression cycles and the rapid opening and closing of the injectors. A 50-bar variation (± 25 bar) around the 1,800 bar commanded pressure is within the normal regulation range for a healthy common rail system during steady-state operation.

26. C — The ECM commands minimum fan speed but the fan runs at maximum. The scan tool confirms the ECM's command is correct, so the problem is between the ECM and the fan clutch. The fan clutch solenoid valve (or equivalent control device) is stuck in the maximum-engagement position from contamination, corrosion, or mechanical failure and cannot respond to the reduced command.

27. B — Before cleaning, the restricted EGR system flowed less than the ECM commanded. The ECM's adaptive learning compensated by commanding a larger valve opening to achieve the desired flow through the restricted system. After cleaning, the system flows freely but the ECM still commands the pre-cleaning (reduced) flow rate until the adaptive values are reset or relearned.

28. D — The replacement oil cooler may be an incorrect part number with insufficient heat exchange capacity for this engine. Different engine models and configurations require coolers with different plate counts, flow areas, and heat rejection ratings. The 15°C temperature elevation above the fleet average indicates the replacement cooler cannot reject adequate heat.

29. B — The cold air intake increases the air density entering the engine, which allows more fuel to be burned per cycle. The additional power from the denser air charge increases the peak cylinder pressure beyond what the engine's pistons, connecting rods, head bolts, and crankshaft bearings were designed to withstand. The increased fatigue loading accelerates component failure.

30. A — The elevated compressor discharge temperature of 230°C (above the 200°C specification) carries significantly more water vapour into the air system. The air dryer's desiccant was designed for the heat load at 200°C. The additional moisture from the 230°C discharge overwhelms the desiccant's absorption capacity, allowing excess water to pass into the downstream tanks.

31. C — The 0.5-second difference means the front brakes apply at full force before the rear brakes reach full pressure. During this delay, the front axle provides all the braking force, creating excessive front brake wear and reduced vehicle stability. The delayed rear response also extends the total stopping distance because the rear brakes are not contributing during the critical initial application.

32. D — All mechanical adjustments are equal and the air pressure delivered is the same. The remaining variable is the friction material itself. Brake linings from different manufacturers, material batches, or compound specifications produce different friction coefficients. A higher-friction lining on the grabbing axle produces more braking force per unit of application pressure than the other axle.

33. B — While the test result technically passes at 25 kPa per minute (below the 28 kPa limit), the rate is near the failing threshold. A system approaching the specification limit has multiple small leaks throughout the brake system that collectively degrade performance. Proactive investigation and repair of these leaks prevents the system from failing the next test.

34. A — Pushing the caliper piston fully into the bore moved it away from the rotor surface. The first pedal application moves the piston slightly toward the rotor, the second moves it further, and the third brings it to the operating clearance where the pad contacts the rotor. The technician should have pumped the brake pedal before the road test to establish the correct running clearance.

35. C — The spring brake must be fully caged before the chamber is removed from the vehicle. An uncaged spring brake chamber contains approximately 1,200 kg (2,700 lbs) of stored spring force. Removing the mounting hardware from an uncaged chamber allows the spring to release its stored energy violently, which can cause severe injury or death to anyone near the chamber.

36. B — The foot valve's delivery ports have a restriction from contamination that limits the air flow rate through the valve to the relay valves. The restricted flow requires more pedal force to push the air through the narrowed passages. The restriction slows the pressure delivery to the relay valves, and the driver compensates by pressing harder on the pedal.

37. D — The sensor has been replaced and the air gap verified, but the erratic code returns within 100 km. The sensor and tone ring are confirmed good. The wiring harness from the sensor connector to the ABS module is the remaining component — chafing, pinching, or connector damage creates intermittent signal disruptions during the vibration and movement of normal driving.

38. A — The automatic slack adjuster is designed to take up any clearance that exceeds the designed running gap between the linings and drum. The initial 5 mm decrease over the first 10 applications indicates the adjuster is functioning correctly — it is reducing the lining-to-drum clearance to the designed running specification.

