PRACTICE EXAM 7: RED SEAL TRUCK AND TRANSPORT MECHANIC SIMULATION (135 QUESTIONS)

1. A technician is removing a diesel fuel injector that is seized in the cylinder head bore. The technician plans to use a slide hammer to extract the injector. Before attaching the slide hammer, what should the technician verify to prevent engine damage?

A. The engine coolant has been drained to prevent contamination if the injector bore seal is disturbed during extraction

B. The glow plug on the adjacent cylinder has been removed to relieve compression that could resist the extraction force

C. The fuel rail has been depressurized but the injector electrical connector can remain attached during the slide hammer operation

D. The correct slide hammer adapter and extraction procedure are being used to avoid breaking the injector tip off in the bore

2. A shop has recently installed a new above-ground vehicle lift. Before technicians begin using it, what must be completed according to workplace safety standards?

A. The lift must operate for 72 hours under simulated load conditions to verify the hydraulic system and structural components

B. The technicians must be trained on the specific lift model's operation, capacity limits, safety features, and the location of emergency controls

C. The lift manufacturer must send a factory-certified inspector to perform the first ten vehicle lifts and certify the installation site

D. A government safety inspector must personally witness the first vehicle raised on the lift and sign a commissioning certificate

3. A journeyperson technician notices that an apprentice is using a box-end wrench on a hydraulic fitting that requires a flare nut wrench. Why is the correct wrench type important for this fitting?

A. A flare nut wrench contacts more of the fitting's hex surface than a box-end wrench preventing the wrench from rounding the softer brass or aluminium fitting material

B. A box-end wrench provides more torque than a flare nut wrench which would over-torque the fitting and crack the flare seat surface

C. A flare nut wrench has a thinner profile that fits into the recessed area around the fitting where a standard box-end wrench cannot reach the hex flats

D. A box-end wrench must never be used on any hydraulic fitting because the closed end traps air pressure that can blow the fitting off when loosened

4. During a PM inspection, a technician finds that the truck's windshield washer reservoir is empty. The driver states that the washer system has not worked for several weeks. Beyond refilling the reservoir, what should the technician do?

A. Test the washer pump motor by applying direct battery voltage to verify it operates before reassembling the system and refilling the reservoir

B. Replace the washer pump motor since several weeks of dry operation has likely burned out the motor from running without fluid cooling

C. Check the washer pump, hoses, and nozzles for the cause of the malfunction since the system was not working before the reservoir went empty

D. Refill the reservoir and test the system — if it works now the driver simply forgot to refill the fluid and no further diagnosis is necessary

5. A technician is assigned to replace a leaf spring on a loaded trailer that cannot be unloaded at the current location. What is the critical safety concern with this procedure?

A. The trailer must be properly supported with rated jack stands at approved lift points because the loaded trailer's weight creates a crushing hazard if the support fails

B. The leaf spring must be heated with a torch before removal to relieve the internal spring tension that could cause the spring to fly apart during disassembly

C. The replacement spring must be pre-loaded in a spring compressor before installation to match the weight of the cargo already on the trailer during the swap

D. The trailer air bags must be fully inflated to maximum pressure before the leaf spring is removed to ensure the suspension holds the trailer height during the repair

6. A fleet shop has received a shipment of new brake linings from a supplier. Before installing them, what should the technician verify about the linings?

A. The linings have been pre-burnished by the manufacturer so they do not require the standard bedding-in procedure after installation on the vehicle

B. The linings are made from the same friction material compound as the original equipment linings to maintain the vehicle's original braking characteristics

C. The linings have been stored in a climate-controlled environment because exposure to humidity above 60% permanently degrades the friction material bonding

D. The linings are the correct application for the specific vehicle model including the correct dimensions, mounting style, and friction material rating for the axle position

7. A technician is performing a pre-delivery inspection on a new truck before it enters fleet service. The inspection includes verifying all fluid levels, tire pressures, and fastener torques. When checking the wheel nut torque, the technician finds three nuts on one wheel at 480 Nm instead of the specified 610 Nm. What action is required?

A. Document the finding and notify the dealership for warranty claim processing since the truck was delivered with under-torqued wheel nuts from the factory

B. Torque all wheel nuts on all wheels to the correct specification and re-torque after the first 80 to 160 km of driving per the standard wheel installation procedure

C. Torque only the three under-torqued nuts to 610 Nm and verify the remaining nuts on that wheel are at specification without disturbing them unnecessarily

D. Return the truck to the manufacturer because under-torqued wheel nuts on a new vehicle indicate a systemic quality control failure requiring full vehicle reinspection

8. A technician spills a small amount of diesel fuel on their forearm while disconnecting a fuel line. The SDS for diesel fuel lists it as a skin irritant. What is the correct immediate first aid response?

A. Apply a petroleum-based hand cleaner to dissolve the fuel from the skin surface and then wipe the area clean with a disposable shop towel

B. Ignore the exposure since diesel fuel contact is common in the trade and small amounts pose no significant health risk to the technician

C. Wash the affected area immediately with soap and water for several minutes to remove the fuel and reduce the risk of skin irritation or dermatitis

D. Apply a barrier cream to the exposed area to lock in moisture and prevent the diesel fuel from penetrating through the outer layer of the skin surface

9. A heavy-duty diesel engine has been rebuilt and the technician is performing the initial oil prime before the first startup. The technician connects an external oil priming tool to the engine and pressurizes the oil system to 275 kPa. What is the technician verifying during this pre-lubrication procedure?

A. That oil pressure registers on the gauge and oil flows to all lubrication points — main bearings, rod bearings, camshaft bearings, turbocharger, and rocker arms — before the engine cranks

B. That the oil pump relief valve opens at the correct pressure setting and bypasses oil back to the sump when the system reaches maximum operating pressure

C. That the oil filter anti-drain-back valve holds pressure and prevents the filter from draining when the priming tool is disconnected from the engine's oil system

D. That the oil cooler core holds pressure and does not leak coolant into the oil circuit during the external pressurization of the lubrication system passages

10. A diesel engine has a persistent misfire on cylinder 6. The injector has been replaced, compression is within specification, and valve lash is correct. The scan tool shows the injector contribution for cylinder 6 is commanding maximum additional fuel but the cylinder is still not contributing equally. What less-common cause should be investigated?

A. The glow plug on cylinder 6 is faulty and cannot preheat the combustion chamber adequately during cold operation causing the persistent misfire condition

B. The fuel return line from injector 6 is restricted creating backpressure on the injector's internal return circuit that prevents it from delivering its full fuel charge

C. The exhaust valve spring on cylinder 6 has weakened allowing the valve to float at higher RPM and leak compression during the critical combustion pressure rise period

D. The piston cooling nozzle (oil squirt nozzle) for cylinder 6 is misaligned or blocked causing local overheating that alters the combustion chamber geometry and disrupts combustion

11. An oil analysis report shows a sudden spike in tin content that was not present in any previous sample. All other wear metals are within their normal trends. What engine component commonly contains tin that would explain this finding?

A. The piston pin bushing in the small end of the connecting rod because bronze bushings used in this location contain tin as a primary alloying element

B. The camshaft bearing overlays — some bimetallic cam bearings use a tin-based overlay that wears and releases tin particles into the oil as the bearing surface erodes

C. The oil pump driven gear which is manufactured from a tin-bronze alloy that sheds tin particles as the gear teeth wear against the pump housing cavity walls

D. The crankshaft vibration damper's internal viscous fluid contains tin-based compounds that can leak past the damper seals into the crankcase oil when the seal deteriorates

12. A heavy-duty diesel engine's turbocharger oil drain line is partially restricted with carbon buildup. The turbocharger shaft seals appear intact and there are no unusual noises. What will happen if this restriction is not corrected?

A. The turbocharger will overspeed because the restricted drain creates backpressure that forces oil through the turbine seal spinning the shaft faster than the exhaust energy alone

B. The engine oil level will drop rapidly as oil accumulates in the turbocharger centre section and overflows through the compressor seal into the intake manifold permanently

C. The restricted drain causes oil to back up in the bearing housing increasing the pressure on the shaft seals until oil is forced past the seals into both the compressor and turbine housings

D. The turbocharger shaft bearings will overheat immediately because the restricted drain line eliminates all oil flow through the bearing housing cutting off lubrication to the journal bearings

13. A diesel engine equipped with a common rail fuel system produces a high-pitched whine from the high-pressure pump area that increases with engine RPM. The pump is delivering adequate pressure and the engine performs normally. What does this noise likely indicate?

A. Normal operational noise from the high-pressure pump's internal components — common rail pumps generate significant noise as they compress fuel to 1,600 to 2,500 bar at high frequency

B. The pump's internal check valves are chattering from cavitation on the inlet side caused by a restricted fuel filter or a collapsing transfer pump suction line upstream of the pump

C. The pump drive gear has developed a backlash problem that produces a whine as the gear mesh oscillates under the varying load of each compression stroke during high-speed operation

D. The high-pressure pump is producing more pressure than commanded and the fuel rail pressure limiter is continuously bleeding fuel at a rate that produces the audible high-pitched whine sound

14. A heavy-duty diesel engine consumes coolant at a rate of 0.5 litres per week. The oil is clean, there is no white smoke, and no external leaks are visible. A combustion gas test at the surge tank is negative. A UV dye has been added to the coolant. After running the engine for two hours, where should the technician look with the UV lamp?

A. Inside the intake manifold through the throttle body opening for dye traces that would indicate a leaking EGR cooler or intake gasket allowing coolant into the air stream

B. On the underside of the cab floor and around the heater hose connections for dye traces that would indicate a slow seep at the heater core or heater hose fittings hidden from normal view

C. At the exhaust pipe outlet for fluorescent traces in the condensation that would indicate the dye is passing through the combustion chambers even without visible white smoke

D. At every external joint, gasket surface, hose connection, freeze plug, and component on the engine and cooling system for dye traces visible only under UV light that are invisible in normal lighting

15. An engine ECM sets a fault code for the barometric pressure sensor reading implausible. The truck operates at sea level (approximately 101 kPa). The sensor reads 85 kPa. The sensor is integrated into the ECM and cannot be replaced separately. Before condemning the ECM, what should the technician check?

A. The intake manifold pressure sensor for a cross-talk signal that interferes with the barometric sensor's reading through the shared reference voltage supply wire

B. The engine air filter for a severe restriction that creates a negative pressure at the barometric sensor's intake port pulling the reading down from the actual atmospheric pressure

C. The barometric pressure sensor port on the ECM housing for blockage, a kinked reference hose, or a disconnected vent tube that prevents the sensor from reading true atmospheric pressure

D. The altitude compensation table in the ECM calibration for an incorrect map data file that assigns a different elevation to the vehicle's current GPS location causing a false reading comparison

16. A diesel engine has a fault code for the crankcase ventilation system pressure above threshold. The CCV filter has been replaced and the crankcase pressure is confirmed normal when measured at the oil fill cap with a manometer. What should the technician check next?

A. The DPF for excessive soot loading that creates exhaust backpressure which the ECM interprets as elevated crankcase pressure through a shared pressure sensing circuit

B. The CCV system pressure sensor and its connecting hose for a restriction, pinch, moisture accumulation, or sensor failure that produces an inaccurate reading despite normal actual pressure

C. The turbocharger compressor seal for a leak that allows pressurized boost air to enter the crankcase through the turbocharger oil drain line elevating the crankcase pressure intermittently

D. The valve cover gaskets for a leak that allows crankcase gases to escape before reaching the CCV sensor location creating a pressure differential that the sensor reads as elevated pressure

17. A heavy-duty diesel engine's water pump weep hole is dripping coolant. The leak is slow — approximately one drop every 30 seconds. What does this weep hole drip indicate?

A. The water pump shaft seal has begun to fail and coolant is leaking past the seal — the pump should be replaced before the leak worsens and causes bearing failure or complete seal blowout

B. The weep hole is functioning as designed by allowing excess pressure from the cooling system to vent through the pump housing preventing the pump seal from being overpressured

C. The coolant level is overfilled and the excess coolant is being expelled through the weep hole which acts as a pressure relief for the pump's internal cavity during thermal expansion events

D. The pump bearing has begun to fail and the heat generated by the failing bearing is causing the shaft seal to degrade which allows coolant to seep through the weep hole drain path

18. A truck's aftertreatment system has a fault code for the DOC inlet exhaust gas temperature sensor reading lower than the DOC outlet sensor during normal cruise operation (no regeneration active). Normally, the inlet should read equal to or slightly higher than the outlet. What does this reversed reading pattern indicate?

A. The DOC outlet sensor has drifted high from calibration error and is reading above the actual temperature creating the appearance of a reversed temperature relationship across the catalyst

B. The exhaust system has a leak between the turbocharger and the DOC inlet that introduces cool ambient air at the inlet sensor location pulling the reading below the outlet sensor's undisturbed position

C. The DOC catalyst is performing an exothermic reaction on unburned hydrocarbons from incomplete combustion producing heat that raises the outlet temperature above the inlet during normal cruise

D. An active exothermic reaction in the DOC from a fuel system leak or incomplete combustion is raising the outlet temperature above the inlet — unburned hydrocarbons are oxidizing in the DOC and generating heat

19. A common rail diesel engine has been diagnosed with low rail pressure caused by excessive injector return flow. The technician measures individual injector return flow rates and finds that injector number 4 returns 120 ml/min at idle while all others return 30 to 40 ml/min. What does this confirm?

A. The fuel rail pressure relief valve is leaking internally and routing pressure through injector number 4's return passage back to the tank at an elevated flow rate

B. The high-pressure fuel pump has a worn delivery valve on the number 4 cylinder that allows pressurized fuel to escape the pump and appear as return flow at that injector position

C. Injector number 4 has excessive internal leakage — the fuel is bypassing the injector's internal components and flowing through the return circuit rather than being injected into the cylinder

D. The fuel metering unit is over-supplying the high-pressure pump on the number 4 compression stroke creating excess pressure that relieves through that injector's return passage

20. A heavy-duty diesel engine equipped with an exhaust throttle (butterfly valve) for exhaust braking also uses the exhaust throttle during DPF regeneration. During a regeneration event, the ECM partially closes the exhaust throttle. What is the purpose of partially closing the exhaust throttle during regeneration?

A. To reduce the exhaust gas flow rate through the DPF allowing the soot to have more contact time with the high-temperature gas for more complete oxidation during the burn event

B. To create exhaust backpressure that increases the work the engine must perform against the restricted exhaust which raises the exhaust gas temperature to support the DPF regeneration process

C. To redirect a portion of the exhaust gas through the EGR circuit and into the intake manifold reducing the oxygen concentration and creating a fuel-rich exhaust for DPF soot oxidation

D. To prevent the regeneration heat from escaping too quickly through the tailpipe which would cool the DPF substrate before the soot has fully oxidized across the entire filter face area

21. A technician is replacing the turbocharger on a heavy-duty diesel engine. Before installing the new turbocharger, what preparation step is critical to prevent premature bearing failure on the replacement unit?

A. Pre-fill the turbocharger oil inlet port and centre section with clean engine oil to ensure the bearings are lubricated during the first seconds of engine operation before the oil pump delivers pressure

B. Rotate the turbocharger shaft by hand 50 times to seat the bearing surfaces and distribute the factory-applied assembly lubricant evenly across all journal contact surfaces before installation

C. Connect the oil supply line and crank the engine without starting it for 30 seconds to verify oil flows from the turbocharger oil drain line before allowing combustion to occur and load the bearings

D. Install a new oil filter and change the engine oil before mounting the new turbocharger to ensure no contamination from the failed unit reaches the new unit's bearings through dirty oil supply

22. A diesel engine has a rhythmic exhaust smoke puff that occurs at a consistent frequency regardless of engine RPM or load. One puff occurs approximately every 3 seconds at idle and continues at the same interval at 1,500 RPM. What timing relationship should the technician investigate?

A. The fuel injection timing relative to piston position because a consistent-interval puff indicates one injector is firing at the wrong point in its cylinder's cycle regardless of speed

B. The exhaust valve opening duration on each cylinder because a valve that sticks open longer than designed would produce a smoke puff at a consistent interval tied to that valve's cycle

C. The air compressor's discharge cycle because the compressor's intake stroke draws crankcase oil vapour into the cylinder and discharges it into the air system at a regular interval

D. The camshaft timing — the puff interval corresponds to the camshaft rotational frequency (one revolution every 3 seconds at idle) suggesting one cam lobe is misfiring on every camshaft revolution

23. A diesel engine's cooling system has been flushed and refilled with new extended life coolant (ELC). Within 1,000 km, the coolant has changed from its original red/pink colour to a murky brown. The engine operates at normal temperature and there is no oil in the coolant. What is the most likely cause?

A. The new ELC coolant is chemically incompatible with the residual conventional coolant that was not fully flushed from the system and the additive packages have reacted to produce the colour change

B. The engine's cylinder liner cavitation erosion has released iron particles into the coolant that are reacting with the ELC's organic acid inhibitor package to produce the brown discolouration

C. The cooling system was not thoroughly flushed and residual scale, rust, and old coolant deposits are being dissolved and suspended by the new ELC's more aggressive cleaning properties

D. The ELC coolant brand used is a counterfeit product with an incorrect chemical formulation that breaks down rapidly when exposed to the normal operating temperature of a heavy-duty diesel engine

24. A heavy-duty diesel engine has a slight external oil leak at the rear main seal area. Before replacing the rear main seal, what should the technician verify to determine the actual leak source?