39. C — The brake release is controlled by the exhaust ports on the relay valves and quick-release valves. The 3-second release time (versus normal 0.5 seconds) indicates the exhaust ports are restricted from contamination, corrosion, or debris. The restricted exhaust holds residual pressure in the chambers longer than designed, creating the slow brake release.

40. B — The spring brake chambers' service diaphragms were pressed against the chamber housing walls during the parked period by the applied spring force. When the supply air suddenly pressurized the chamber to release the parking brake, the diaphragm separated from the wall with a sudden pop — similar to a suction cup releasing. This is a normal sound during release.

41. D — A single-piston floating caliper relies on the slide pins to allow the caliper body to float freely. When the slide pins are seized or corroded, the piston pushes the inboard pad against the rotor but the caliper cannot slide to pull the outboard pad into contact. The inboard pad does all the braking work and wears faster than the outboard pad.

42. A — After the governor signals the compressor to unload, the compressor's unloading mechanism takes a brief period to fully transition. During this transition, the compressor produces a small amount of pressurized air that enters the system. The 15 kPa rise over 2 minutes represents this residual output during the unloading transition — a normal operating characteristic.

43. C — Heat checking (a network of fine surface cracks from thermal fatigue) indicates the drum has experienced repeated thermal cycles that have fatigued the cast iron at the surface level. The cracks will propagate deeper under continued braking loads, and the thermally weakened drum risks fracture during a heavy brake application. The drum should be replaced.

44. D — The replacement desiccant cartridge was stored improperly — with the packaging opened or the lid removed — before installation. The exposed desiccant absorbed moisture from the ambient air during storage. When installed, the pre-saturated desiccant cannot absorb moisture from the compressed air because it has already reached its absorption capacity.

45. B — The ESC system requires the steering angle sensor to determine the driver's intended direction of travel. By comparing the steering angle input (what the driver wants) to the actual yaw rate (what the vehicle is doing), the ESC detects oversteer or understeer. Without the steering angle data, the ESC cannot determine the intended path and cannot apply corrective braking.

46. A — A brake drum measured at exactly the discard diameter has reached its maximum allowable dimension. Any additional wear during continued service will exceed the discard limit. The discard diameter represents the point at which the drum must be replaced — a drum at exactly this measurement must be removed from service and replaced before further operation.

47. C — The scan tool communicates with the engine ECM but cannot connect to the transmission module. The engine runs normally (ECM functions) but the transmission does not shift (TCM offline). The most likely cause is that the TCM has lost its power supply or ground connection — without basic power, the module cannot communicate on the CAN bus or control the transmission.

48. B — The batteries pass load tests, the alternator produces full output, and the cables are good — the charging system replenishes the batteries during driving. The batteries discharge overnight despite the disconnect being off. A parasitic drain exceeding the specification during the key-off period depletes the batteries faster than the next day's driving can fully recharge them.

49. D — FMI 18 (sub-component calibration) indicates the NOx sensor's internal calibration data does not match the ECM's expected parameters. The sensor may be the wrong part number with different calibration coefficients, or the ECM's sensor calibration parameters need to be updated to match the installed sensor's specification for proper signal interpretation.

50. B — Both headlamps are the same part number but produce different colour temperatures. LED manufacturing processes produce slight variations in the phosphor coating thickness between batches. Different phosphor thicknesses produce different colour temperatures (warmer or cooler white) even within the same part number specification.

51. C — FMI 10 (abnormal rate of change) triggers when the sensor signal changes faster than the ECM's threshold allows. The APPS signal wire has an intermittent connection at a connector that creates momentary voltage dropouts during driving vibration. The sudden voltage drop from the intermittent contact exceeds the ECM's rate-of-change detection threshold.

52. B — Two 120-ohm resistors in parallel should read 60 ohms. A reading of 40 ohms means a third parallel resistance path exists. An aftermarket module (telematics unit, GPS tracker, or other device) has been connected to the CAN bus with its own internal 120-ohm terminating resistor, creating a three-resistor parallel combination that reads 40 ohms.

53. D — The marker lamps turn on and off randomly while all other lamps from the same switch work correctly. The body controller's marker lamp output driver has an intermittent thermal fault — the driver semiconductor overheats during operation, shuts down to protect itself, then re-enables when it cools. The thermal cycling produces the random on-off pattern during continuous nighttime operation.

54. A — The scan tool communicates with the ECM (processor has power) and the ECM commands injection (processor functions correctly). But no exhaust smoke appears during cranking (no fuel is burning). The ECM's output driver power supply circuit has lost voltage — the processor works but the driver stage cannot energize the injector solenoids without its separate power feed.

55. A — At engine idle (650 RPM), the alternator shaft speed — determined by the pulley ratio — may not reach the minimum RPM needed for the alternator to generate adequate output for charging. The alternator can produce full output at higher engine RPM where the shaft speed exceeds the minimum threshold, but idle RPM is insufficient for proper regulation.

56. C — MAP sensors measure absolute pressure referenced to a perfect vacuum (0 kPa absolute). Standard atmospheric pressure at sea level is approximately 101 kPa absolute. With the engine off and the intake open to atmosphere, the MAP sensor correctly reads 101 kPa — confirming the sensor is functioning and reading atmospheric pressure accurately.

57. B — During DPF regeneration, the soot inside the filter burns at temperatures that can exceed 600°C. The exhaust gas temperature downstream of the DPF can momentarily exceed the EGT sensor's normal measurement range during this combustion event. The FMI 0 code is expected during or immediately after a regeneration event when the temperature briefly exceeds the sensor's range.

58. D — The pump runs (confirming the motor and switch circuit work) but no fluid reaches the nozzles despite a full reservoir. The fluid path from the pump to the nozzles has an interruption — a disconnected hose, a kink that blocks flow, a frozen section at a high point, or a split in the line that vents the pressurized fluid before it reaches the spray nozzles.

59. C — The scan tool shows the right rear door ajar switch reading "open" with the door closed. The switch or its wiring has a fault that holds the circuit in the "door open" state permanently. The body controller responds correctly to the signal by keeping the courtesy lamp illuminated because it believes the door is open based on the stuck switch signal.

60. A — The battery disconnect switch is in the off position but 150 mA still drains from the batteries. A circuit wired directly to the battery terminals upstream of the disconnect switch bypasses the switch entirely. Common culprits include aftermarket accessories, clock circuits, memory keep-alive circuits, or alarm systems connected directly to the battery.

61. B — The ECM commands the fan on through a PWM signal that should cycle between 12V and ground. A continuous 12V signal without PWM cycling means the ECM's output driver cannot pull the signal to ground. The solenoid's supply voltage pulls up through the coil winding appearing as 12V at the pin — the open driver cannot create the ground-switching needed for PWM.

62. D — The trailer ABS functions correctly during controlled tests (confirming the system works) but the lamp illuminates intermittently during normal driving. The tractor-to-trailer electrical connection has an intermittent contact on the ABS power or communication circuit that degrades during driving vibration, causing the trailer ABS module to lose power or communication momentarily.

63. A — FMI 4 (voltage below normal) on a 5-volt reference sensor means the signal voltage is below the ECM's minimum expected range. A short to ground on the signal wire pulls the voltage down toward 0 volts. The ECM reads the abnormally low voltage and sets the fault because the reading is below the sensor's designed minimum output for any physical position.

64. C — The remanufactured cluster requires programming with the vehicle's specific fuel tank size and sender resistance range. Without this configuration data, the cluster's fuel gauge driver cannot properly interpret the sender's resistance signal. The other gauges work because they receive data through the CAN bus, but the fuel gauge requires direct sender-to-cluster calibration.

65. B — The replacement starter has a different gear ratio (pinion tooth count relative to the ring gear) than the original specification. The different ratio cranks the engine at a higher RPM than designed. While faster cranking may seem beneficial, an incorrect ratio creates excessive wear on the ring gear and may affect the ECM's cranking fuel strategy.

66. D — The DEF temperature sensor has failed and produces a fixed output that the ECM interprets as -5°C regardless of the actual fluid temperature. The ambient temperature is 25°C and the tank feels warm — the actual DEF temperature is clearly not -5°C . The sensor's fixed false reading does not reflect reality and the sensor must be replaced.