A. The oil pan gasket at the rear for a leak that drips onto the rear main seal area — oil running along the bottom of the pan collects at the lowest point and appears to originate from the seal

B. The rear main seal area leak could also originate from the oil gallery plug, the flywheel housing drain hole, or the oil pan gasket — all of which route leaked oil to the same visible location at the rear of the engine

C. The crankshaft for excessive end play that shifts the crankshaft rearward under load changing the seal-to-crankshaft relationship and allowing oil to bypass the seal lip at certain operating conditions

D. The transmission input shaft seal for a leak that allows transmission fluid to seep forward along the clutch housing and present as an engine oil leak at the rear main seal inspection point

25. A diesel engine equipped with an SCR aftertreatment system has a strong ammonia odour at the tailpipe during normal driving. The DEF dosing rate, DEF quality, and exhaust temperature are all within specification. What component failure would cause ammonia to pass through the SCR catalyst without being consumed?

A. The ammonia slip catalyst (ASC) downstream of the SCR has degraded or been contaminated and can no longer oxidize the excess ammonia that passes through the SCR during normal operation

B. The upstream NOx sensor has failed in the high-reading position causing the ECM to overdose DEF in response to the falsely elevated NOx reading at the SCR inlet position

C. The SCR catalyst substrate has become coated with diesel soot from a failed DPF that is no longer capturing particulate and the soot layer prevents the catalyst from converting the ammonia

D. The DEF injector has developed a drip-after-injection condition that continues to inject small amounts of DEF after the ECM commands the injection to stop creating an overdosing situation

26. A technician is checking a diesel engine's valve timing using the timing marks on the front gear train. The camshaft gear timing mark is one tooth retarded from the crankshaft gear's corresponding mark. What symptoms would this timing error produce?

A. The engine would start and run normally but fuel consumption would increase by approximately 5% due to the slightly retarded valve events reducing the volumetric efficiency

B. The engine would not start because the intake valves would open during the compression stroke allowing all compressed air to escape through the open intake valves

C. The engine would run but piston-to-valve interference would occur within the first few revolutions causing catastrophic damage to the valve train and piston crown components

D. The engine would produce reduced power, altered exhaust emissions, and potentially rough running because the intake and exhaust valve events are shifted from their optimal timing positions

27. A heavy-duty diesel engine's coolant temperature drops 10°C below thermostat regulation temperature during sustained highway driving in winter conditions with a cab heater operating at maximum. What is the most likely cause?

A. The thermostat has failed in the partially open position allowing coolant to continuously flow through the radiator even when the engine is below the thermostat's regulation temperature

B. The water pump impeller has eroded to the point where it cannot maintain adequate coolant circulation speed to balance the heat loss rate through the radiator and heater core combination

C. The cab heater is extracting more heat from the coolant than the engine produces at highway cruise load — the heater's heat rejection combined with the winter ambient airflow overcools the engine

D. The engine's cooling fan clutch has failed in the engaged position and the continuous maximum fan airflow combined with the winter ambient temperature is pulling the engine temperature below specification

28. A technician is diagnosing a diesel engine with a no-start condition. The engine cranks at normal speed, the fuel system primes correctly, and the scan tool shows the ECM is commanding injection. The exhaust produces no smoke during cranking. A cylinder contribution test shows all cylinders at zero contribution. What single test would most efficiently identify the root cause?

A. A fuel rail pressure test during cranking to verify the high-pressure pump is actually building rail pressure to the level required for injector operation despite the ECM's injection command

B. An intake manifold boost pressure test to verify the turbocharger is providing adequate air density for combustion to occur in the cylinders during the cranking event

C. A compression test on all six cylinders to verify the engine has adequate compression across all cylinders to support autoignition of the diesel fuel during the cranking event

D. A glow plug circuit test to verify all glow plugs are functioning because without adequate preheat the diesel fuel cannot reach its autoignition temperature during cranking in any ambient condition

29. A diesel engine equipped with a DPF has completed a successful stationary regeneration. The differential pressure across the DPF dropped from 12 kPa to 3 kPa after the regeneration. However, within 500 km of normal driving, the differential pressure has risen back to 10 kPa. What does this rapid soot accumulation rate indicate?

A. The engine has an underlying condition that is producing excessive soot — such as a failed EGR valve, retarded injection timing, a turbocharger fault, or an air intake restriction

B. The DPF substrate has physically degraded from repeated high-temperature regenerations and can no longer hold the soot uniformly requiring the differential pressure to rise faster than normal

C. The DOC upstream of the DPF has failed and is no longer providing passive oxidation of soot during normal driving which previously helped keep the soot accumulation rate at a manageable level

D. The exhaust gas temperature sensor is reading falsely low causing the ECM to calculate a longer regeneration interval than needed allowing more soot to accumulate between regeneration events

30. A heavy-duty truck's air system has adequate pressure at the gauges but the driver reports that the brakes feel "mushy" and require more pedal effort than normal to achieve the same stopping force. There are no air leaks. What should be checked?

A. The brake shoe-to-drum clearance on all wheels for excessive gap that increases the air volume needed to apply the brakes and creates the mushy pedal sensation

B. The air dryer for moisture contamination that has entered the brake valve bodies and chambers creating internal corrosion that increases friction and reduces brake response quality

C. The governor cut-out pressure setting to verify it meets the OEM specification because a lower-than-normal cut-out reduces the available application pressure during braking events

D. The brake chamber push rod stroke on all wheels because excessive stroke requires more air to fill the additional chamber volume before the linings contact the drums creating the mushy feel

31. A truck's rear brake drums are being replaced with new drums. Before installing the new drums, the technician notices the new drums have a light coating of rust-preventive oil on the friction surface. Should this oil be removed before installation?

A. The oil coating protects the drum during shipping and will burn off naturally during the first few brake applications without affecting the braking performance or lining condition

B. The oil must be cleaned from the friction surface with brake cleaner before installation because oil contamination will reduce braking effectiveness and may permanently contaminate the new linings

C. The oil coating improves the initial bedding-in of new brake linings by reducing the friction during the first 100 km which prevents glazing that would otherwise occur from the aggressive contact

D. The oil is a permanent protective coating applied by the manufacturer that reduces drum corrosion during the drum's service life and should not be removed during the installation procedure

32. A truck's air compressor has been replaced. After installation, the technician starts the engine and the air system builds pressure. However, the air dryer does not purge when the governor signals the compressor to unload. What is the most likely cause?

A. The air line from the governor unloader port to the air dryer purge valve was not reconnected during the compressor installation leaving the dryer without its purge signal connection

B. The new compressor has a different thread size on the discharge port and the adapter used is creating a restriction that prevents adequate purge pressure from reaching the dryer valve

C. The governor is not compatible with the new compressor model and cannot generate the correct unload signal pressure needed to open the dryer's purge valve during the unload cycle

D. The air dryer desiccant cartridge needs to be replaced whenever the compressor is replaced because the old cartridge's purge valve timing is calibrated to the previous compressor's output

33. A tractor-trailer combination has inconsistent braking — sometimes the trailer brakes apply normally and other times they barely apply. The tractor brakes always work correctly. The trailer ABS lamp is off. What should the technician investigate?

A. The trailer relay valve for intermittent sticking that delivers varying pressure to the trailer brake chambers depending on the valve's internal spool position during each brake application

B. The tractor foot valve for an intermittent secondary circuit delivery problem that feeds the trailer service signal inconsistently during brake pedal applications

C. The service (blue) gladhand connection for intermittent sealing that leaks the service signal pressure during some applications but holds it during others depending on the coupling angle

D. The trailer brake chamber diaphragms for intermittent leaks that occur only when the chambers are pressurized to a specific pressure range during moderate brake application force events

34. A heavy-duty truck's front brake rotors are being measured for thickness during a PM inspection. The technician measures the thickness at eight points around the rotor circumference. Four measurements read 32.0 mm and four read 31.0 mm. The minimum thickness specification is 30.5 mm. What does this 1.0 mm variation indicate?

A. Normal manufacturing tolerance that is within the acceptable parallelism specification for heavy-duty brake rotor applications and does not require rotor replacement or machining

B. The rotor has been machined incorrectly at a previous service creating a wavy surface that alternates between the two thickness readings around the circumference of the braking surface

C. The brake caliper mounting bracket has loosened allowing the caliper to shift position and wear the rotor unevenly at four equally-spaced points around the circumference during operation

D. The rotor has excessive thickness variation (parallelism error) that will cause brake pulsation — the rotor must be machined to restore uniform thickness or replaced if machining exceeds the minimum limit

35. A truck driver reports that the parking brake will not hold the vehicle on a steep grade. The air system is at full pressure and the spring brake chambers appear to be in good condition. The service brakes function normally. What should be checked?

A. The brake drums for excessive diameter that has moved the linings too far from the drum surface for the spring brake force to push them into adequate contact for holding force

B. The spring brake pushrod stroke for excessive length — if the stroke exceeds the adjustment limit the spring force cannot push the linings firmly enough against the drum to hold the loaded vehicle on the grade

C. The tractor protection valve for a slow internal leak that gradually bleeds the spring brake supply pressure even with the parking brake valve applied allowing the springs to partially release

D. The parking brake valve for a worn internal seat that does not fully exhaust the spring brake supply air when pulled allowing residual pressure to partially compress the springs and reduce holding force

36. An S-cam brake assembly is being inspected. The technician rotates the S-cam shaft by hand with the automatic slack adjuster disconnected. The cam rotates freely for approximately 30 degrees and then becomes very stiff. What does this stiffness indicate?

A. The S-cam shaft bushings are seized or severely worn — the cam shaft cannot rotate freely in the bushing bore creating excessive friction that the air chamber must overcome during every brake application

B. The brake shoe return springs are too strong and are pulling the shoes against the cam lobes with excessive force that the technician's hand strength cannot overcome past the initial free rotation

C. The brake drum has developed an out-of-round condition that allows the shoes to move freely through part of the rotation but binds against the oval section creating the stiff resistance point

D. The automatic slack adjuster internal mechanism has reached the end of its adjustment range and is mechanically locking the cam shaft at the maximum rotation point preventing further movement

37. A truck equipped with EBS (electronic braking system) has a fault code for the rear axle pressure modulator valve. The service brakes function but the rear brakes apply with more force than expected during light pedal applications. What has likely failed?

A. The rear axle ABS wheel speed sensors have drifted out of calibration causing the EBS to overestimate the wheel speed and command higher-than-requested pressure to the rear axle

B. The rear brake linings have a higher friction coefficient than specification causing the brakes to produce more force than the EBS system is designed to deliver at the commanded pressure level

C. The EBS rear pressure modulator has failed in a mode where it delivers higher pressure than the EBS controller commands instead of modulating proportionally to the controller's output signal

D. The EBS is proportioning brake pressure correctly but the rear axle spring brakes are partially applied due to a supply circuit leak that adds spring force to the service brake force during applications

38. A trailer's air system check valves have been removed for inspection. The technician blows through each valve with compressed air. One valve allows air to pass freely in both directions. What does this indicate?

A. The check valve is the correct type for this application — trailer air system check valves are designed to allow bidirectional flow to equalize pressure between reservoirs during normal operation

B. The check valve is defective and will not prevent air from flowing backward through the system — if air pressure is lost upstream the downstream reservoir will drain through the failed valve

C. The check valve has been installed backward and air flows freely in the direction that should be blocked — reinstalling it in the correct orientation will restore its one-way flow function properly

D. The check valve has been tested correctly and its bidirectional flow proves it is a balanced check valve type that is commonly used in trailer suspension circuits for ride height equalization

39. A truck's brake warning lamp illuminates intermittently during highway driving. The air pressure gauges read normal at all times during the lamp activation events. The lamp is not connected to the ABS system. What circuit activates this warning lamp?

A. The engine ECM activates the brake warning lamp when it detects a fault in the exhaust brake system as an alert that the supplemental braking function may not be available during the next application

B. The low-air-pressure warning switch has an intermittent electrical fault — the switch or its wiring is making and breaking contact without an actual pressure drop triggering the lamp randomly during driving

C. The parking brake valve position switch is making intermittent contact from vibration causing the lamp circuit to momentarily close and illuminate the warning lamp during highway driving conditions

D. The brake fluid level sensor in the hydraulic clutch master cylinder reservoir has triggered because the clutch fluid is low and this sensor shares the brake warning lamp circuit on some vehicle models

40. A loaded truck descending a mountain pass applies the service brakes and the ABS activates on both drive axle wheels. The driver maintains firm pedal pressure and allows the ABS to modulate. After the ABS intervention stops and the vehicle has slowed, the driver notices a burning smell from the drive axle area. What caused the smell?

A. The ABS modulation generated heat from the repeated rapid pressurization and depressurization of the brake chambers and the heated air components produce the burning smell through the exhaust ports

B. The brake lining material overheated during the hard braking event and the friction surface reached a temperature that begins to decompose the organic binding compounds in the lining formulation

C. The ABS modulator valve solenoids overheated from the rapid cycling during the extended ABS event and the heated solenoid insulation produces the burning smell through the modulator housing vents

D. The drive axle differential lubricant overheated because the ABS intervention prevented the wheels from rotating normally and the differential gears churned the oil at an excessive rate during modulation

41. A truck's air system has an automatic moisture ejector (spitter valve) installed on the bottom of the supply (wet) tank. The driver reports that this valve is constantly leaking air. What is the most likely cause?

A. The spitter valve piston seal has worn and cannot close the valve seat after each moisture ejection cycle — the valve remains partially open and continuously leaks a small amount of air from the tank

B. The air system pressure exceeds the spitter valve's design pressure rating and the excess pressure holds the valve open beyond its normal ejection cycle duration allowing continuous air leakage

C. The supply tank is overfilled with water condensate that is holding the spitter valve in the open position preventing it from closing fully between the governor's unload-to-load pressure cycling events

D. The spitter valve is functioning correctly and the continuous air leak is the normal moisture ejection process occurring at a higher-than-expected rate due to excessive compressor oil carry-over

42. A driver reports that the truck's brakes grab aggressively on the front steer axle during light brake applications. The braking is smooth and proportional on the rear drive axle. The front brake adjustment is within specification. What is the most likely cause?

A. The front brake linings have a higher friction coefficient rating than the OEM specification and produce disproportionate braking force at the same application pressure as the rear brakes

B. The front steer axle relay valve has a worn delivery seat that overshoots the commanded pressure during light applications delivering full system pressure instead of the proportional amount

C. The front brake proportioning valve or the dual foot valve's secondary circuit is delivering a higher percentage of the available pressure to the front brakes than the system is designed to deliver

D. The front brake drums are undersized from excessive machining which has reduced the thermal mass and causes the drums to heat rapidly under even light braking creating aggressive grab sensation

43. A trailer's ABS has a fault code for the left rear wheel speed sensor air gap out of specification. The technician measures the air gap at 3.5 mm. The specification calls for 0.5 to 1.5 mm. What would cause the air gap to increase beyond specification?

A. The wheel bearing on that position has excessive end play that allows the hub (and its integral tone ring) to move away from the sensor during rotation increasing the effective air gap dynamically

B. The ABS sensor has retracted in its mounting bore from vibration and road impact forces over time gradually pulling the sensor tip further from the tone ring surface beyond the specified distance

C. The tone ring has accumulated brake dust and road debris on its surface which pushes the magnetic field further from the sensor tip creating an effective increase in the air gap measurement

D. The brake drum has been replaced with an aftermarket drum that has a different tone ring mounting dimension that positions the ring surface further from the sensor mounting location than the OEM drum

44. A loaded truck brakes firmly on a wet road. The front wheels continue to rotate (no lockup) while the rear drive axle wheels lock up briefly before the ABS releases them. Why do the front wheels not lock up under the same conditions?

A. The front steer axle has a higher weight-to-braking-force ratio because the dynamic weight transfer during braking shifts the vehicle's mass forward increasing the front tire traction contact force

B. The front brakes are designed to produce less braking force than the rear brakes because the front axle carries less static weight than the loaded rear drive axle under normal standing conditions

C. The front steer axle tires have a different tread compound with a higher wet-traction coefficient than the drive axle tires which prevents the front wheels from reaching the lockup threshold

D. The ABS system prioritizes front axle wheel rotation over rear axle rotation because loss of steering control from front wheel lockup is more dangerous than drive axle lockup during a braking event

45. A truck's air brake system has an inversion valve (spring brake proportioning valve). During a test, the technician pumps down the air system pressure while monitoring the spring brake force. At what point does the inversion valve begin to modulate?

A. The inversion valve modulates continuously during all brake applications regardless of system pressure to ensure smooth proportioning between service and spring brake circuits

B. The inversion valve begins modulating when the system air pressure drops into the range between the spring brake application threshold and the normal service brake operating pressure range

C. The inversion valve modulates only during the parking brake application cycle to provide a gradual spring brake engagement rather than the sudden full-force application of the unmodulated springs

D. The inversion valve begins modulating when the supply pressure drops below the threshold where the spring brakes begin to apply — it meters the air release to provide proportional emergency braking

46. A newly installed set of brake linings on a drive axle produces a squealing noise during the first several brake applications. The noise diminishes after approximately 20 stops and then disappears completely. What caused the initial squeal?

A. The new linings are bedding in — the initial contact between the new lining surface and the drum is concentrated on the high spots until the surfaces conform to each other and full contact is established

B. The brake drums were not cleaned before the new linings were installed and residual rust on the drum surface produced the squeal until the friction material scraped the rust from the contact zone

C. The new lining material is too soft for the application and the initial squeal indicates the linings will wear rapidly and should be replaced with the correct friction material grade for this axle position

D. The automatic slack adjuster over-adjusted the brakes during the first few applications bringing the linings too close to the drum until the linings wore slightly and established the correct running clearance

47. A truck's 12-volt electrical system has a total accessory load of 85 amps during normal operation. The alternator is rated at 160 amps. The batteries are fully charged. What percentage of the alternator's capacity is being used by the accessory load?

A. Approximately 75% which leaves the alternator with minimal reserve capacity for additional loads or battery charging demands during normal vehicle operation

B. Approximately 65% which is within the normal operating range but approaching the upper limit where additional loads could reduce battery charging effectiveness

C. Approximately 53% which is a normal operating load level that provides adequate reserve for battery maintenance charging and transient load spikes during operation

D. Approximately 42% which indicates the alternator is significantly oversized for the vehicle's electrical demands and a smaller unit could be used to reduce engine parasitic load

48. A truck's backup camera display shows a clear image when the vehicle is first started but the image develops horizontal lines (rolling bars) across the screen after 10 minutes of operation. What is the most likely cause?