67. A — The fusible link blows immediately upon connection, indicating a dead short exists on one of the circuits downstream of the link. To isolate the shorted circuit, the technician must disconnect all circuits fed through the fusible link and reconnect them one at a time while monitoring for the short. The specific circuit that blows the link contains the fault.

68. C — An improperly connected aftermarket CAN bus module can degrade communication quality across the entire J1939 network. Incorrect wiring, missing or extra termination, or inadequate signal integrity from the telematics connection can load the bus, reflect signals, or introduce noise that causes intermittent communication errors triggering the engine fault codes.

69. D — Gear noise in all forward gears that disappears when the clutch is disengaged points to the countershaft — the only component loaded in all forward gears but unloaded when the clutch disengages. In direct drive (if equipped), the countershaft is unloaded. The noise disappears with the clutch disengaged because the countershaft stops carrying load without input torque.

70. B — A torque converter lockup clutch that shudders during engagement has worn or contaminated friction material. The degraded friction surface cannot transition smoothly from the slipping engagement phase to the fully locked condition. The alternating grab-slip pattern during the transition produces the driveline shudder that the driver perceives at highway speed.

71. A — The noise changes pitch with vehicle speed but not with engine RPM changes in the same gear. The drive axle components rotate at a speed proportional to vehicle speed — changing engine RPM in the same gear changes the engine and transmission speeds but not the axle speed. The speed-dependent, RPM-independent noise confirms the source is in the drive axle.

72. C — A rhythmic vibration in all gears at all speeds, proportional to engine RPM, that disappears with the clutch disengaged isolates the source to the rotating assembly between the engine and transmission. A new clutch disc with a manufacturing imbalance, missing balance weight, or assembly error produces a once-per-revolution vibration at engine speed through the drivetrain.

73. D — A click once per wheel revolution during both acceleration and coast indicates a physical defect on the ring gear. A chipped or damaged tooth produces the click at the same rotational position regardless of load direction because the damage exists on the tooth itself. The click occurs each time the damaged tooth meshes with the pinion during each ring gear revolution.

74. A — The shift quality changed after the fluid service — the same transmission with different fluid feels different. Transmission fluid friction characteristics directly affect the clutch engagement behavior during each shift event. If the new fluid has different friction modifier properties than the previous fluid, the clutch engagement feel changes throughout all shift ranges.

75. D — The AMT reports excessive engagement force specifically in 5th gear while all other gears engage normally. Either the 5th gear synchronizer has worn (requiring more force to match speeds) or the shift fork is bent (creating mechanical interference). Both conditions independently increase the engagement force and both must be inspected to identify the actual cause.

76. B — The welded tube splice has created an angular misalignment between the two tube sections. The bend at the weld joint causes the shaft to rotate eccentrically, producing a vibration proportional to driveshaft speed at all vehicle speeds. The shaft must be straightened and dynamically balanced — or preferably replaced with a properly manufactured tube.

77. C — A banging or clunking noise (not the typical chatter of dry clutch discs) indicates a different problem than friction modifier. The spider gear cross shaft has worn its bore in the differential case, creating excessive play. During tight turns, the alternating load direction of differential action causes the loose shaft to impact the worn case bore producing the banging noise.

78. A — The transfer case has a non-synchronized shift mechanism for 2WD-to-4WD engagement. The front axle output shaft must be spinning at the same speed as the rear output before the engagement collar can mesh smoothly. The driver should briefly accelerate to spin the front wheels through the hubs, matching the front output speed to the rear before engaging the shift.

79. D — The transmission consistently skips 9th gear during coastdown. The 9th gear clutch pack or its hydraulic application circuit has a fault that the TCM detects during the shift sequence. The TCM recognizes that 9th gear cannot be applied and commands a skip-shift directly to 8th gear to maintain smooth driveline operation during the coastdown.

80. C — Three pinion seal replacements in one year — each lasting 3 months — indicates a recurring surface defect at the seal contact area. The pinion yoke has scoring, corrosion, or a wear groove from the original seal's service life. Each new seal initially contacts the smooth portion of the yoke but the seal lip wears into the existing defect within 3 months.