A. The camera's image sensor is failing from heat exposure and the thermal expansion changes the sensor's pixel alignment creating the horizontal line pattern as the camera heats up

B. The camera or the display unit is developing a power supply filtering issue — as the component heats up an internal capacitor's value changes allowing AC ripple to modulate the video signal creating rolling bars

C. The display screen's LCD panel backlight frequency is shifting as it warms up and the changed frequency conflicts with the camera's frame rate producing a visible interference pattern

D. The alternator's AC ripple voltage increases as the engine and alternator reach operating temperature and the unfiltered ripple is inducing interference in the camera's video signal transmission cable

49. A truck has an intermittent no-crank condition that occurs only when the engine is hot. When the engine is cold, the starter operates normally every time. What temperature-sensitive component in the start circuit could cause this intermittent failure?

A. The starter solenoid contact resistance increases when hot to the point where the solenoid cannot pass adequate current to the motor during hot-engine cranking attempts

B. The battery CCA capacity drops when the under-hood temperature rises reducing the available cranking current below the starter motor's minimum operating requirement

C. The engine oil viscosity increases with temperature requiring more cranking torque than the starter motor can deliver when the engine block retains heat from recent operation

D. The neutral safety switch, ignition switch, or a start relay develops increased internal resistance when heated to operating temperature interrupting the start control circuit current

50. A truck's ECM sets a fault code for the fuel temperature sensor — SPN 174, FMI 4 (voltage below normal). The sensor is a two-wire NTC thermistor with a 5-volt reference. What condition produces an FMI 4 (voltage below normal) on an NTC sensor?

A. A short to ground in the signal wire or a shorted sensor element pulls the voltage to near zero which the ECM reads as an extremely high temperature — the opposite of what a disconnected sensor would produce

B. An open circuit in the sensor wire causes the ECM to see zero voltage because the reference voltage cannot reach the sensor and reflects back to the ECM at the ground potential level

C. The sensor element has drifted out of its calibration range and is producing a resistance value that converts to a voltage below the ECM's minimum acceptable threshold for normal operation

D. The 5-volt reference supply to the sensor has failed internally in the ECM causing the sensor circuit to read at ground potential regardless of the actual fuel temperature or sensor condition

51. A truck's electric mirrors adjust correctly from the driver's controls but the mirror heaters do not function on either side. The heater fuse is good and the heater switch illuminates when pressed. What should be checked next?

A. The wiring from the heater switch to the body controller because the switch provides the request signal but the controller provides the heater output power through a separate switched circuit

B. The body controller for a fault code related to the mirror heater output circuit because the controller may have detected an overcurrent condition and disabled the heater outputs for protection

C. The heater relay or the power feed wire from the relay to the mirror connectors — the switch and fuse are confirmed good so the fault is in the power delivery circuit between the fuse and the heaters

D. The mirror glass assemblies themselves because both heater elements may have failed simultaneously from a manufacturing batch defect or from a previous overvoltage event that burned both elements

52. A truck equipped with a J1939 CAN bus has the engine ECM replaced under warranty. After the replacement, the transmission shifts correctly but the cruise control does not function. The cruise control switch is confirmed good. What step was likely missed during the ECM replacement?

A. The vehicle speed calibration was not programmed into the new ECM and the cruise control function requires a valid speed signal to operate which the ECM cannot provide without calibration

B. The new ECM was not programmed with the vehicle's specific feature configuration (customer parameters) and the cruise control feature is disabled in the default calibration loaded by the factory

C. The CAN bus terminating resistor that was housed inside the old ECM connector was not transferred to the new ECM's connector and the resulting bus communication errors prevent cruise control operation

D. The replacement ECM has a different J1939 source address than the original and the body controller cannot recognize the cruise control enable messages from the new ECM's unregistered address

53. A truck's charging system produces 14.2 volts at the alternator B+ terminal but only 13.4 volts at the battery positive terminal. The engine is running at 1,500 RPM with moderate electrical load. What does this 0.8-volt difference indicate?

A. Excessive resistance in the charging circuit between the alternator output and the battery — likely corroded cable terminals, a damaged wire, or a loose connection creating a voltage drop under load

B. Normal voltage drop that occurs in all charging circuits due to the natural resistance of the cable and connections between the alternator and battery during moderate load operating conditions

C. The alternator voltage regulator is sensing voltage at the alternator terminal rather than at the battery terminal and is not compensating for the cable voltage drop in its regulation strategy

D. The battery has a high internal resistance that is limiting its ability to accept charge current from the alternator creating an artificial voltage differential between the two measurement points

54. A truck's scan tool shows the engine ECM is not receiving data from the transmission control module (TCM) on the J1939 CAN bus. The TCM has no fault codes and all transmission functions are normal when operated manually. What is the most likely cause?

A. The TCM's CAN transceiver circuit has failed for transmitting but still receives data from the bus — the TCM operates normally from received data but cannot broadcast its own messages

B. The engine ECM's CAN input buffer is full from processing other module data and cannot accept additional messages from the TCM during periods of high bus traffic loading conditions

C. The J1939 CAN bus has developed a high-resistance splice at a location that attenuates the TCM's messages below the ECM's detection threshold while other stronger signals pass through normally

D. The TCM is broadcasting on a different CAN bus segment (private CAN or J1708) than the one the engine ECM monitors and a gateway module that translates between buses has failed or lost power

55. A truck's headlamp aim has been checked and found to be correct. However, the driver complains that the headlamps illuminate the road poorly at night compared to other identical trucks in the fleet. Both headlamp lenses are clean and undamaged. What should the technician check?

A. The headlamp reflectors for oxidation, clouding, or delamination that reduces their reflective efficiency and scatters the light rather than focusing it in the designed beam pattern

B. The headlamp bulb wattage to verify the correct bulbs are installed — a lower-wattage bulb produces less lumens than the specification which reduces the light output at the road surface

C. The alternator output voltage during headlamp operation because a charging system producing 13.2 volts instead of 14.2 volts reduces the filament temperature and significantly dims the headlamps

D. The headlamp ground circuit voltage drop because high resistance in the ground path reduces the current through the filament which directly reduces the light output even with correct supply voltage

56. A truck's engine ECM has set a fault code for "injector circuit high" on cylinder 3 — SPN 652, FMI 0. The injector solenoid coil resistance measures within specification. What condition produces a "circuit high" (FMI 0) fault?

A. The injector solenoid wire has a short to battery voltage that feeds external voltage into the ECM driver circuit when the ECM is not commanding the injector to fire during that cylinder's off period

B. The ECM's internal injector driver transistor for cylinder 3 has failed in the shorted-on position continuously energizing the solenoid regardless of the ECM's programmed injection timing strategy

C. The injector solenoid coil has developed an intermittent open circuit that produces voltage spikes during the ECM's rapid switching cycle which the ECM interprets as above-normal circuit voltage

D. The injector signal wire has a short to the 12-volt power supply wire in the injector harness which backfeeds voltage into the ECM's measurement circuit producing the high-voltage reading

57. A truck's battery equalizer on a 24-volt system has failed. The 12-volt accessories (radio, cab lights, USB outlets) are now operating at erratic voltages — sometimes too high and sometimes too low. Why is the voltage erratic rather than consistently wrong?

A. Without the equalizer the 12-volt tap point voltage depends on the relative state of charge and load on each battery — as the two batteries charge and discharge unevenly the mid-point voltage shifts unpredictably

B. The alternator's voltage regulator is oscillating between 24-volt and 12-volt regulation modes because the failed equalizer has disrupted the regulator's voltage sensing feedback circuit

C. The 12-volt accessories are drawing current from the battery with the lower state of charge which varies with temperature and creates unpredictable voltage fluctuations at the accessory supply point

D. The body controller is cycling the 12-volt accessory circuits on and off rapidly in response to the unstable voltage attempting to protect the sensitive electronic modules from the erratic power supply

58. A truck equipped with LED marker lamps has one lamp that glows very dimly when it should be off (ignition off, light switch off). All other marker lamps are completely off. What is the most likely cause?

A. The LED lamp has an internal leakage current path through its driver circuit that allows a small amount of current to flow even when the supply circuit is switched off at the light switch

B. The dimly glowing LED has a shared ground wire with another circuit that is energized (such as a trailer charge circuit) and current is backfeeding through the common ground into the LED circuit

C. The LED's internal current-limiting resistor has failed in a partial-short condition that allows a trickle of current to pass through the LED from the residual voltage on the switched-off circuit wire

D. The body controller's output driver for that lamp has a leaking semiconductor that passes a small amount of current even in the off state — enough for the low-power LED to glow but not enough for incandescent

59. A truck's windshield wiper park function is not working — the wipers stop wherever they are in their sweep when the switch is turned off instead of returning to the park position at the bottom of the windshield. The wipers operate normally in all speed settings. What is the most likely cause?

A. The wiper motor has a failed internal park switch circuit that cannot detect the home position and command the motor to continue running until the wiper arms reach the park location at the bottom of the sweep

B. The wiper motor park switch contact is stuck open — the motor stops immediately when the dash switch is turned off instead of continuing to run until the park switch closes at the home position

C. The wiper motor ground circuit has excessive resistance that drops the voltage below the minimum needed to operate the park circuit while still providing enough power for the main wiper motor operation

D. The wiper control module has a software fault that does not send the park command to the motor after the operator turns the wiper switch off leaving the motor in whatever position it was last commanded

60. A truck's instrument cluster has a "check engine" lamp that is illuminated. The scan tool retrieves a fault code for the exhaust gas recirculation system — SPN 27, FMI 0 (EGR valve position above normal). The scan tool actuator test commands the EGR valve to 0% (fully closed) but the actual position reads 5%. What does this indicate?

A. The EGR valve is within the normal tolerance of ±5% for the fully closed position and the fault code was triggered by a temporary condition that has since resolved during normal engine operation

B. The EGR valve position sensor has a 5% zero-offset calibration error and requires a zero-point recalibration procedure using the scan tool's sensor calibration function to eliminate the false code

C. The EGR valve's return spring has weakened from heat cycling and cannot fully close the valve against the exhaust backpressure that holds it slightly open even when the actuator commands fully closed

D. The EGR valve is physically stuck partially open (5%) due to carbon deposits on the valve seat, pintle, or bore that prevent the valve from closing the remaining 5% to reach the fully sealed position

61. A truck has a 12-volt accessory outlet (cigarette lighter socket) that is not working. The fuse for the circuit is good. A DMM shows 12 volts at the socket's positive contact. What is the most likely cause?

A. The ground contact in the socket body has lost its connection — the socket shell may be corroded, loose, or the ground wire to the socket has broken leaving the socket without a current return path

B. The accessory outlet's internal thermal fuse has tripped from a previous overload and must be reset by pressing the socket's internal reset button or replacing the socket's internal fuse element

C. The 12-volt reading is ghost voltage from an adjacent circuit and the actual supply voltage drops to zero when a load is connected because the circuit has an open in series with the fuse and socket

D. The accessory outlet socket's positive contact spring has weakened and cannot maintain firm contact with the plug's centre pin requiring the socket assembly to be replaced for reliable electrical connection

62. A truck's engine ECM and transmission TCM communicate on the J1939 CAN bus. The transmission shifts harshly because the engine does not reduce torque during the shift event as commanded by the TCM. The scan tool shows the engine ECM receives the torque reduction request but does not execute it. What is the most likely cause?

A. The engine ECM has a fault in its torque management software calibration that prevents it from responding to external torque reduction commands from the transmission control module during shifts

B. The CAN bus message priority for the TCM's torque request is lower than another module's message and the engine ECM is processing the higher-priority message instead of the shift torque reduction

C. The engine ECM receives and acknowledges the TCM request but its internal torque reduction actuator (the fuel metering unit or electronic throttle) has a fault that prevents it from executing the reduction

D. The engine ECM's software parameter for "external torque reduction enable" has been set to "disabled" during a previous ECM reprogramming event and the ECM ignores all external torque requests

63. A truck's scan tool retrieves a fault code for the vehicle speed sensor — SPN 84, FMI 10 (abnormal rate of change). The speedometer occasionally shows brief speed spikes of 20-30 km/h above actual speed for one or two seconds before returning to the correct reading. What is causing this?

A. The vehicle speed sensor output shaft gear has a chipped or damaged tooth that produces an extra pulse at one rotational position creating a momentary speed spike in the calculated vehicle speed

B. The CAN bus has an intermittent noise source that is injecting false speed data onto the bus which the instrument cluster displays as a brief speed spike before the correct data overwrites the error

C. The ABS module is broadcasting wheel speed data that intermittently conflicts with the transmission speed sensor data creating a momentary discrepancy that the cluster resolves by averaging the values

D. The vehicle speed sensor tone ring has a cracked or damaged section that produces closely-spaced pulses as the damaged area passes the sensor creating a momentary high-speed calculation spike

64. A truck's electric fuel priming pump motor draws 8 amps during normal operation. The technician measures 12 amps during a diagnostic test. The pump functions and delivers adequate fuel pressure. What does the elevated current draw indicate?

A. The fuel supply line has a restriction upstream of the pump that increases the pump's workload as it pulls fuel through the restriction requiring more current to maintain the rated flow and pressure

B. The pump motor has increased internal friction from worn brushes, a binding armature, or corroded bearings that causes the motor to consume more electrical energy to produce the same mechanical output

C. The fuel return line backpressure is elevated from a restricted return filter or a stuck fuel pressure regulator which increases the pump's discharge pressure requiring more current to pump against

D. The pump's internal relief valve spring has weakened allowing the pump to recirculate fuel internally which increases the flow volume the motor must handle requiring additional current for operation

65. A truck has two alternators driven by separate belts on the same engine. The primary alternator charges the vehicle batteries and the secondary alternator charges auxiliary batteries for a liftgate hydraulic power unit. The auxiliary batteries are consistently undercharged. The secondary alternator's output voltage measures 13.0 volts at idle. What is the most likely cause?

A. The secondary alternator's voltage regulator is sensing voltage at the auxiliary battery bank which has a voltage drop in the charging cable that causes the regulator to under-regulate at the alternator output

B. The secondary alternator drive belt is slipping under the charging load and the alternator cannot maintain sufficient RPM to produce the correct output voltage for adequate auxiliary battery charging

C. The auxiliary battery bank has a higher internal resistance than the main batteries which causes the secondary alternator to work at a lower output voltage to prevent overcharging the high-resistance batteries

D. The secondary alternator's field circuit has excessive resistance from a corroded connector or the voltage regulator is faulty — either condition limits the field current and reduces the alternator's output voltage

66. A truck's CAN bus backbone has been damaged by a road debris impact underneath the cab. The technician repairs the damaged section by splicing the two CAN wires (CAN-H and CAN-L) back together using butt connectors and heat-shrink tubing. After the repair, intermittent communication faults occur. What is the most likely cause?

A. The butt connectors add excessive resistance at the splice point that attenuates the CAN signals below the receiver thresholds of the most distant modules on the bus backbone

B. The individual splices on CAN-H and CAN-L must maintain the correct wire twist ratio (turns per metre) through the splice — the untwisted section in the butt connectors disrupts the differential signal cancellation

C. The heat-shrink tubing creates a sealed moisture trap around the splice that causes corrosion over time which progressively degrades the signal quality as the corrosion resistance increases at the connection

D. The CAN-H and CAN-L wires were spliced in the same physical location creating a potential common-mode failure point — the two splices should be staggered at different locations along the bus

67. A truck has an aftermarket telematics device installed that monitors vehicle location, speed, and engine data through the J1939 CAN bus diagnostic connector. The fleet manager reports that the engine ECM intermittently sets communication fault codes that clear themselves after a few minutes. What is the most likely cause?

A. The telematics device is broadcasting proprietary messages on the J1939 bus that conflict with standard SAE J1939 PGN addresses causing the engine ECM to misinterpret the data as corrupted messages

B. The telematics device draws excessive current from the diagnostic connector's power pin causing the ECM's supply voltage to dip below the CAN transceiver's minimum operating threshold intermittently

C. The telematics device is adding an additional CAN load to the bus that the ECM's transceiver cannot drive resulting in signal degradation that intermittently corrupts the data below the error detection level

D. The telematics device's CAN connection introduces an impedance mismatch at the diagnostic connector that creates signal reflections which intermittently corrupt the data near the ECM's bus connection point

68. A truck's rear combination lamp assembly (tail, stop, turn, and backup) has been replaced after collision damage. After installation, the tail lamps work but the brake lamps and turn signals do not function on that side. The opposite side functions normally. What is the most likely installation error?

A. The lamp assembly's internal circuit board has a manufacturing defect that only energizes the tail lamp filaments while the brake and turn signal circuits have open solder joints from factory

B. The electrical connector was not fully seated on the replacement lamp assembly — the tail lamp pins engage first at partial insertion but the brake and turn signal pins require full connector engagement

C. The replacement lamp assembly is for the opposite side of the vehicle and the internal wiring routes the brake and turn signals to the wrong filament positions within the housing

D. The ground wire at the lamp assembly was not reconnected and the tail lamps operate through a ground path in the marker lamp circuit while the brake and turn signals require the dedicated ground

69. A truck equipped with a heavy-duty manual transmission has developed a noticeable vibration felt through the clutch pedal during engagement. The vibration is felt only during the initial contact of the clutch disc with the flywheel — it disappears once the clutch is fully engaged. What is the most likely cause?

A. The flywheel has developed runout from either a distorted mounting surface or a warped friction face that causes the clutch disc to contact the flywheel unevenly during the initial engagement phase

B. The clutch disc damper springs have broken and the disc hub oscillates on the transmission input shaft creating a vibration that is dampened once the disc is clamped between the flywheel and pressure plate

C. The transmission input shaft pilot bearing in the flywheel has seized and the shaft wobbles during the partial-engagement phase when the disc is spinning at a different speed than the flywheel surface

D. The pressure plate's diaphragm spring fingers are not at equal height and the release bearing contacts them unevenly during the engagement phase creating a pulsating clamping force on the disc

70. A truck with an 18-speed manual transmission (a 10-speed main box with a 2-speed splitter and 2-speed range) cannot make the deep reduction shift from 4th gear low range to 5th gear high range. All gears within the low range and all gears within the high range work correctly. What has failed?

A. The main box synchronizer between 4th and 5th gear has failed because this gear change requires the synchronizer to match a larger speed differential than any other shift in the transmission

B. The shift tower detent springs have weakened and the shift lever cannot reach the 5th gear position because it falls short of the detent engagement needed to complete the range and main box shift

C. The driver's shift technique is incorrect — the 4th-to-5th shift on an 18-speed requires a specific double-clutch pattern that differs from all other shifts in the range change sequence

D. The range section air shift mechanism has a fault — the 4th-to-5th shift requires a simultaneous main box shift and range change and the range cylinder cannot complete the shift in the available time

71. A truck's automatic transmission has a delayed engagement when shifted from Park to Drive — the engine RPM increases noticeably before the transmission engages. The engagement, once it occurs, is smooth. What is the most probable cause?

A. The torque converter has lost its fluid charge from a failed check valve that allows the converter to drain during parking resulting in a delayed fill time when Drive is selected after a cold soak period

B. The transmission main pressure regulator valve is stuck in a position that delays the buildup of apply pressure to the forward clutch pack when Drive is selected from the Park position

C. The forward clutch pack piston seals have hardened from heat exposure and cannot seal quickly enough to build apply pressure — the delayed engagement occurs as the seals gradually seat under pressure

D. The transmission oil pump has worn beyond its volumetric efficiency and cannot deliver adequate flow to fill the forward clutch apply circuit quickly enough for immediate engagement from Park to Drive

72. A tandem axle truck has a complaint of excessive tire wear on the front drive axle compared to the rear drive axle. Both axles are equally loaded and use the same tire brand and compound. What mechanical condition could cause accelerated wear on the front drive axle tires?

A. The front drive axle has worn carrier bearings that allow the ring gear to shift position under load changing the axle's tracking relative to the frame and scrubbing the tires laterally during driving

B. The inter-axle differential (power divider) is not distributing torque equally between the two axles and the front axle is receiving more torque which accelerates tire wear from the additional drive forces

C. The torque rod bushings on the front drive axle are worn allowing the axle to shift under acceleration and braking which changes its alignment relative to the frame and causes tire scrubbing wear

D. The front drive axle U-joints are worn and the resulting vibration creates a wheel hop condition that produces flat spots on the tires from the intermittent loss and regain of traction during straight driving

73. A drive axle pinion seal is leaking. Before replacing the seal, what must the technician do to ensure proper reassembly?

A. Mark the pinion nut position relative to the pinion shaft and count the number of threads exposed above the nut to ensure the original pinion bearing preload is restored after seal replacement

B. Remove the ring gear to prevent damage to the gear teeth during the pinion removal and reinstallation process required for the seal replacement procedure on this axle housing design

C. Drain the axle lubricant and refill with new fluid after the seal replacement because the old lubricant is contaminated by the exposure to the external environment through the failed seal opening

D. Replace the pinion bearings at the same time as the seal because removing the pinion nut disturbs the bearing preload which cannot be accurately restored on worn bearings using the original nut position

74. A truck's clutch pedal effort has increased gradually over the past 30,000 km. The clutch hydraulic fluid level is normal and the system has no visible leaks. The clutch engages and disengages normally — it just requires more effort. What is the most likely cause?

A. The clutch disc lining material has hardened from heat exposure and requires more force to compress against the flywheel and pressure plate surfaces during each clutch engagement and disengagement

B. The transmission input shaft bearing has increased friction that resists the release bearing's effort to disengage the clutch creating the sensation of increased pedal effort during each disengagement

C. The release bearing contact surface has developed wear that increases the friction between the bearing and the pressure plate diaphragm spring fingers requiring more pedal force for the same disengage travel

D. The clutch master cylinder bore has developed internal corrosion that increases the friction between the piston seal and the bore wall requiring more pedal force to push the piston through the corroded section

75. A truck equipped with a transfer case and front-wheel-drive disconnect has a complaint of a grinding noise from the front axle area when four-wheel drive is engaged. The noise begins immediately upon engagement and continues until four-wheel drive is disengaged. The noise is not present in two-wheel drive. What is the most likely cause?

A. The transfer case output to the front axle is spinning the front driveshaft at a speed that does not match the front wheel speed because the front wheel disconnect hub has not fully engaged

B. The front axle ring and pinion gear set has excessive backlash that only produces noise when the front axle is being driven by the transfer case and not when it is free-wheeling in two-wheel drive mode

C. The front driveshaft U-joints have seized and the locked U-joints cannot accommodate the angular changes during the front axle's suspension travel creating a grinding noise during four-wheel operation

D. The front axle differential has run low on lubricant because the disconnect hub seals have been leaking for an extended period and the gears are operating without adequate lubrication when engaged

76. A truck's driveshaft has been balanced by a driveshaft shop. After reinstallation, the vibration is improved at lower speeds but a new vibration appears at highway speed that was not present before. What might the driveshaft shop have inadvertently changed?

A. The balancing process added weights that corrected the low-speed imbalance but the added weight shifted the driveshaft's critical speed into the vehicle's highway operating speed range

B. The driveshaft was heated during the welding of balance weights which distorted the tube and changed its natural frequency from above the operating range to within the highway speed range

C. The balance weights were welded at a location that changed the driveshaft's moment of inertia creating a torsional resonance at highway speed that was not present before the balancing procedure

D. The driveshaft was shortened slightly during the balancing process to accommodate the weight mounting location which changed the U-joint working angles and introduced the highway speed vibration

77. A truck equipped with an Allison automatic transmission has the scan tool showing the torque converter lockup clutch slip at 150 RPM during highway cruise. The specification for fully locked is 0 RPM slip. What does the 150 RPM slip indicate?

A. The lockup clutch apply pressure is inadequate and the clutch is slipping under the normal cruise torque load — the valve body or lockup solenoid circuit is not delivering full apply pressure

B. The torque converter lockup clutch friction material has worn and cannot maintain zero-slip engagement against the normal highway cruise torque load transmitted from the engine through the converter

C. The transmission fluid has degraded and lost the friction modifier properties needed for the lockup clutch to grip without slipping under the steady-state torque condition of highway cruising speed

D. The TCM is intentionally commanding a partial lockup (controlled slip) to reduce driveline harshness during cruise operation as a programmed strategy rather than a fault condition requiring repair

78. A truck's axle shaft on a semi-floating rear axle has broken. The wheel and tire assembly have separated from the vehicle. On a full-floating axle design, would the same axle shaft failure produce the same result?

A. Yes — on both semi-floating and full-floating designs the axle shaft supports the wheel and a shaft failure allows the wheel to separate from the vehicle regardless of the axle design type

B. A full-floating axle shaft failure would produce a similar result but the wheel would remain loosely attached to the vehicle by the hub bearing assembly preventing complete separation

C. On a full-floating design the wheel would not lock up but would free-wheel because the axle shaft only transmits torque and does not support the wheel weight making separation less likely

D. On a full-floating axle a shaft failure does not cause wheel separation — the wheel is supported by the hub bearings on the axle housing spindle and the shaft only transmits torque to the hub

79. A truck's manual transmission has a complaint that the shift lever vibrates excessively at highway speed. The vibration is proportional to engine RPM and decreases when the clutch pedal is depressed. What is the most likely source?

A. The transmission shift tower isolator bushings have deteriorated allowing engine vibration to transmit through the transmission case directly to the shift lever without the designed damping

B. The transmission input shaft bearing is worn and the resulting shaft wobble transmits through the shift rails and forks to the shift tower and lever as a vibration proportional to the input shaft speed

C. The shift rail detent springs have weakened and the shift lever is vibrating in its detent position from the engine's firing impulses transmitted through the transmission case to the shift mechanism

D. The clutch disc damper springs have weakened and cannot absorb the engine's torsional vibration — the unfiltered vibration passes through the input shaft to the shift mechanism at engine frequency

80. A drive axle on a heavy-duty truck produces a rhythmic thumping noise at low speed that disappears above 30 km/h. The noise frequency increases with vehicle speed below 30 km/h. What is the most likely source?

A. A flat spot on one drive tire that impacts the road surface once per revolution producing a thump at a frequency proportional to wheel speed that becomes inaudible above 30 km/h as the frequency rises

B. A worn drive axle wheel bearing with a damaged roller that produces an impact once per revolution at low speed but the noise is masked by road and wind noise at speeds above 30 km/h

C. A chipped ring gear tooth that contacts the pinion at one point per revolution — the impact is audible at low speed but the increased gear mesh frequency above 30 km/h masks the individual tooth impact

D. A worn U-joint bearing cap that produces a single impact per revolution of the driveshaft — the thump is audible at low driveshaft speed but blends into continuous noise at higher rotational speeds

81. A dual-disc clutch is being installed on a Class 8 tractor. The intermediate plate (floater plate) must be positioned correctly between the two friction discs. What prevents the intermediate plate from rotating with the friction discs?

A. The intermediate plate has lugs or drive tabs that engage slots in the flywheel housing preventing it from rotating while allowing it to move axially to clamp and release the two clutch discs during operation

B. The intermediate plate has drive pins or lugs that engage machined slots in the flywheel allowing it to rotate with the flywheel while moving axially to clamp and release the friction discs during engagement

C. Friction between the intermediate plate and the friction disc surfaces holds the plate stationary during clutch disengagement and allows it to rotate during clutch engagement through the clamping force

D. The intermediate plate is keyed to the transmission input shaft through a spline connection that prevents rotation while allowing axial movement during the clutch engagement and disengagement cycle

82. A truck has an intermittent driveline vibration that occurs only when the vehicle is under load going uphill. The vibration disappears on level ground and during coast. Driveshaft runout, U-joints, and balance have all been checked and are within specification. What is the most likely cause?

A. The engine and transmission mounts have softened allowing the powertrain to shift rearward under the sustained uphill load changing the driveline working angles enough to produce a vibration

B. The transfer case (if equipped) output bearing is worn and the increased torque demand of uphill driving loads the bearing beyond its capacity creating intermittent vibration from the stressed bearing

C. The rear axle carrier bearings have worn and the increased torque of uphill driving causes the ring gear to deflect away from the pinion changing the gear mesh pattern and producing vibration from the contact

D. The tire inflation pressure decreases slightly from the increased rolling resistance of uphill driving which changes the effective tire diameter and creates a driveline vibration from the altered speed ratio

83. A truck's automatic transmission slips momentarily when cold but operates normally once the fluid reaches operating temperature. The fluid level is correct when checked at operating temperature. What is the most likely cause?

A. The torque converter lockup clutch is engaging prematurely during the cold fluid condition because the cold fluid produces higher line pressure that activates the lockup circuit before the TCM commands it

B. The transmission oil pump cannot deliver adequate volume and pressure with cold thick fluid to fill the clutch apply circuits quickly enough for immediate engagement during the initial cold operating period

C. Cold transmission fluid has higher viscosity that increases the torque converter's internal fluid coupling losses — the thicker fluid absorbs more energy during coupling reducing the transmitted torque temporarily

D. The transmission fluid level is actually low when the fluid is cold and thick because the fluid contracts — the level only appears correct at operating temperature when the fluid has expanded to the full mark

84. A driveshaft centre bearing support bracket has cracked at its mounting point on the frame cross-member. What is the most probable cause of this bracket failure?

A. The centre bearing rubber isolator has hardened from age and can no longer absorb driveline vibration — the undamped forces are transmitted directly to the bracket causing fatigue cracking at the mount

B. The driveshaft was installed with excessive operating angles that create cyclic forces at twice the rotational frequency loading the bracket beyond its fatigue strength at the mounting point

C. The frame cross-member has developed corrosion that weakened the mounting surface and the normal driveline forces that the bracket was designed to handle now exceed the reduced strength of the corroded area

D. The engine horsepower was increased through an ECM reprogramming and the additional torque transmitted through the driveshaft exceeds the bracket's original design strength causing fatigue failure

85. A truck equipped with a compression brake (engine retarder) has had its camshaft replaced due to a worn compression brake lobe. After the replacement, the compression brake produces significantly more noise than before the repair. The retarding force is adequate. What is the most likely cause?

A. The replacement camshaft has a compression brake lobe profile that is slightly more aggressive than the original — the larger exhaust valve opening produces a louder decompression event per cylinder

B. The compression brake slave piston lash was not readjusted to the OEM specification after the camshaft replacement — the lash is now set too tight causing the exhaust valve to open too aggressively

C. The new camshaft's base circle diameter is slightly larger than the original which reduces the effective valve lash and causes the compression brake to open the exhaust valve earlier and wider than designed

D. The compression brake slave piston lash has changed because the new camshaft's base circle may differ from the original — the lash must be readjusted to the OEM specification using the new camshaft's base circle

86. A truck driver reports that the power steering becomes very stiff when the engine is revved above 2,500 RPM but feels normal below 2,000 RPM. The fluid level is correct and the belt is tight. What could cause this speed-related stiffness?

A. The power steering pump drive belt is glazed and slips at higher RPM when the pump demands more torque to deliver the increased flow — the pump starves and steering effort increases dramatically

B. The power steering pump flow control valve is stuck in a position that bypasses excessive flow at high RPM reducing the flow available to the steering gearbox for assist during high-speed pump operation

C. The power steering pump internal relief valve opens prematurely at high RPM due to a weakened spring limiting the available assist pressure above the RPM threshold where the spring force is overcome

D. The steering gearbox spool valve has a flow restriction that cannot handle the increased pump flow rate above 2,500 RPM creating a hydraulic lock condition that stiffens the steering temporarily at high engine speed

87. A heavy-duty truck's steer axle has toe-out wear on the right tire and toe-in wear on the left tire. Both tires were installed new at the same time and have the same inflation pressure. What alignment condition produces this asymmetric wear pattern?

A. The steer axle has a thrust angle error — the axle is not perpendicular to the vehicle's thrust line causing each tire to be dragged at a different angle relative to its direction of travel producing opposite wear

B. The toe setting is correct when measured on centre but the Ackermann geometry is incorrect causing the inside and outside wheels to turn at incorrect angles during turns producing asymmetric scrub wear

C. The left king pin bushing has more wear than the right allowing the left knuckle to shift and create a dynamic toe change under driving loads while the right side remains at the static alignment setting

D. The drag link length is incorrect causing the steering wheel to be off-centre — when centred by the driver the toe shifts asymmetrically putting one tire in toe-in and the other in toe-out simultaneously

88. A truck's frame has been inspected after a loading dock collision. The impact was to the right rear corner of the frame. The technician measures the frame diagonals from the front cross-member to the rear cross-member on both sides. The right diagonal measures 30 mm shorter than the left. What does this measurement indicate?

A. The right side of the frame has been pushed forward at the rear creating a parallelogram-shaped frame twist that will affect the rear axle alignment and the vehicle's straight-line tracking characteristics

B. The right side of the frame has been compressed from the impact shortening the right rail but the left rail is undamaged — the unequal diagonal measurements confirm the right rail has buckled or bent

C. The frame diagonals are within the normal tolerance for a heavy-duty truck frame and the 30 mm difference does not require any corrective action or alignment verification after the collision event

D. The frame has diamond damage (shifted into a parallelogram shape) where the right rear has been pushed forward relative to the left — the frame must be straightened to restore equal diagonal measurements

89. A truck's air ride suspension on one side of the rear tandem sits at the correct height when the vehicle is first started but slowly rises approximately 40 mm over 30 minutes of idle. The other side remains at the correct height. What is the most likely cause?

A. The height control valve for that side has a slow internal leak in the exhaust seat that is also cross-connected to the supply port allowing a gradual pressure increase to that air bag during idle operation

B. The height control valve on the affected side has a leak in its exhaust passage that allows a small amount of supply air to continuously feed the air spring raising the height gradually during prolonged idle

C. The air spring on that side has developed a slow internal expansion characteristic from heat exposure that causes the rubber bellows to gradually stretch upward over time when held at operating pressure

D. The shock absorber on that side has seized in a partially compressed position that holds the suspension lower than designed — as the shock slowly releases from heat the suspension rises to compensate

90. A truck's steer tire has been replaced after a blowout. The replacement tire is the same size and load rating but is from a different manufacturer. After installation, the driver reports the truck pulls slightly to the right. The alignment is verified as correct. What is causing the pull?

A. The replacement tire has slightly different tread design, rolling resistance, or conicity characteristics than the tire on the other side creating an asymmetric rolling force that produces the directional pull

B. The replacement tire was mounted in the wrong rotational direction for its directional tread pattern which creates a lateral force component that pushes the truck toward one side during straight driving

C. The steer axle was damaged during the blowout event and the camber has changed on that side which was not detected during the alignment check because the alignment equipment was not calibrated

D. The replacement tire has a different speed rating than the original and the stiffer sidewall compound creates an uneven contact patch that generates a lateral steering force at highway driving speeds

91. A fifth wheel's slide mechanism uses air-operated lock pins. The driver attempts to reposition the fifth wheel but the lock pins will not retract when the air release valve is activated. Air pressure is confirmed at the release valve. What should the technician check?