81. B — A clutch engagement point near the floor indicates excessive free play in the clutch linkage. The large gap between the release bearing and the pressure plate diaphragm spring fingers means the pedal must travel through most of its range before the bearing contacts the fingers. Only the last portion of the pedal travel produces useful clutch disengagement.

82. C — The engine makes rated power (eliminating the engine as the cause) but the stall speed is 200 RPM above specification. A high stall speed with a good engine indicates the driveline resistance is lower than designed. A slipping clutch pack or band in the transmission reduces the resistance the engine must overcome, allowing the RPM to rise above the specification.

83. A — The front section has a vibration proportional to vehicle speed. The rear section was replaced 1,000 km ago but the centre bearing was not replaced. The centre bearing's rubber mount may have deteriorated or shifted during the rear section replacement, allowing the bearing to move out of position. The shifted bearing changes the front section's alignment creating the vibration.

84. D — Heavy coast-side gear tooth wear with normal drive-side wear indicates the truck spends significant time in engine braking and coast conditions. Extended engine braking during mountain descents and frequent coasting downhill loads the gear teeth on their coast sides more heavily than flat-terrain highway cruise. Mountainous operating routes produce this characteristic wear pattern.

85. B — The compression brake solenoid valves are slow to respond due to contaminated electrical connectors. The increased resistance at the corroded or contaminated connectors delays the magnetic field buildup in the solenoid coils. The delayed magnetic field slows the solenoid valve opening, which delays the oil flow to the slave pistons creating the 1-second activation delay.

86. A — The pump produces correct maximum pressure but reduced flow at idle that recovers at highway RPM. The pump's internal flow control valve is stuck partially closed, restricting the maximum flow output at all pump speeds. At idle, the restricted flow is below specification. At higher RPM, the pump's increased output compensates for the restriction and meets the flow specification.

87. D — Low caster ($+2.0^\circ$ versus the $+3.5^\circ$ to $+5.0^\circ$ specification) reduces the geometric trail — the distance between the steering axis intersection with the road and the tire contact patch centre. Reduced trail decreases the self-centering force that returns the steering to centre after turns and maintains directional stability during highway driving, causing wandering.

88. B — New air springs with different volume-to-pressure characteristics at the set ride height may produce a higher spring rate than the worn springs they replaced. The existing shock absorbers were matched to the old springs' characteristics and cannot properly control the new springs' increased energy. The shock absorbers should be upgraded to match the new spring rate.

89. C — A sidewall bulge near a tread puncture indicates internal structural damage — a separation between the tire's belt layers, body plies, or inner liner that was caused by the nail's impact or the repair process. The structural damage creates a weak point that is susceptible to sudden failure (blowout) under inflation pressure and road loading.

90. A — The inner wheel seal lip must face inward toward the bearing (toward the fluid it retains). A reversed seal lip faces away from the hub oil and cannot retain the lubricant inside the hub cavity. The oil leaks past the incorrectly oriented lip under the internal pressure from hub oil expansion during driving, leading to bearing damage from lubricant loss.

91. D — The ride height is correct and the axles are square to the frame, but the trailer tracks to the right. The air ride suspension's softer spring rate has changed the trailer's dynamic response and may be exposing a pre-existing frame twist that the original leaf springs' higher stiffness compensated for. The stiffer leaf springs held the frame square while the softer air ride reveals the twist.

92. B — The alignment is correct, pressure is correct, and the tread wears evenly across the width — eliminating alignment, inflation, and camber as causes. The truck's specific operating conditions — route profile (city vs highway), speed, braking frequency, road surface type, and load — significantly affect tire wear rates independently of alignment and pressure.

93. D — The fifth wheel passed the tug test and visual inspection, but a rhythmic clicking noise proportional to road speed occurs only with a trailer connected. The trailer's upper coupler plate surface may have wear, debris, or damage that intermittently contacts the fifth wheel plate as the tractor and trailer articulate over road surface variations during driving.

94. A — A new leaf spring typically has a slightly higher arch than a worn spring it replaces — the original spring's arch has decreased from years of cyclic loading. The 20 mm height difference will decrease as the new spring settles under normal loaded operating conditions during the first 5,000 to 10,000 km of service.