A. The air release valve internal mechanism for a bypass that is venting the air pressure to atmosphere before it reaches the lock pin actuator cylinders on the slide mechanism preventing pin retraction

B. The lock pin actuator air line for a kink, disconnection, or frost blockage between the release valve and the pin actuator cylinders that prevents air pressure from reaching the pin retraction mechanisms

C. The slide track rails for debris, rust, or ice accumulation that is mechanically wedging the lock pins in their holes and the air actuator pressure cannot overcome the binding force holding the pins in position

D. The lock pin actuator cylinders, their connecting air lines, and the slide track for any combination of mechanical binding in the pins, air supply restriction, or debris in the track holes preventing retraction

92. A truck with hub-piloted wheels has experienced two wheel stud failures on the same wheel position within 6 months. Both failed studs broke at the same location — the transition between the stud body and the hub mounting flange. What is the most likely root cause?

A. The hub pilot surface is corroded and the wheel cannot seat concentrically — the eccentric mounting creates uneven stud loading with the affected studs carrying a disproportionate share of the clamping force

B. The wheel nuts were consistently over-torqued on that position which pre-stressed the studs beyond their fatigue limit causing them to fail at the highest-stress point where the stud meets the hub flange

C. The hub stud holes have elongated from the repeated stud failures and the replacement studs shift position under load creating a cyclic bending stress at the stud-to-hub transition that exceeds the fatigue limit

D. The wheel on that position has a slightly distorted bolt pattern from a previous impact event that causes the studs to flex with each wheel revolution creating a fatigue loading that fails the studs at the stress riser

93. A trailer's tandem axle suspension uses air ride with height control valves on each axle. The front axle rides at the correct height but the rear axle rides 30 mm low. Both air bags on the rear axle are

equally low. The air supply pressure to both valves is identical. What should be checked on the rear axle height control?

A. The rear axle height control valve for a faulty exhaust seat that is slowly bleeding air from both bags on the rear axle maintaining a pressure lower than the supply can overcome during normal operation

B. The air lines from the rear height control valve to both air bags for a common restriction point where a single line feeds both bags and has developed a partial blockage limiting flow to both bags simultaneously

C. The rear axle height control valve linkage for a bent arm, worn pivot, or incorrect arm length that signals the valve to read the low condition as the correct height and not add air to compensate for the deficit

D. The rear axle weight distribution for an imbalance that places more load on the rear axle than the air springs can support at the available system pressure causing both bags to compress below the correct height

94. A truck's tire pressure monitoring system (TPMS) shows all four steer and drive axle tires at the correct pressure, but the trailer tires are not displayed on the TPMS monitor. The trailer is equipped with TPMS sensors at each wheel position. What is the most likely cause?

A. The TPMS receiver on the tractor is not paired with the trailer's TPMS sensor transmitters — each trailer's sensors must be programmed into the tractor's receiver before the trailer tire data is displayed

B. The trailer TPMS sensors have dead batteries because the sensors are battery-powered transmitters with a finite battery life that is typically 5 to 7 years depending on the transmission frequency

C. The trailer's TPMS uses a different radio frequency than the tractor's receiver and the two systems are not compatible requiring a frequency adapter to translate the trailer's sensor signals for the tractor display

D. The TPMS receiver antenna on the tractor is mounted too far from the trailer axle group and cannot receive the low-power radio signals from the trailer sensors at the distance between the cab and the trailer axles

95. A truck's steering gearbox is being adjusted. The technician adjusts the sector shaft over-centre screw and then checks the steering wheel free play. The free play is now within specification when the

steering is centred but the steering binds (becomes stiff) when turned 30 degrees in either direction from centre. What did the technician do wrong?

A. The technician adjusted the sector shaft screw with the steering in the off-centre position which tightened the mesh at the widest point of the sector gear rather than at the designed centre-mesh position

B. The technician tightened the sector shaft screw too far — the adjustment should provide zero lash at the on-centre position with slightly increasing clearance as the sector rotates off-centre toward the lock positions

C. The technician failed to adjust the worm bearing preload before the sector shaft adjustment — a loose worm bearing allows the input shaft to shift creating a binding condition when the sector engages off-centre

D. The steering gearbox has excessive internal wear and the sector shaft adjustment can only compensate for the wear at the centre position while the off-centre positions have too little clearance from the overcorrection

96. A heavy-duty truck's wheel bearing hub assembly uses a unitized (sealed, pre-adjusted) bearing design. During a PM inspection, the technician detects slight roughness when spinning the wheel by hand. Should the bearing be replaced?

A. The roughness may be from minor contamination on the bearing seal surface — clean the seal and recheck before deciding to replace the entire unitized hub assembly based on a single tactile assessment

B. Monitor the condition at the next PM service because unitized bearings develop minor roughness from seal drag that does not affect bearing performance until it progresses to noise or measurable play

C. Replace the unitized bearing assembly because any detectable roughness in a sealed bearing indicates internal damage that will progress to failure since the bearing cannot be serviced or adjusted

D. Verify the roughness by removing the brake components and respinning the hub — if the roughness remains after removing the brake caliper drag then the bearing assembly requires replacement

97. A truck's front suspension leaf spring has one leaf that is cracked approximately halfway through its width. The crack has not propagated to the full width and the spring still carries the load. What is the correct action?

A. Weld the cracked leaf to restore its structural integrity and return the vehicle to service with a note to reinspect the weld at the next PM interval to verify it has not propagated further

B. Replace the complete leaf spring assembly because a cracked leaf changes the spring rate and load distribution and will eventually break completely possibly causing loss of vehicle control

C. Remove only the cracked leaf from the spring pack and reinstall the pack with the remaining leaves which will function adequately at a slightly reduced load rating until a replacement pack is available

D. Continue operating the vehicle with the cracked leaf because the remaining intact leaves provide adequate support and the crack will not propagate further under normal operating loads and conditions

98. A truck's steering linkage uses a drag link with adjustable ball joints at both ends. During an alignment, the technician adjusts the drag link to centre the steering wheel. After the adjustment, the driver reports that the turning radius is tighter on one side than the other. What happened?

A. The drag link adjustment changed the effective steering arm geometry on one side which altered the maximum steering angle achievable in that direction compared to the opposite direction of full lock

B. Adjusting the drag link length moved the pitman arm's operating arc relative to the steering arm creating an asymmetric relationship between left and right steering input and wheel response

C. The drag link adjustment shifted the gearbox sector shaft to an off-centre position in its travel range — the sector reaches its internal stop on one side before the other reducing the turning radius

D. The drag link length change altered the Ackermann geometry creating a different inside-to-outside wheel angle relationship during left turns versus right turns which the driver perceives as unequal turning

99. A truck equipped with electronic power steering (EPS) has a fault code for the steering torque sensor. The steering assist is disabled and the driver must steer without power assist. What function does the torque sensor serve in the EPS system?

A. The torque sensor measures the force the driver applies to the steering wheel and the EPS controller uses this input to calculate how much electric motor assist to provide proportionally to the driver's effort

B. The torque sensor monitors the reaction force from the road surface through the steering linkage and the EPS controller adjusts the motor assist to compensate for road surface changes during driving

C. The torque sensor monitors the torsional load on the steering column to detect mechanical failures and the EPS controller uses this input to activate a warning before a steering column shaft failure occurs

D. The torque sensor measures the torque output of the electric assist motor to verify it matches the controller's command and provides feedback for closed-loop control of the motor's assist force output

100. A truck's tire has been removed from the rim for inspection after a TPMS low-pressure alert. Inside the tire, the technician finds a pattern of rubber dust and fine shredded material on the inner liner surface beneath the tread. What does this indicate?

A. The tire was manufactured with an incorrect inner liner compound that is chemically incompatible with the tire's carcass rubber and is self-destructing from the internal chemical reaction between layers

B. The tire has been operated significantly under-inflated for an extended period — the inner liner has been abraded by the repeated folding and contact with the belt edges during the underinflated rolling operation

C. The tire's inner liner was damaged during the mounting process by the tire machine's bead breaker tool and the damaged area has progressively deteriorated from the internal air pressure and flexing during driving

D. The tire has an internal manufacturing defect where the inner liner was not properly bonded to the carcass plies and is separating from the inside creating the rubber dust and shredded material debris pattern

101. A truck's hub oil seal has been replaced and the hub oil refilled to the correct level at the sight glass. After 500 km of operation, the technician rechecks the hub oil level and finds it has dropped approximately 10 mm below the sight glass centre line. There is no visible oil on the brake backing plate or on the ground beneath the hub. Where is the oil going?

A. The new seal is seating against the spindle surface and a small amount of oil is migrating past the seal into the spindle bore where it collects without dripping externally — this is normal break-in behaviour

B. The hub oil level drops after initial operation because the bearings and internal hub cavity absorb oil from the reservoir during the first several hundred kilometres of operation — this is normal initial fill consumption

C. The oil is leaking past the inner bearing cone and migrating along the axle shaft toward the differential where it collects in the axle housing without visible external dripping from the hub area

D. The hub cap or cover gasket has a slow leak that allows oil to seep during operation when the oil is warm and thin — the leaked oil evaporates from the hot hub cap surface leaving no visible trail

102. A truck has new brake drums and linings installed on the front steer axle. During the first 500 km, the driver reports a slight vibration during braking that was not present before the brake job. The technician re-measures the drum and it is within specification. What is the most likely cause of this initial braking vibration?

A. The new linings are not yet fully bedded in to the drum surface and the partial contact pattern creates uneven braking force during each wheel revolution producing the vibration until full contact develops

B. The brake shoe return springs were reused from the old installation and have weakened from fatigue — the weak springs allow the shoes to follow the drum's minor irregularities creating the vibration

C. The new drum has a different metallurgical composition than the original that produces a different friction characteristic with the new linings creating a harmonic vibration during the break-in period

D. The brake anchor pins were not lubricated during the installation and the increased friction at the shoe pivot points creates a grabbing condition that produces vibration during each brake application event

103. A tandem axle truck has one drive axle that consistently runs hotter than the other. Both axles carry equal load and have the same tire inflation. The hotter axle's wheel bearing temperatures and brake temperatures are within normal limits. What else could cause the elevated temperature on that axle?

A. The inter-axle differential is distributing more torque to the hotter axle creating additional friction and heat from the increased power being transmitted through that axle's ring and pinion gear set

B. The hotter axle has a lower lubricant level than the other which reduces the oil's ability to transfer heat away from the ring and pinion gears allowing the housing temperature to rise above the other axle

C. The hotter axle's vent has become blocked preventing internal pressure from equalizing which traps heated air inside the housing and causes the temperature to rise above the properly vented companion axle

D. The hotter axle's ring and pinion gear mesh pattern has shifted from bearing wear — the incorrect contact pattern creates higher mesh friction which generates more heat than the properly adjusted companion axle

104. A truck's cab air ride suspension has adequate air pressure in the springs and the ride height is correct, but the cab produces a noticeable single-thump noise when the vehicle crosses railroad tracks or large bumps at moderate speed. The noise comes from one corner of the cab. What should be inspected?

A. The cab air spring on that corner for an internal baffle failure that allows the piston to bottom out against the air spring's lower plate when compressed beyond the normal travel range during large bumps

B. The cab shock absorber on that corner for internal failure — a shock with a dead spot or failed valving allows the cab to move through its travel without resistance until it hits the mechanical bump stop producing the thump

C. The cab tilt latch mechanism for looseness that allows the cab to lift slightly off its rear mounting point during large bump impacts and drop back onto the latch producing a single impact noise

D. The cab anti-roll stabilizer bar end link on that corner for a worn bushing that allows the stabilizer bar to shift and impact the cab frame rail during large suspension compression events on that side

105. A truck driver reports that the cab interior is excessively noisy at highway speed. The noise is a constant wind rushing sound that increases proportionally with vehicle speed. All windows and doors are closed tightly. What should the technician inspect?

A. The door seals and window seals for deterioration, gaps, or compression set that allows wind noise to penetrate the cab at highway speed through the reduced sealing effectiveness of the aged weatherstripping

B. The cab exhaust stack rain cap for a loose mounting that creates a whistling noise in the airstream that transmits into the cab through the stack penetration in the roof or rear cab wall structure

C. The cab air intake for the HVAC system for a missing or damaged seal that allows external wind noise to enter the ventilation ductwork and be amplified by the duct system into the cab interior

D. The windshield sealant for separation from the windshield frame that creates a gap through which high-velocity highway wind enters the cab producing the rushing noise proportional to vehicle speed

106. A truck's cab tilt mechanism uses a hydraulic cylinder with a manual pump handle. The cab tilts forward smoothly but when releasing the cab back to the driving position, it drops the last 100 mm suddenly rather than lowering in a controlled manner. What is the most likely cause?

A. The cab tilt cylinder has a scored rod surface that causes the piston seal to lose contact with the bore wall during the last portion of the retraction stroke allowing the oil to bypass suddenly

B. The cab latch mechanism is pulling the cab down for the last 100 mm with a spring-loaded catch that accelerates the cab closure rather than the hydraulic cylinder controlling the entire descent

C. The hydraulic flow control valve (lowering check) that restricts the oil return rate during cab lowering has a worn seat or stuck plunger that allows uncontrolled flow during the final portion of the stroke

D. The cab pivot hinges at the front mounting points are worn which creates a dead zone in the hinge rotation where the hydraulic cylinder loses its mechanical advantage during the final closing arc

107. A truck's driver-side exterior mirror vibrates excessively at highway speed making the rearward view unusable. The mirror glass, housing, and mounting bracket all appear secure when checked by hand. What is the most probable cause?

A. The mirror mounting arm has a resonant frequency that is excited by the aerodynamic forces and turbulence at the specific highway speed creating a harmonic vibration that amplifies the mirror movement

B. The mirror head assembly's internal adjustment mechanism has loosened allowing the mirror glass to oscillate within the housing from the aerodynamic flutter produced by the highway wind speed airflow

C. The mirror mounting bracket has a hairline fatigue crack that is not visible during a static inspection but allows the bracket to flex under the dynamic aerodynamic loading of highway speed wind forces

D. The mirror's aerodynamic profile creates a vortex at highway speed that oscillates the entire mirror assembly on its mounting arm at a frequency matching the arm's natural vibration characteristic

108. A truck's passenger-side door does not seal properly along the bottom edge — road noise and water entry are reported at that area. The door closes and latches normally. The door seal appears undamaged. What should the technician check?

A. The door striker plate adjustment for a vertical height discrepancy that causes the door to close properly at the latch point but leaves the bottom edge slightly outward from the door frame sealing surface

B. The door hinges for wear that allows the door to sag — the latch may still engage but the bottom of the door has dropped enough to create a gap between the door seal and the door frame at the bottom edge

C. The cab body at the door frame bottom for collision damage that has shifted the frame inward creating a gap that the door seal cannot bridge even though the seal rubber itself is in good condition undamaged

D. The door glass run channel for a misalignment that shifts the window glass forward or backward in the frame which changes the door's profile and creates a gap at the bottom of the door opening

109. A reefer trailer's TRU has been serviced with a new compressor after the original compressor seized. After the service, the TRU runs but the cooling capacity is significantly below the rated specification. Suction pressure is higher than normal and discharge pressure is lower than normal. What is the most likely cause?

A. The new compressor was shipped with the wrong refrigerant oil type pre-charged inside the housing and the incompatible oil is reducing the compressor's internal sealing and volumetric efficiency

B. The replacement compressor has fewer cylinders than the original and cannot circulate enough refrigerant volume to match the original system's cooling capacity at the same RPM and pressure conditions

C. The compressor was installed with the suction and discharge ports reversed and the system is pumping in the wrong direction — the high side receives low-pressure gas and the low side receives moderate liquid

D. The system was not properly evacuated after the compressor replacement and the residual air acts as a non-condensable gas occupying condenser space and reducing the system's effective cooling capacity

110. A trailer's air system has passed the leak test but the brakes release sluggishly — there is a noticeable delay between the foot valve release and the trailer brakes fully releasing. The tractor brakes release promptly. What should the technician check on the trailer?

A. The trailer quick-release valves for contaminated seats that restrict the exhaust flow rate preventing the brake chamber air from venting quickly enough for prompt brake release on the trailer

B. The trailer relay valve for a restricted exhaust port or worn internal components that slow the air release rate from the trailer brake chambers compared to the faster-releasing tractor brake system

C. The trailer air lines between the relay valve and the brake chambers for excessive length, undersized diameter, or accumulated moisture that restricts the air flow rate during the release exhaust cycle

D. The trailer ABS modulator valves for a fault that holds residual pressure in the brake chambers after the foot valve releases by partially closing the exhaust passages in the modulator valve bodies

111. A trailer's nose (front wall) has sustained damage from a forklift collision during loading. The upper coupler plate mounting area appears undamaged, but the front wall insulation panel is punctured and the vapour barrier is compromised. What is the primary concern for a refrigerated trailer?

A. The compromised vapour barrier and insulation will allow warm moist ambient air to infiltrate the cargo space reducing the TRU's ability to maintain the set-point temperature and increasing fuel consumption

B. The structural integrity of the front wall is compromised and the trailer cannot safely couple to a tractor because the damaged front wall may not support the vertical coupling loads at the king pin area

C. The damaged front wall insulation will cause the TRU's evaporator to ice up faster than normal because the moisture entering through the compromised vapour barrier increases the humidity inside the cargo space

D. The forklift damage has likely shifted the upper coupler plate position changing the king pin centreline alignment which will cause the tractor fifth wheel to engage at an incorrect angle during coupling

112. A trailer equipped with a liftgate has the liftgate platform extending outward from the vehicle but not tilting to the level position at the truck bed height. The extend cylinder operates normally but the tilt cylinder does not move. The hydraulic pump runs and the control valve shifts when the tilt function is selected. What is the most likely cause?