95. D — Inner and outer edge wear with a healthy centre tread is the classic pattern of underinflation. The tire pressure is insufficient for the load carried, causing the tread to distort under load and the shoulder edges to carry disproportionate weight. The self-steering axle tires may require a different inflation pressure than the fixed axle tires due to their specific loading.

96. B — Two adjacent wheel nuts loosened while all others remained tight. A localized high spot or debris on the hub pilot surface under the wheel at those two stud positions prevents the wheel from seating flat. The raised area creates a fulcrum point — the wheel rocks on the high spot and the two adjacent nuts lose their clamping force during driving.

97. D — The sheared centre bolt is the primary locating device that positions the spring pack on the axle pad and prevents fore-aft movement. Without the centre bolt, the axle can shift forward during braking and rearward during acceleration. The spring pack may also shift laterally on the axle pad, changing the wheel alignment and creating a tracking error.

98. C — The new king pin bushings were installed but not properly lubricated before assembly. The dry metal-to-metal contact between the king pins and the unlubricated bushings creates friction that the power steering system must overcome during every steering input. Proper lubrication of new bushings during installation is essential for normal steering effort.

99. D — A vibration that appears 5,000 km after a balance indicates the tire's balance has changed. The most common cause is one or more clip-on wheel weights falling off from road debris impact, vibration loosening, or inadequate initial installation. The lost weight creates an imbalance proportional to the weight lost and the wheel's rotational speed.

100. B — The truck leans to the left when loaded but is level when empty. The height control valve should add air to the left spring under load to maintain equal ride height. A restricted supply port, worn internal seal, or faulty valve linkage on the left side limits the air delivery during the loaded condition, preventing the left spring from rising to match the right.

101. C — All other TPMS positions read correctly, and the tire is visually inflated. The TPMS sensor in that specific tire has failed or has a dead battery. Without power, the sensor cannot transmit its pressure data to the receiver module. The system displays 0 kPa as the default for a non-communicating sensor position.

102. A — Zero end play on a traditional adjustable wheel bearing indicates the bearing is too tight — the rollers are preloaded against the races. The specification requires measurable end play (typically 0.001 to 0.005 inches) to allow for thermal expansion during driving. A preloaded bearing generates excessive heat from the tight contact and will fail prematurely.

103. D — A 50 mm flat spot on a steer tire indicates the tire was locked up and skidded on the pavement. The stationary tire's contact patch was abraded by the road surface during the slide, removing rubber and creating the flat spot. The ABS should have prevented lockup — the system may have failed during the braking event allowing the wheel to lock.

104. B — The safety prop is installed, which is correct procedure. However, the hydraulic hissing sound indicates the tilt cylinder may be failing. The technician should stop work, verify the safety prop is fully seated and locked in its support position, and then investigate the hydraulic sound before resuming work. The prop must be confirmed secure before relying on it exclusively.

105. D — The refrigerator draws 6 amps during compressor run time with a 50% duty cycle, averaging 3 amps continuous draw. The dual batteries provide 200 amp-hours total, but only 100 amp-hours are usable before reaching 50% SOC (to protect battery life). At 3 amps average, the 100 usable amp-hours support approximately 33 hours of refrigerator operation.

106. A — At highway speed, the aerodynamic pressure zone on the outside of the glass creates a negative pressure (suction) that pulls the glass away from the window channel seal. This suction force separates the glass from the seal at the weakest point, creating a gap that allows wind noise. The effect increases with vehicle speed as the aerodynamic pressure differential increases.

107. A — The musty odour when the A/C first activates is caused by microbial growth (mould, mildew, bacteria) on the evaporator coil's wet surface. Moisture condensation during A/C operation creates an ideal environment for microbial colonization. The odour diminishes after 5 minutes because the cold evaporator inhibits microbial activity. The coil should be treated with an antimicrobial agent.

108. D — A minor front-end collision can damage cab mounting isolators, bend the radiator support or front cross-member, shift engine or component positions, and misalign body panels. All of these conditions can independently create vibration at highway speed. The collision damage must be assessed across all potentially affected components — not just the visibly damaged bumper and hood.