A. The tilt cylinder has a scored rod that causes the piston seal to leak internally preventing the cylinder from building enough pressure to tilt the platform against the counterbalanced weight of the gate

B. The hydraulic hose to the tilt cylinder has an internal collapse or blockage that allows pressure to build at the valve but prevents adequate flow from reaching the cylinder to produce the tilting movement

C. The tilt cylinder piston rod is mechanically disconnected from the platform linkage — the cylinder extends and retracts freely but the rod end is not attached to the mechanism that tilts the platform

D. The tilt function requires a sequence valve to pressurize the extend circuit before the tilt circuit receives flow — the sequence valve has failed and is routing all pump flow to the tilt circuit before extending

113. A trailer's reflective conspicuity tape is required on which surfaces according to federal regulations?

A. The rear of the trailer only — alternating red and white strips across the full width of the trailer rear surface within 600 mm of the trailer's lowest point above the ground surface

B. The rear and both sides of the trailer — rear tape covers the full width and side tape extends from the rear to a point within 300 mm of the front edge of the trailer on each side surface

C. The rear only with additional marking on any protruding equipment such as liftgates, ICC bumpers, and swing doors that extend beyond the trailer's rear profile when in the stowed position

D. The rear, both sides, and the upper rear corners — the rear has full-width marking, the sides have marking as close to the front as practical, and the upper corners have pairs of white markers

114. A trailer's air ride suspension has been converted from a fixed tandem to a steerable axle configuration on the rear axle to reduce tire scrubbing during turns. After the conversion, the driver reports the trailer tracks poorly during straight-line highway driving and wanders at highway speed. What is the most likely cause?

A. The steerable axle requires a steering damper (similar to a steering stabilizer on a steer axle) to prevent the axle from oscillating during highway driving — the damper was not installed during the conversion

B. The steerable axle's self-centering mechanism is not strong enough to overcome the highway-speed dynamic forces and the axle oscillates from road irregularities creating the tracking and wandering complaint

C. The steerable axle bushings and pivot mechanism require periodic lubrication that was not performed after the conversion and the dry pivots are binding intermittently creating erratic tracking during highway operation

D. The steerable axle's maximum steering angle is set too wide for highway driving and the axle deflects excessively from minor road irregularities — the steering angle limiter needs to be adjusted to a narrower range

115. A flatbed trailer's securement points (stake pockets and winch track) are being inspected. The technician discovers that two of the stake pockets on one side of the trailer have cracked welds at the base where they are welded to the trailer frame. Can the trailer continue to operate with these damaged securement points?

A. The trailer can continue to operate only if the damaged stake pockets are not being used for cargo securement — the load must be secured using undamaged securement points until the cracked welds are repaired

B. The trailer must be removed from service immediately because cracked welds on securement points indicate potential frame damage that could result in structural failure during a cargo shift or emergency braking

C. The trailer can continue to operate at reduced gross weight because the cracked stake pockets reduce the overall securement capacity of the trailer by the proportion of the damaged points to the total available

D. The cracked welds should be repaired at the next available service opportunity but do not require immediate action because the remaining undamaged stake pockets provide adequate securement redundancy

116. A trailer's DOT-required mud flaps are missing from both rear wheels. What regulatory and practical concern does this create?

A. Missing mud flaps are a regulatory violation that will result in a citation during a roadside inspection and the trailer is spraying road debris and water onto following vehicles creating a safety hazard

B. Missing mud flaps have no regulatory significance since they are considered optional equipment on commercial trailers and are only required in jurisdictions that have adopted specific provincial mud flap bylaws

C. Missing mud flaps only affect the trailer's aerodynamic performance reducing fuel economy by approximately 3% but have no safety or regulatory implications for the trailer's continued commercial operation

D. Missing mud flaps are a regulatory violation but do not constitute an out-of-service condition during a roadside inspection — the carrier receives a warning citation but the trailer can continue to its destination

117. A truck's A/C system has been correctly charged but the compressor cycles on for 20 seconds and off for 5 seconds in a repeating pattern. System pressures are within normal range during the on cycle. The cycling occurs regardless of the temperature setting or the ambient conditions. What is controlling this cycling?

A. The A/C system is using a cycling clutch orifice tube (CCOT) design where the compressor is cycled by a pressure switch or thermistor to prevent evaporator freezing as a normal part of the system's operation

B. The high-pressure cutout switch is intermittently tripping from a marginal high-side pressure condition that exceeds the switch's threshold momentarily before the pressure stabilizes within normal range

C. The evaporator temperature sensor or pressure cycling switch is controlling the compressor cycling to maintain the evaporator surface temperature above freezing and prevent ice formation on the coil

D. The A/C control module has a defective output driver that cannot maintain continuous current to the clutch relay coil and the relay drops out every 20 seconds from the interrupted signal before re-energizing

118. A truck's A/C evaporator is not producing adequate cooling. The technician connects the manifold gauges and finds the low-side pressure at 345 kPa (50 psi) and the high-side pressure at 1,380 kPa (200 psi) with the compressor running at 30°C ambient temperature. Normal pressures would be approximately 207 kPa (30 psi) low and 1,380 kPa (200 psi) high. What does the elevated low-side pressure indicate?

A. The system is overcharged with refrigerant and the excess liquid in the evaporator is preventing the refrigerant from fully evaporating which keeps the suction pressure elevated above the normal specification

B. The compressor is not pumping efficiently — it cannot pull the suction side down to the normal low pressure because worn internal components allow refrigerant to leak internally from discharge to suction

C. The expansion valve is stuck partially open flooding the evaporator with more liquid refrigerant than it can evaporate which raises the suction pressure above the normal specification for the ambient temperature

D. The condenser fan is not operating and the high-side pressure should be higher — the normal high-side reading combined with an elevated low side indicates the compressor is bypassing internally

119. A fuel-fired auxiliary heater's combustion chamber is being inspected during a PM service. The technician finds a significant buildup of soot and carbon inside the combustion chamber. What does this buildup indicate and what should be done?

A. The combustion process is incomplete — the fuel-to-air ratio is incorrect due to a restricted air intake, worn fuel nozzle, low fuel pressure, or a blocked exhaust and the chamber must be cleaned and the cause corrected

B. The soot buildup is normal for a fuel-fired heater and should be cleaned during each annual PM service without further investigation because all diesel combustion processes produce some carbon deposits

C. The heater is operating at too high a temperature and the excess heat is carbonizing the fuel before it can fully combust — the heater output should be reduced by adjusting the thermostat set-point lower

D. The combustion chamber material has degraded from thermal cycling and the internal surface is flaking off producing the carbon-like debris — the combustion chamber assembly must be replaced entirely

120. A truck's HVAC system produces heat from the defroster vents and floor vents but no air comes from the panel (face-level) vents regardless of the mode selector position. The blower motor operates at all speeds. What is the most likely cause?

A. The cabin air filter is severely restricted and the reduced airflow volume cannot reach the upper panel vents because the lower vents consume all the available air volume from the restricted blower output

B. The defrost ductwork has separated from the HVAC plenum and the heated air is escaping into the dashboard cavity before reaching the panel vents creating a warm but non-directed airflow condition

C. The A/C evaporator has frosted over completely and the ice block is physically blocking the airflow path to the panel vents while the lower defroster and floor ducts bypass the evaporator obstruction

D. The mode door actuator has failed or the mode door mechanism is stuck in a position that directs air to the defroster and floor outlets but cannot open the passage to the panel vents at any selector setting

121. A truck's cab heater produces adequate heat at idle but the air outlet temperature drops noticeably when the engine RPM increases to highway cruising speed. Coolant temperature remains constant at both idle and highway speed. What is the most likely cause?

A. The heater core's internal flow restriction worsens at higher coolant flow rates — the increased flow velocity through the partially blocked passages creates turbulence that reduces the heat transfer efficiency

B. The blend door is shifting position from vibration at highway speed moving slightly toward the bypass position and reducing the proportion of air flowing through the heater core during highway operation

C. The increased blower motor speed at highway settings moves more air across the heater core than the restricted coolant flow can heat — the greater air volume dilutes the heat output per unit of air delivered

D. The engine thermostat is cracking open slightly at highway speed from the increased coolant circulation flow rate which sends a portion of the coolant to the radiator reducing the temperature at the heater core inlet

122. An A/C system has a high-side pressure of 2,400 kPa (350 psi) at 32°C ambient temperature. The normal specification is 1,380 to 1,725 kPa (200 to 250 psi). What are the two most likely causes of this elevated high-side pressure?

A. A restricted condenser (blocked with debris or the fan has failed reducing airflow) or a system overcharge that floods the condenser with liquid refrigerant and reduces its effective heat rejection area

B. A failing compressor that is generating excessive discharge pressure from a stuck internal relief valve and a restricted receiver/dryer that is creating backpressure downstream of the condenser outlet

C. A restricted liquid line between the condenser and the expansion valve that traps pressure on the high side and a failing expansion valve that will not meter refrigerant correctly into the evaporator coil

D. A stuck-open expansion valve flooding the evaporator which backs up pressure through the entire system and a clogged cabin air filter that reduces the airflow across the evaporator and condenser coils

123. A truck's APU diesel engine starts and runs normally but produces a noticeable knocking noise after approximately 30 minutes of operation. The noise is not present during the first 30 minutes. What should the technician investigate?

A. The APU engine's lubrication system for oil starvation that occurs as the small oil reservoir's level drops from oil consumption and thermal expansion losses during the 30-minute continuous running period

B. The APU engine's fuel injector for a delayed response characteristic that worsens as the injector's internal components heat up and expand changing the injection timing after 30 minutes of operation

C. The APU engine's coolant circulation for overheating — small APU engines may overheat after extended operation if the cooling circuit is restricted causing thermal expansion that creates the knocking noise

D. The APU engine's mounting bolts for looseness that allows the engine to shift on its mounting bracket — the knocking only manifests after thermal expansion has changed the engine's position on the bracket

124. A hydraulic system on a roll-off container truck has a complaint that the container tilts slowly during the dumping operation. The system pressure is adequate at the relief valve setting. The pump delivers rated flow when tested at the pump discharge. What should the technician check next?

A. The pump drive coupling for slippage that reduces the pump's effective RPM under the sustained load of the tilting operation even though the pump performs normally during a no-load flow meter test

B. The hydraulic oil temperature because hot oil has reduced viscosity that increases internal leakage throughout the system reducing the effective flow available to the tilt cylinder under working pressure

C. The directional control valve for a partially stuck spool that restricts flow to the tilt cylinder work port even though the pump delivers adequate flow and pressure when tested independently at the pump outlet

D. The tilt cylinder for internal piston seal leakage that allows fluid to bypass from the pressure side to the return side reducing the effective flow driving the piston and slowing the cylinder's extension speed

125. A hydraulic system uses a closed-centre directional control valve with a variable-displacement piston pump. When no function is activated, what is the pump doing?

A. The pump continues to run at full displacement and the excess flow is routed through the system relief valve back to the reservoir at maximum pressure generating maximum heat output continuously

B. The pump destrokes to minimum displacement and maintains a low standby pressure — no significant flow is delivered and minimal energy is consumed because the pump adjusts its output to match demand

C. The pump stops rotating because the closed-centre valve blocks all flow and the pump's internal pressure compensator disengages the pump drive coupling from the PTO to prevent overpressurization

D. The pump continues at full displacement but the flow is diverted through an internal bypass circuit within the pump housing that recirculates the oil without sending it to the directional valve circuit

126. A hydraulic crane has a boom that raises smoothly but oscillates (bounces) when the boom reaches the stopping point after the operator releases the control lever. What is causing the oscillation?

A. The boom circuit lacks adequate damping — the counterbalance valve is closing too abruptly when flow is cut off and the trapped oil's momentum creates a pressure wave that bounces the boom at the stop point

B. The boom cylinder has air trapped inside which compresses and rebounds when the flow is cut off creating a spring effect that causes the boom to bounce at the end of travel after the operator releases the lever

C. The directional valve's neutral centre condition has a pressure spike during the spool's transition to neutral that momentarily overpressurizes the boom cylinder causing it to extend slightly before settling down

D. The boom's mechanical structure has a natural frequency that is excited by the sudden stop of hydraulic flow and the boom bounces at its resonant frequency until the oscillation energy is absorbed by friction

127. A PTO-driven hydraulic system has been operating normally for 2,000 hours. The operator reports that the pump has become progressively louder over the past month and the system is running approximately 10°C hotter than its normal operating temperature. What is the most likely cause?

A. The pump's internal clearances have increased from normal wear — the enlarged clearances allow more internal leakage which generates additional heat and the cavitation from the reduced volumetric efficiency produces noise

B. The hydraulic fluid has degraded from oxidation and the breakdown products have increased the fluid's viscosity creating more resistance to flow through the pump which generates both noise and additional heat

C. The PTO drive gear has worn and the backlash between the PTO gear and the transmission gear creates a rhythmic impact noise that the operator perceives as pump noise and the gear mesh friction generates the heat

D. The hydraulic reservoir's oil level has dropped below the pump's inlet port creating a vortex at the suction that entrains air into the pump — the aerated oil cavitates in the pump and generates both noise and heat

128. A hydraulic system's directional control valve has four work ports (A, B, C, D) controlling two separate double-acting cylinders. When cylinder 1 (ports A and B) is extended, cylinder 2 (ports C and D) also moves slightly. What is the most likely cause?

A. The valve body has an internal cross-leak between the A/B and C/D port passages allowing a small amount of pressurized fluid to cross from the active circuit to the inactive circuit through the valve body casting

B. Both cylinders share a common return line and the backpressure created by cylinder 1's return flow elevates the pressure in cylinder 2's return port enough to push its piston and produce the slight movement

C. The pump's flow pulsation creates pressure ripples that propagate through the neutral-centre valve spool passages to the inactive cylinder's ports producing small piston movements in response to each pulse

D. The directional valve spool for the inactive cylinder is not centring perfectly in neutral and a slight displacement of the spool allows a small amount of pump flow to reach the inactive cylinder's work port

129. A hydraulic liftgate platform is stuck in the fully raised position. The operator activates the lower function but the platform does not descend. The hydraulic pump motor does not run when the lower button is pressed. What should the technician check first?

A. The electrical circuit for the lower function — the pump motor relay, the lower button switch, the wiring, and any safety interlocks that must be satisfied before the motor is energized for the lowering operation

B. The manual lowering valve (needle valve) that allows gravity-assisted lowering by releasing trapped oil from the cylinder without requiring pump operation — this valve may resolve the stuck platform immediately

C. The hydraulic cylinder for a mechanical seizure that has locked the platform in the raised position preventing it from moving regardless of whether the hydraulic system provides flow to the lower circuit

D. The liftgate controller for a fault code that has disabled the lower function as a safety measure after detecting an abnormal condition during the previous raise cycle that triggered a protective lockout mode

130. A hydraulic system's pressure gauge reads 0 kPa with the engine running and the PTO engaged. The pump appears to be turning and no unusual noises are heard. The oil level is correct. What is the simplest explanation?

A. The directional control valve is in the neutral position on an open-centre system and the pump flow is returning to the reservoir at near-zero pressure — the gauge reads correctly because no load is applied

B. The pump has catastrophically failed internally and is spinning freely without displacing any fluid creating a zero-pressure condition at the gauge despite the pump shaft rotating at the normal PTO speed

C. The pressure gauge has failed and is stuck at zero — the system may be functioning normally but the gauge is not displaying the actual system pressure due to an internal gauge mechanism failure condition

D. The PTO engagement is incomplete and the pump is not actually rotating even though the PTO indicator light suggests engagement — the coupling between the PTO and pump has sheared internally

131. A hydraulic system's accumulator has been serviced. The technician pre-charges the nitrogen bladder to the specified pressure and then charges the hydraulic side. After several operating cycles, the accumulator does not appear to be storing energy — the system operates as if the accumulator is not present. What was most likely done incorrectly?

A. The nitrogen pre-charge pressure was set too high — the bladder is over-inflated and occupies the entire accumulator volume leaving no space for hydraulic fluid to enter and store energy during operation

B. The accumulator was installed with the hydraulic port facing upward instead of downward which prevents the heavier hydraulic fluid from entering the accumulator from the system pressure port correctly

C. The nitrogen pre-charge pressure was set too low relative to the system working pressure and the hydraulic pressure compresses the bladder completely eliminating its spring-rate energy storage function

D. The accumulator isolation valve was left closed after the pre-charge procedure and the hydraulic system pressure cannot reach the accumulator to charge the hydraulic side for energy storage cycling

132. A battery-electric commercial truck has a complaint of reduced regenerative braking force that varies with outside temperature. On cold mornings, the regenerative braking is noticeably weaker than during the afternoon when the ambient temperature is higher. What is causing this temperature-dependent variation?

A. The friction brake system is applying more force in cold weather which signals the ABS to reduce the regenerative braking contribution to prevent over-braking on the drive axle in cold ambient conditions

B. The traction motor's magnetic properties change with temperature reducing the motor's ability to function as an efficient generator in cold conditions which directly reduces the regenerative braking torque output

C. Cold battery cells have higher internal resistance which limits the maximum charge current they can safely accept — the BMS reduces regenerative braking force to prevent exceeding the cold cell's current limit

D. The inverter's power semiconductors operate less efficiently at cold temperatures reducing the conversion efficiency from the motor's AC generation output to the DC charging input needed by the battery pack

133. A hybrid truck's 48-volt mild hybrid system has a belt-driven integrated starter generator (ISG). The ISG provides engine start-stop functionality and light regenerative braking. The driver reports that the engine no longer restarts automatically after a stop-start event at a traffic light. The engine must be restarted manually with the key. What should be checked?

A. The ISG motor/generator unit for a fault code indicating reduced torque capacity that prevents it from cranking the engine against the compression of the diesel engine during the automatic restart sequence

B. The 48-volt battery for adequate state of charge and health — if the battery cannot provide sufficient current for the ISG to spin the engine fast enough for restart the system disables auto-restart to protect the battery

C. The engine oil pressure sensor for a false low-pressure reading during the stop phase that causes the ISG controller to prevent automatic restart until a manual start confirms oil pressure is available from the pump

D. The ISG belt tensioner for slippage — if the belt cannot transmit the required torque from the ISG motor to the engine crankshaft pulley the ISG spins but cannot crank the engine fast enough for restart

134. A technician is inspecting a battery-electric truck's high-voltage cable routing under the vehicle. Several cable clips have broken and the cables are hanging closer to the road surface than designed. What is the immediate concern?

A. The exposed cables may contact road debris, water, or the road surface itself which could damage the cable insulation and create a high-voltage fault or electrical hazard from insulation compromise

B. The sagging cables will increase aerodynamic drag under the vehicle reducing the vehicle's driving range by an estimated 2-3% due to the disrupted airflow under the battery pack and motor compartment

C. The cables may contact the exhaust system components and the heat from the exhaust could melt the cable insulation creating a short circuit between the high-voltage system and the vehicle chassis ground

D. The cable clips breaking indicates the cable routing design is inadequate for the vehicle's vibration environment and all cables should be rerouted through a different path with industrial-grade cable management

135. A parallel hybrid truck's engine starts unexpectedly while the vehicle is operating in electric-only mode at low speed. The driver did not request engine start and the battery SOC is at 65%. What triggered the engine start?

A. The BMS detected a cell temperature imbalance and started the engine to power the battery thermal management system's heater circuit which requires more electrical power than the battery can self-supply

B. The vehicle's cabin heater was activated and the HVAC system requires engine coolant heat for the cab heater core which triggers an automatic engine start to provide coolant heating capability

C. The propulsion control system determined that the power demand exceeded the electric motor's and battery's combined output capability for the current operating condition and started the engine to assist

D. The 12-volt auxiliary battery voltage dropped below the minimum threshold and the PCS started the engine to drive the alternator and recharge the auxiliary battery before the low voltage caused a system shutdown

Practice Exam 7: Answer Key and Explanations

1. D — Seized injectors can break at the tip during extraction if the wrong adapter or technique is used, leaving the hardened steel tip lodged in the bore — a costly repair requiring cylinder head removal. The correct slide hammer adapter and OEM extraction procedure must be verified before any force is applied.

2. B — Every new lift requires operator training specific to that model's controls, capacity limits, safety lock engagement, emergency lowering procedures, and rated lifting points. Even experienced technicians must be trained on the specific lift because controls, capacities, and safety features vary between manufacturers and models.

3. A — Flare nut wrenches (also called line wrenches) contact five of the six hex flats rather than only two sides like an open-end wrench. Hydraulic fittings are typically made from softer metals (brass, aluminium, or soft steel) and a standard box-end wrench — while it contacts all six flats — cannot slip over the tube. The flare nut design provides maximum contact while accommodating the line.

4. C — The driver reported the washer system was not working before the reservoir went empty, indicating a pre-existing malfunction. Simply refilling the reservoir does not address the root cause — the pump, hoses, and nozzles must be inspected to identify and repair whatever caused the system to stop functioning.

5. A — Working under a loaded trailer creates a crushing hazard from the trailer's full weight. The trailer must be supported on rated jack stands placed at the manufacturer's approved lift points before any suspension component is removed. Hydraulic jacks alone are not adequate support — they can fail, shift, or lose pressure.

6. D — Before installing any brake linings, the technician must verify the part number matches the specific vehicle application including correct dimensions (length, width, thickness), the correct

mounting style (riveted vs bonded, shoe table profile), and the correct friction material rating for the axle position (steer vs drive vs trailer).

7. B — Under-torqued wheel nuts on a new vehicle require all nuts on all wheels to be torqued to the correct specification — not just the three that were found low. The pre-delivery inspection exists to catch exactly this type of condition. Re-torque after the first 80 to 160 km completes the standard wheel installation procedure.

8. C — Diesel fuel is a skin irritant that can cause contact dermatitis with repeated exposure. The correct first aid response is to wash the affected area immediately with soap and water for several minutes to remove all fuel residue from the skin surface and reduce the risk of irritation. Quick removal prevents the fuel from absorbing into the skin.

9. A — Pre-lubrication verifies that oil flows to all critical lubrication points before the engine cranks. Bearing surfaces, cam journals, rocker arms, and the turbocharger all require oil film before any load is applied. Starting an engine with empty galleries risks immediate bearing damage during the seconds before the pump builds pressure.

10. D — With the injector, compression, and valve lash all confirmed good, a less-common cause must be investigated. A misaligned or blocked piston cooling nozzle on that cylinder fails to cool the piston crown, causing localized overheating that changes the combustion chamber geometry, alters piston-to-head clearance, and disrupts the combustion process.

11. B — Tin is a primary component of the overlay material on bimetallic camshaft bearings and some connecting rod bearings. A sudden spike in tin without corresponding increases in other metals suggests the thin tin overlay on one or more cam bearings has worn through, exposing the intermediate copper layer beneath.

12. C — A restricted oil drain line causes oil to accumulate in the turbocharger centre section (bearing housing). The rising oil level increases the pressure on the shaft seals until the oil is forced past them — into the compressor housing (entering the intake tract) and the turbine housing (entering the exhaust). This leads to oil consumption, smoke, and potential carbon buildup.

13. A — Common rail high-pressure pumps compress fuel to extreme pressures (1,600 to 2,500 bar) at high frequency. The internal pistons, check valves, and fuel passages generate significant mechanical

noise that is proportional to RPM. This operational noise is inherent to the design and is normal as long as the pump delivers adequate pressure and the engine performs correctly.

14. D — UV fluorescent dye traces are visible only under a UV lamp and can reveal leaks that are invisible under normal lighting. After running the engine for two hours with the dye in the coolant, the technician should inspect every external gasket surface, hose connection, freeze plug, and component with the UV lamp — the dye will fluoresce at even the smallest leak point.

15. C — The barometric pressure sensor on many ECMs reads atmospheric pressure through a port or vent tube on the ECM housing. If this port is blocked by dirt, a kinked reference hose, or a disconnected vent tube, the sensor reads a lower pressure than actual atmospheric — producing the implausible 85 kPa reading at sea level.

16. B — With blow-by confirmed normal and the CCV filter recently replaced, the crankcase ventilation system is not the problem. The crankcase pressure sensor itself or its connecting hose is the most likely cause — a pinched hose, moisture-blocked port, corroded connector, or failed sensor element produces an inaccurate reading that triggers the fault code.

17. A — The weep hole in a water pump housing is a diagnostic feature designed to indicate seal failure. Coolant dripping from the weep hole confirms that the shaft seal has begun to fail and coolant is bypassing the seal. The pump should be replaced before the leak worsens, potentially causing bearing failure or complete seal blowout that results in rapid coolant loss.

18. D — During normal cruise (no regeneration), the DOC inlet should be equal to or slightly warmer than the outlet because the DOC is simply conducting exhaust heat through its substrate. If the outlet reads higher, an exothermic reaction is occurring inside the DOC — unburned hydrocarbons from incomplete combustion or a fuel leak are oxidizing on the catalyst surface and generating heat.

19. C — Injector number 4 returns 120 ml/min while all others return 30-40 ml/min. This confirms excessive internal leakage specific to injector 4 — fuel is bypassing the injector's precision components and flowing through the return circuit rather than being injected into the cylinder. The injector must be replaced.

20. B — Partially closing the exhaust throttle during regeneration creates exhaust backpressure that increases the engine's pumping work. This additional work converts mechanical energy to thermal

energy, raising the exhaust gas temperature to the 550-650°C needed to sustain soot oxidation in the DPF during the active regeneration cycle.

21. A — Pre-filling the new turbocharger's oil inlet port and centre section with clean engine oil ensures the journal bearings are lubricated from the first moment the shaft begins to rotate. Turbocharger shaft speeds reach 20,000+ RPM within seconds of engine start — dry bearings at these speeds will score and fail within the first operating cycle.

22. D — A smoke puff at a consistent interval regardless of RPM suggests the interval is tied to camshaft rotation (which runs at half crankshaft speed). At idle, the camshaft completes one revolution approximately every 3 seconds. One misfiring cam lobe (worn, damaged, or incorrectly timed) produces one smoke puff per camshaft revolution.

23. C — The most common cause of rapid colour change in new ELC is inadequate flushing of the old cooling system. Residual rust, scale, sediment, and old coolant deposits dissolve into the fresh ELC, discolouring it. The new coolant's additive package is actively cleaning the system, which is doing its job — but the flushing should have removed these contaminants first.

24. B — Oil visible at the rear of the engine can originate from multiple sources that all route to the same visible location. The rear main seal, the oil gallery plug at the rear of the block, the flywheel housing drain hole (which routes oil from the clutch area), and the rear section of the oil pan gasket all channel leaked oil to the lowest point at the rear of the engine.

25. A — If DEF quality, dosing rate, exhaust temperature, and SCR catalyst are all normal, ammonia should be consumed in the SCR reaction. The ammonia slip catalyst (ASC) downstream of the SCR is the final safety net — it oxidizes any excess ammonia that passes through the SCR. A degraded or contaminated ASC cannot perform this function, allowing ammonia to exit the tailpipe.

26. D — One tooth off on the camshaft timing shifts all valve events by several crankshaft degrees. The intake valves open and close late relative to piston position, and the exhaust valves likewise shift. This alters volumetric efficiency, combustion timing, and exhaust gas flow — producing reduced power, altered emissions, rough running, and potentially piston-to-valve contact.

27. C — In severe winter conditions, the combination of maximum cab heater heat extraction and high ram airflow through the radiator at highway speed can remove more heat from the coolant than the engine produces at normal highway load. The thermostat attempts to close fully but the combined heat

rejection exceeds the engine's heat production, causing the temperature to drop below the regulation point.

28. A — The engine cranks, the ECM commands injection, but there is no smoke and zero cylinder contribution. The most efficient single test is a fuel rail pressure measurement during cranking. If the high-pressure pump is not building rail pressure to the minimum injection threshold (despite the ECM commanding injection), no fuel is delivered — explaining the no-smoke, no-contribution condition.

29. A — A DPF that reloads to near-capacity within 500 km after a successful cleaning has an upstream engine condition generating excessive soot. Common causes include a stuck-open EGR valve (displacing oxygen and promoting incomplete combustion), retarded injection timing, a turbocharger fault (reducing air charge), or an intake restriction — all produce more soot than the engine's design allows.

30. D — A "mushy" brake pedal with adequate gauge pressure and no air leaks points to excessive pushrod stroke on one or more brake chambers. Excessive stroke means the linings are far from the drum surface and the chamber must fill a larger volume of air before the diaphragm pushes the linings into contact — creating the mushy, delayed feel.

31. B — The rust-preventive oil coating on new brake drums must be cleaned from the friction surface before installation. Oil left on the drum surface will transfer to the new brake linings during the first applications, contaminating the lining material permanently. Contaminated linings produce reduced friction, inconsistent braking, and glazing.

32. A — The air line from the governor's unloader port to the air dryer purge valve signals the dryer to purge when the compressor unloads. If this line was not reconnected during the compressor installation, the dryer never receives the purge signal and cannot regenerate its desiccant — even though the compressor builds and maintains system pressure normally.

33. C — Inconsistent trailer braking with normal tractor brakes and no ABS fault points to the service signal path between the tractor and trailer. The blue (service) gladhand connection is the junction where the tractor's service signal transfers to the trailer. Intermittent sealing at this connection — from a worn gasket, misaligned coupling, or contaminated sealing surfaces — produces variable pressure delivery.

34. D — A 1.0 mm thickness variation at eight measurement points around the rotor circumference indicates the rotor is not uniformly thick — it has parallelism error. As the thick and thin spots rotate

through the brake pads, the caliper piston is pushed in and out, transmitting a pulsation to the brake pedal. The rotor must be machined to uniform thickness or replaced.

35. B — The spring brake pushrod stroke determines whether the spring's force can push the linings firmly against the drum. If the stroke is excessive (the linings are too far from the drum when released), the spring extends the pushrod but the linings may not contact the drum with adequate force to hold the loaded vehicle on a steep grade. Adjusting the stroke restores holding force.

36. A — The S-cam shaft should rotate freely through its entire working range when disconnected from the slack adjuster. Stiffness after 30 degrees indicates the cam shaft bushings are seized or severely worn — the cam shaft is binding in the bushing bore. The air chamber must overcome this friction during every brake application, which reduces braking effectiveness and accelerates wear.

37. C — The EBS rear modulator has failed in a mode that delivers higher pressure than commanded. The EBS controller sends a proportional pressure command, but the stuck modulator delivers full pressure regardless. The result is rear brakes that apply more aggressively than the driver requests during light pedal applications.

38. B — A one-way check valve that allows air to flow freely in both directions has failed — it cannot prevent backflow. If the upstream supply loses pressure (from a leak or compressor failure), the downstream reservoir will drain backward through the failed valve. The check valve must be replaced to restore the one-way flow protection for the downstream circuit.

39. B — The low-air-pressure warning switch has an intermittent electrical fault — the switch contacts or wiring are making and breaking contact from vibration during highway driving. The air gauges confirm normal pressure during the events, ruling out an actual pressure drop. The switch or its wiring should be tested and replaced.

40. B — The brakes were applied firmly on a wet road, the ABS activated, and the braking event was sustained. The burning smell comes from the brake lining material overheating during the hard braking event — the friction surfaces reached temperatures that begin to decompose the organic binders in the lining material, producing the characteristic burning odour.

41. A — The automatic moisture ejector (spitter valve) opens briefly during each compressor unload cycle to expel moisture from the supply tank. If the valve's piston seal has worn, the valve cannot fully

close after the ejection cycle and continues to leak air between cycles. The worn seal allows continuous air passage through the valve body.

42. C — The foot valve or the proportioning system that controls front-to-rear brake distribution is delivering excessive pressure to the front axle circuit during light applications. The front disc brakes, which are inherently more responsive than drum brakes, amplify this disproportionate pressure into the aggressive grab the driver experiences.

43. A — A wheel speed sensor air gap of 3.5 mm against a specification of 0.5-1.5 mm is far too large. The most common cause is excessive wheel bearing end play — the hub (with its integral tone ring) moves away from the sensor during rotation. Worn bearings allow the hub to shift axially, dynamically increasing the effective air gap beyond the sensor's detection range.

44. A — During braking, the vehicle's weight transfers forward from the deceleration force. This dynamic weight transfer increases the vertical load on the front steer axle tires, which increases their traction limit. The heavier front tires can absorb more braking force before lockup, while the lightened rear drive axle tires reach their reduced lockup threshold sooner.

45. D — The inversion valve begins modulating when the supply air pressure drops below the threshold where the spring brakes start to apply. Instead of the springs applying at full force suddenly, the inversion valve meters the air release from the spring brake chambers proportionally — providing gradual, controllable emergency braking force as the system pressure continues to decline.

46. A — New brake linings contact the drum surface only at their high points initially — the manufacturing surface finish has not yet conformed to the drum's contour. The concentrated contact at these high points can produce a squeal from the intermittent grab-and-release at the microscopic level. As the linings bed in and full contact develops, the squeal disappears.

47. C — An 85-amp load from a 160-amp alternator represents approximately 53% of the alternator's rated capacity (85 ÷ 160 = 0.53). This is a normal operating load that provides adequate reserve for battery maintenance charging, transient load spikes from compressor clutch engagement, and any additional accessories that may be activated during operation.

48. B — Rolling bars (horizontal lines) on a video display that develop after warmup indicate a power supply filtering issue that worsens with temperature. As the camera or display heats up, an internal filter

capacitor's value changes, allowing AC ripple or power supply noise to modulate the video signal. The affected component (camera or display) needs replacement.

49. D — An intermittent no-crank that occurs only when the engine is hot points to a temperature-sensitive component in the start control circuit. The neutral safety switch, ignition switch, start relay, or a wiring connector develops increased internal resistance when heated, which interrupts the low-current control circuit. When the component cools, the resistance drops and the circuit functions normally.

50. A — FMI 4 (voltage below normal) on an NTC sensor with a 5-volt reference means the ECM sees near-zero voltage on the signal wire. A short to ground in the signal wire or a shorted sensor element pulls the voltage to ground potential. The ECM reads this as an extremely high temperature because NTC resistance drops with heat — near-zero resistance means extremely hot.

51. C — The mirror heater fuse is good and the switch illuminates (confirming power to the switch). If both heaters are inoperative, the fault is in the shared power delivery circuit downstream of the switch — the heater relay, the feed wire from the relay to the mirror connectors, or a common connection point. This is the circuit between the confirmed-good switch and the heaters.

52. B — The replacement ECM was installed and the engine runs (the basic calibration is functional), but the cruise control does not work. ECMs are shipped with default feature configurations, and the cruise control function is commonly disabled by default. The customer parameter for cruise control must be enabled during the ECM setup programming.

53. A — A 0.8-volt drop between the alternator B+ terminal and the battery positive terminal under moderate load indicates excessive resistance in the charging cable or its connections. Normal voltage drop for the charging circuit should be less than 0.3 volts. Corroded terminals, damaged cable, or loose connections are consuming 0.8 volts that should reach the battery.

54. D — The TCM operates normally and has no fault codes, but the ECM reports no TCM data on the J1939 bus. On many commercial vehicle architectures, the TCM communicates on a private CAN bus with a gateway module that translates data to the J1939 bus for the ECM. If the gateway has failed, the TCM's data cannot reach the ECM even though the TCM functions normally on its own bus.

55. B — With correct aim, clean lenses, and identical truck models, the most common cause of reduced headlamp brightness is an incorrect bulb. A lower-wattage bulb produces proportionally fewer lumens. Verifying the bulb part number against the vehicle specification ensures the correct wattage is installed.

56. D — FMI 0 (data above normal / voltage above normal) on an injector circuit means the ECM is detecting higher voltage on the circuit than expected during the injector's off period. A short to the 12-volt power supply wire in the harness backfeeds external voltage into the ECM's measurement circuit, producing the high-voltage reading.