109. B — The TRU cools adequately when empty but cannot maintain setpoint when loaded. The loaded cargo is blocking the airflow path from the evaporator to the rear doors. Frozen product must be loaded with adequate airflow channels between pallets and between the cargo and the walls to allow the conditioned air to circulate throughout the entire cargo space.

110. D — The forklift tine punctured both the outer skin and inner liner at 600 mm from the floor. Beyond the visible puncture, the structural cross-members, frame rail, brake lines, air lines routed at that height, and the foam core must all be assessed. The tine may have penetrated deep enough to contact structural or brake components, and the breach allows moisture into the foam core.

111. A — The ABS activates too aggressively on wet roads with the sensors and tone rings within specification. The trailer's tire tread depth is the most likely issue — worn tires have reduced traction on wet surfaces. The ABS correctly detects impending lockup at the worn tires' lower traction threshold and modulates the brakes at that reduced limit, producing the weak braking feel.

112. C — A rhythmic vibration during the raise cycle proportional to platform speed indicates a pulsating hydraulic force. Air trapped in the hydraulic cylinder oil compresses and expands during each pump delivery pulse. The compressible air creates a spring effect that oscillates the platform force in rhythm with the pump's delivery pulsation during the raising operation.

113. B — Deck boards that have sagged between cross-members have lost structural integrity. The most common cause in trailer service is moisture absorption that weakens the wood fibre structure. Water-saturated deck boards lose their bending strength and cannot support the designed loads across the cross-member span. The wet boards sag under normal cargo loading.

114. D — Landing gear that becomes progressively more difficult to crank requires investigation of the entire internal mechanism. The gears, shafts, bearings, and pivot points may have corrosion, contamination, lack of lubrication, or mechanical wear that creates the increasing resistance. All internal components must be assessed to identify the specific source of the progressive difficulty.

115. A — Voltage is present at the socket (12.4V confirmed) but the new bulb does not illuminate. The supply circuit is functioning. The most likely remaining cause is an inadequate ground circuit. A voltage drop test on the ground wire under load will reveal if the ground has excessive resistance that prevents current from flowing through the bulb despite adequate supply voltage.

116. C — The brake drum measures 423 mm — 1 mm beyond the 422 mm discard diameter stamped on the drum. The drum has exceeded the maximum allowable dimension. A larger inside diameter means the drum wall is thinner and weaker than the minimum design standard. The drum is a safety violation and must be replaced before the vehicle can continue operating.

117. B — The compressor runs continuously without cycling, the evaporator reaches -5°C , and frost forms on the coil. The component responsible for cycling the compressor off at the frost-prevention threshold has failed. The thermostatic switch or evaporator temperature sensor is stuck in the closed (compressor-on) position and cannot signal the clutch to disengage when the evaporator approaches freezing.

118. D — Bypassing the heater core creates a shorter coolant path. The reduced circuit length allows coolant to circulate faster through the engine, carrying heat away more efficiently per unit of time. The increased circulation rate through the shorter path removes more heat from the engine than the longer path through the heater core, causing the thermostat to regulate at a slightly lower temperature.

119. A — R-1234yf and R-134a are not interchangeable despite similar thermodynamic properties. They have different operating pressures, different compressor oil requirements (R-134a uses PAG, R-1234yf uses specific PAG types), and different system component specifications. Cross-contamination of refrigerants is also a violation of refrigerant management regulations.

120. C — The driver's side produces cold A/C correctly (confirming the refrigerant system functions) but the passenger side produces ambient temperature air. In a dual-zone system, the passenger-side blend door actuator has failed in the full-heat bypass position. All passenger-side air bypasses the evaporator and passes through or around the heater core at ambient temperature.

121. B — The manufacturer's specification for the new compressor's oil charge accounts for the oil that remains distributed throughout the system — in the evaporator, condenser, lines, receiver/dryer, and other components. The specified compressor oil charge adds only the amount needed for the compressor itself, not the entire system's total oil volume.

122. D — A strong sulphur smell from the heater's exhaust with a normal-appearing flame indicates incomplete combustion of the fuel's sulphur content. The fuel metering pump is delivering excess fuel and the rich combustion cannot fully oxidize the sulphur compounds. The unburned sulphur exits the exhaust as hydrogen sulphide producing the characteristic rotten-egg smell.

123. A — The shaft seal should be replaced independently if the compressor model allows field replacement. A leaking shaft seal at 100,000 km is a normal wear item — not an indicator that the entire compressor has reached its end of life. However, the technician must verify that the specific compressor model has a field-replaceable shaft seal before attempting the repair.

124. C — The packer blade cycle time has increased from 8 to 12 seconds — a 50% increase. The oil level is correct and the system pressure is within specification. The directional control valve spool for the packer function has contamination in its bore that restricts flow through the extend direction. The restriction reduces the flow to the cylinder at the correct pressure.

125. B — The dump body raises correctly but drops immediately when the valve goes to neutral. The holding circuit has failed. The pilot-operated check valve has a worn seat that allows reverse flow when the directional valve centres. The load pressure pushes oil backward through the leaking check seat, and the body drops under its own weight.

126. D — The boom telescope cylinder drifts 25 mm over 5 minutes under load with the valve in neutral. The drift can originate from the piston seal (internal bypass), the holding valve (worn seat), or the directional valve (spool clearance leakage). Each must be isolated individually because the symptom is identical regardless of which component is the actual leak source.

127. A — A new filter going into bypass after only 50 hours (versus the 250-hour interval) indicates a contamination event has loaded the filter beyond its capacity. A component failure, seal ingestion, or external contamination entry introduced a large volume of debris into the system that the new filter captured rapidly. The contamination source must be identified and corrected.

128. C — In a series cylinder connection where Cylinder 1's rod end connects to Cylinder 2's cap end, extending Cylinder 1 displaces oil from its rod end into Cylinder 2's cap end. Because the rod-end volume per unit of stroke is less than the cap-end volume (the rod occupies space), Cylinder 2 extends at a slower rate than Cylinder 1.

129. B — The outrigger extends fully but will not retract. Oil pressure is confirmed at the rod-end port. The most common cause is that the replacement cylinder was installed with the port connections reversed. The retract pressure enters the cap end (extending the cylinder further) instead of the rod end, and the hydraulic force holds the cylinder in the extended position.

130. D — A high-pitched whining noise proportional to pump RPM with correct pressure and flow is the classic symptom of inlet cavitation. The pump's inlet suction is restricted from a plugged strainer, kinked hose, or high-viscosity fluid that prevents adequate oil from reaching the pump chambers. The pump creates vacuum pockets that collapse producing the whine.

131. A — The LMI reads 85% while the bare load is 80% of rated capacity. The 5% difference represents the weight of the rigging hardware — slings, shackles, hooks, spreader bars, and the hook block. The LMI calculates the total load moment including all weight suspended from the boom, not just the bare payload. The rigging weight must always be included in lift planning.

132. C — Winter range reduction results from multiple simultaneous factors: cold temperatures increase the battery cells' internal resistance (reducing available energy), the electric cabin heater draws significant power from the battery, cold tires have higher rolling resistance, and the denser cold air increases aerodynamic drag. All four factors contribute to the 30% range reduction.

133. B — Cell balancing equalizes the voltage across all cells in the pack. The process discharges higher-voltage cells or charges lower-voltage cells to bring all cells to the same voltage level. This equalization maximizes the pack's usable capacity (limited by the weakest cell) and prevents individual cells from being over-charged or over-discharged during normal operation.

134. D — At 85% SOH, the battery cells' internal resistance has increased from aging. Higher internal resistance generates more heat during fast charging from I^2R losses. The BMS limits the maximum charging current to prevent the aging cells from overheating during DC fast charging. The reduced current directly reduces the charging power from 150 kW to 50 kW.

135. A — The motor provides 80 kW peak for 30 seconds (within specification) and then drops to 50 kW continuous (within specification). After 10 minutes at 50 kW, the output drops to 35 kW — below the continuous rating. The motor's thermal management system cannot reject the sustained heat and the controller reduces output to prevent the windings from exceeding their thermal limit.