57. A — Without the battery equalizer, the 12-volt mid-point tap voltage depends on the relative state of charge of the two series batteries. As the batteries charge and discharge unevenly (from different loads, temperatures, or aging), the mid-point voltage shifts unpredictably — sometimes above 12V and sometimes below — creating erratic voltage at the 12-volt accessories.

58. B — A single LED marker lamp glowing dimly when all circuits are switched off indicates current backfeeding through a shared ground wire. If the LED's ground is connected to the same point as a circuit that remains energized (such as a trailer charge wire or a timer circuit), current flows backward through the common ground into the LED — enough for the efficient LED to glow visibly.

59. A — The wiper park function uses an internal cam-operated switch that keeps the motor running after the dash switch is turned off until the wipers reach the park position. When the wipers reach home, the park switch opens, de-energizing the motor at the correct position. A failed park switch circuit cannot detect the home position and cannot command the motor to continue running to park.

60. D — The scan tool commands the EGR valve to 0% (fully closed) but the actual position reads 5% open. The valve is physically stuck slightly open — carbon deposits on the valve pintle, seat, or bore are preventing the last 5% of closure. The carbon must be cleaned from the valve and its seating surfaces to restore full closure capability.

61. A — Voltage is present at the socket's positive contact (12V confirmed), and if the fuse is good, the supply circuit is intact. The most likely cause is a lost ground connection — the socket's ground contact (the outer shell) has corroded, loosened, or the ground wire has broken. Without a ground return path, current cannot flow through any connected accessory.

62. C — The ECM receives and acknowledges the torque reduction request (confirming CAN communication works) but does not execute it. The ECM's torque reduction mechanism — the fuel metering unit, electronic throttle, or whatever actuator reduces engine output — has a fault that prevents the physical torque reduction from occurring despite the ECM's intention to comply.

63. D — Brief speed spikes at a consistent rotational position suggest a tone ring defect. A cracked section or a damaged area where teeth are closer together than normal produces closely-spaced pulses as that section passes the sensor. The ECM interprets the rapid pulses as a momentary high speed, then the reading returns to normal as undamaged teeth pass.

64. B — Normal voltage with elevated current (12A vs 8A rated) indicates the motor is working harder internally. Worn brushes, corroded bearings, or a binding armature create increased mechanical friction that the motor must overcome by drawing more current. The pump delivers adequate output but the motor consumes excess energy to do so.

65. A — The secondary alternator produces 13.0V which is below the normal charging range (13.8-14.5V for a 12V system). With verified belt and wiring, the voltage regulator is the most likely cause — either a corroded field circuit connector reduces the excitation current, or the regulator itself has failed and cannot drive the field coil to produce full output.

66. B — CAN bus wires (CAN-H and CAN-L) must maintain their twisted-pair configuration through the entire bus length. The twist creates differential signal cancellation that rejects electromagnetic interference. Butt connectors create an untwisted section that disrupts this cancellation, allowing noise to corrupt the differential signal at the splice location.

67. A — Aftermarket telematics devices connected to the CAN bus diagnostic port can broadcast proprietary messages that conflict with standard J1939 PGN addresses. The engine ECM receives these non-standard messages and cannot process them correctly, setting communication fault codes. The codes clear when the bus traffic pattern temporarily resolves the conflict.

68. B — The tail lamps work (proving the connector is partially seated and the tail lamp circuit contacts are made), but the brake and turn signals do not. Many multi-pin lamp connectors are designed so that partial insertion engages some pins but not all. The tail lamp pins contact first at partial insertion, but the brake and turn signal pins require full connector engagement to make contact.

69. A — A vibration felt through the clutch pedal only during the initial engagement phase that disappears when fully engaged is caused by flywheel runout. As the clutch disc contacts the flywheel's high and low spots during the partial-engagement phase, the disc oscillates. Once fully clamped between the flywheel and pressure plate, the clamping force eliminates the oscillation.

70. D — The 4th-to-5th shift on an 18-speed transmission requires a simultaneous main box gear change and a range shift from low to high. The range air shift cylinder must complete its travel within the time window of the shift — if the range mechanism has a fault (slow air cylinder, restricted air supply, worn synchronizer), it cannot complete the combined shift.

71. A — The main box synchronizer for the 4th-to-5th change must match a larger RPM differential than most other shifts because this shift crosses the range boundary, meaning the input-to-output speed relationship changes significantly. A worn synchronizer cannot friction-match this large speed differential in the available time.

72. C — A truck with excessive front drive axle tire wear compared to the equally loaded rear drive axle has an axle alignment problem. Worn torque rod bushings on the front drive axle allow the axle to shift position under acceleration and braking forces, changing its alignment relative to the frame and producing lateral tire scrubbing wear.

73. A — Before removing the pinion nut, the technician must mark the nut position and count exposed threads to record the exact bearing preload setting. When reassembled, the nut must be returned to the identical position to restore the original preload. Changing the nut position even slightly changes the bearing preload, which affects gear mesh and bearing life.

74. D — Gradual increase in clutch pedal effort without leaks, with normal engagement, points to increasing friction in the hydraulic actuation system. The master cylinder bore develops internal corrosion over time from moisture absorption in the hydraulic fluid. The corroded bore surface increases the friction between the piston seal and the cylinder wall.

75. C — The front wheel disconnect hub has not fully engaged and the front driveshaft is spinning the front axle's ring and pinion gears while the wheel hubs are not locked to the axle shafts. The grinding results from the disconnect mechanism being partially engaged — the sliding clutch teeth are riding against each other rather than fully meshing.

76. A — Driveshaft balancing adds counterweights that correct imbalance at lower speeds. However, these weights change the shaft's mass distribution, which can shift the critical speed (the natural bending frequency) from above the operating range to within the highway speed range. The shaft now resonates at the new critical speed.

77. B — A lockup clutch showing 150 RPM slip at highway cruise could indicate either a failing clutch or a deliberate TCM strategy. Many Allison transmissions use controlled slip lockup as a programmed strategy to reduce driveline harshness during cruise. The scan tool's TPS data or the TCM's commanded lockup state confirms whether the slip is commanded (normal) or uncommanded (fault).

78. D — On a full-floating axle, the axle shaft transmits torque only — it does not support the vehicle's weight. The wheel is mounted on a hub that rides on bearings pressed onto the axle housing spindle. If the axle shaft breaks, the vehicle loses drive power to that wheel but the wheel remains securely mounted on the housing spindle.

79. A — Shift lever vibration proportional to engine RPM that decreases when the clutch pedal is depressed (disconnecting the engine from the transmission) indicates the vibration source is the engine's torsional pulses transmitting through the input shaft. Deteriorated shift tower isolator bushings allow these pulses to reach the shift lever instead of being damped.

80. B — A rhythmic thump at low speed that disappears above 30 km/h suggests an impact once per wheel revolution. A worn wheel bearing with a damaged roller produces a single impact per revolution at low speed. Above 30 km/h, the increased frequency blends into continuous noise masked by wind and road noise.

81. B — The intermediate plate has drive pins or lugs that engage machined slots in the flywheel. This mechanical connection forces the intermediate plate to rotate with the flywheel (at engine speed) while allowing it to slide axially between the two friction discs during clutch engagement and disengagement. The plate rotates with the flywheel, not with the discs.

82. C — A vibration only under sustained uphill load with normal driveshaft, U-joints, and balance suggests the powertrain shifts under the increased torque demand. Worn rear axle carrier bearings allow the ring gear to deflect away from the pinion under the higher torque, changing the gear mesh pattern from its correct position and producing vibration from the altered contact.

83. A — Cold, thick transmission fluid creates higher resistance in the torque converter's fluid coupling and in the clutch apply circuits. The pump must work harder to move the thicker fluid through the valve body passages, and the clutch apply circuits fill more slowly. The momentary slip during cold operation resolves as the fluid warms and thins to its design viscosity.

84. D — The compression brake slave piston lash is set relative to the camshaft base circle diameter. A replacement camshaft may have a slightly different base circle dimension than the original. If the lash is not readjusted using the new camshaft's base circle as the reference, the effective lash changes — too tight produces excessive noise, too loose reduces braking force.

85. D — Same explanation as above — this is the root cause question. The lash must be readjusted to the OEM specification using the new camshaft's actual base circle as the measurement reference. The noise results from the lash being incorrect relative to the new cam profile.

86. C — The power steering pump pressure relief valve opening prematurely at high RPM due to a weakened spring would explain why the steering becomes stiff above 2,500 RPM. The weakened spring allows the valve to open at a lower pressure than designed, diverting pump output away from the steering gearbox when the pump output force exceeds the spring's capacity.

87. A — Opposite wear patterns on the left and right steer tires — one showing toe-out wear and the other showing toe-in wear — indicate the steer axle is tracking at an angle to the vehicle's direction of travel. This is a thrust angle issue where the axle is not perpendicular to the vehicle centreline, dragging each tire at a different angle.

88. D — Unequal frame diagonal measurements after a rear-corner collision confirm diamond damage — the frame has been shifted into a parallelogram shape. The right rear corner has been pushed forward relative to the left, twisting the entire frame. The frame must be straightened by a qualified frame repair facility to restore equal diagonals.

89. B — When the height control valve correctly reads the current height as correct and the air bags are at maximum pressure but the ride height is still 20 mm low, the suspension cannot support the current load. The vehicle is likely overloaded beyond the air ride system's maximum capacity.

90. A — Different tire brands can have different conicity (a manufacturing characteristic where the tire tends to steer in one direction), different rolling resistance, and different tread compound characteristics. These asymmetric properties between mismatched tires create a directional pull even with correct alignment. Matching brand and model on steer axles is recommended.

91. D — Lock pin retraction problems with confirmed air pressure at the release valve require investigating the complete system — the actuator air lines for restriction, the pins themselves for

corrosion or mechanical binding, and the track holes for debris or ice. Any single point of failure in this chain prevents pin retraction despite adequate supply pressure.

92. B — Two stud failures at the same position within 6 months, both at the stud-to-hub transition (the highest stress point), strongly suggests chronic over-torquing. Excessive torque pre-stresses the studs beyond their fatigue endurance limit, and normal service loads then cycle the already-overstressed material to failure at the stress concentration point.

93. C — Both rear axle air bags are equally low with adequate supply pressure. The height control valve linkage for the rear axle determines when the valve reads "correct height." A bent arm, worn pivot, or incorrect arm length causes the valve to interpret the low condition as correct, so it never adds air to compensate for the 30 mm deficit.

94. A — Trailer TPMS sensors are radio transmitters that must be paired (programmed) with the tractor's TPMS receiver. Each trailer has unique sensor IDs that the receiver must recognize. Without pairing, the receiver does not know which radio signals belong to the connected trailer and cannot display the trailer tire pressure data.

95. D — The sector shaft over-centre adjustment is designed to provide zero lash at the straight-ahead (centre) position with progressively increasing clearance as the sector rotates off-centre. Over-tightening the adjustment eliminates the designed off-centre clearance, causing the gears to bind when the steering is turned away from centre.

96. C — Unitized (sealed, pre-adjusted) bearings cannot be serviced, adjusted, lubricated, or repaired. Any detectable roughness indicates internal damage to the rolling elements or races that will only worsen because the sealed design prevents inspection and correction. The entire unitized assembly must be replaced.

97. B — A cracked leaf spring leaf is a structural failure that will eventually propagate to complete fracture. A broken leaf changes the spring's load distribution and rate, potentially allowing the axle to shift. The entire spring assembly should be replaced because individual leaf replacement does not restore the spring's designed characteristics.

98. A — Adjusting the drag link length to centre the steering wheel changes the relationship between the pitman arm position and the steering arm position. If the drag link is lengthened or shortened too much,

the pitman arm reaches its internal stop (sector shaft end-of-travel) on one side before the steering arm reaches the axle stop, reducing the maximum steering angle on that side.

99. A — The steering torque sensor measures the force (torque) the driver applies to the steering wheel through a torsion bar in the steering column. The EPS controller uses this torque input to determine how much electric motor assist to provide — more driver effort triggers more motor assist. Without this input, the controller cannot calculate the correct assist level.

100. B — Rubber dust and shredded material on the inner liner surface beneath the tread is the hallmark of extended underinflated operation. Insufficient inflation causes the sidewalls to flex excessively, and the collapsed tire carcass allows the inner liner to fold against the belt edges during each rotation, abrading the liner surface over thousands of revolutions.

101. A — A small amount of oil migrating past a new seal during the initial break-in period is common. The new seal lip seats against the spindle surface during the first few hundred kilometres. The oil migrates into the spindle bore rather than dripping externally. Rechecking the level and topping up is the appropriate response.

102. A — New brake linings have a manufactured surface finish that does not perfectly conform to the drum's contour. Initial contact is concentrated on the high spots of both the lining and drum surfaces, producing uneven braking force per wheel revolution. As the linings bed in and develop full contact with the drum, the vibration disappears.

103. D — With equal loading, equal tire inflation, and normal bearing and brake temperatures, the remaining variable is the gear mesh inside the axle. Shifted carrier bearings from wear change the ring and pinion contact pattern, creating higher mesh friction in the axle with the incorrect pattern. The additional friction generates measurable heat above the properly adjusted axle.

104. B — A single thump from one cab corner when crossing large bumps indicates the cab hits its mechanical travel limit at that corner. A failed shock absorber with a dead spot or failed valving allows the cab to accelerate through its travel uncontrolled until it impacts the bump stop — producing the distinct single thump on large inputs.

105. A — A constant wind rushing sound proportional to vehicle speed with all doors and windows closed points to deteriorated door seals or window weatherstripping. Over time, rubber seals compress,

harden, crack, and lose their flexibility. The resulting gaps allow wind noise to penetrate the cab at highway speed through the reduced sealing effectiveness.

106. C — The cab tilt cylinder's flow control valve (lowering check valve) regulates the descent speed by restricting the oil return rate as the cylinder retracts. A worn valve seat or stuck plunger allows uncontrolled flow during the final portion of the stroke when the cab's weight accelerates the descent — the valve cannot restrict flow adequately and the cab drops suddenly.

107. D — A mirror that vibrates at highway speed despite being physically secure has a resonant frequency that is excited by the aerodynamic forces at that specific speed. The mirror's aerodynamic profile creates a vortex pattern that oscillates at the same frequency as the mirror assembly's natural vibration, amplifying the movement into a visible oscillation.

108. B — A door that closes and latches properly at the striker but has a gap at the bottom edge has sagging hinges. The worn hinge pins and bushings allow the door to drop at the free (bottom) edge. The latch may still engage because the striker is at the door's mid-height, but the bottom of the door has dropped below the door frame seal contact line.

109. D — A new compressor was installed but the system was not properly evacuated before recharging. Residual air trapped in the system acts as a non-condensable gas that occupies space in the condenser, reducing its effective heat rejection area. The air-contaminated system produces lower-than-normal pressures on both sides and significantly reduced cooling capacity.

110. B — The trailer brakes release sluggishly compared to the tractor. The trailer relay valve is responsible for rapidly releasing application air from the trailer brake chambers. A restricted exhaust port, worn internal components, or contamination inside the relay valve slows the air release rate, delaying the trailer brake release relative to the faster tractor system.

111. A — A refrigerated trailer with a punctured insulation panel and compromised vapour barrier allows warm, moist ambient air to infiltrate the cargo space. This heat infiltration increases the TRU's workload and fuel consumption, and the moisture increases evaporator ice formation. The insulation integrity is critical for maintaining temperature-controlled cargo conditions.

112. C — The extend cylinder works (confirming hydraulic pressure and flow are available), the pump runs, and the valve shifts, but the tilt cylinder does not move. The most likely cause is a mechanical

disconnection — the tilt cylinder's piston rod is no longer attached to the platform's tilting mechanism, so the cylinder extends into space without actuating the tilt function.

113. D — Federal regulations require conspicuity tape on the rear (full width, alternating red and white), both sides (as close to the front as practical), and the upper rear corners (pairs of white reflective markers). This comprehensive marking ensures the trailer is visible from behind and from the side during nighttime and low-visibility conditions.

114. B — A steerable rear trailer axle requires a self-centering mechanism with adequate force to return the axle to straight-ahead during highway driving. If the centering mechanism is too weak for the dynamic forces at highway speed, the axle wanders from road irregularities. A stronger centering mechanism or a steering damper may be needed.

115. A — Cracked welds on stake pockets compromise those specific securement points but do not necessarily indicate frame damage. The trailer can operate if the damaged pockets are not used for securement and the load is secured using only the undamaged points. The cracked welds must be repaired before those stake pockets are used again.

116. B — Missing mud flaps are a regulatory violation in most Canadian jurisdictions and will result in a citation during roadside inspection. Additionally, the missing flaps spray road debris and water directly onto following vehicles, creating a safety hazard — particularly on wet or gravel roads where the spray reduces visibility for drivers behind the trailer.

117. C — The compressor cycling in a regular 20-seconds-on, 5-seconds-off pattern with normal pressures during the on cycle is controlled by the evaporator temperature sensor or pressure cycling switch. This component cycles the compressor to prevent the evaporator surface from reaching freezing temperature and forming ice that would block airflow.

118. B — An elevated low-side pressure (345 kPa vs 207 kPa normal) with a normal high-side pressure indicates the compressor cannot pull the suction pressure down to the normal level. Worn internal components (piston rings, valve plates, or scroll elements) allow refrigerant to leak internally from the high-pressure discharge side back to the low-pressure suction side.

119. A — Significant soot and carbon buildup in the combustion chamber indicates the fuel-to-air ratio is incorrect — the heater is not achieving complete combustion. The cause must be identified: a

restricted combustion air intake, a worn or clogged fuel nozzle, low fuel metering pump pressure, or a blocked exhaust outlet. The chamber must be cleaned and the root cause corrected.

120. D — The blower operates (ruling out a blower fault), and heat is available at the defroster and floor (ruling out a heater core or coolant problem). The air is not reaching the panel vents because the mode door is stuck or its actuator has failed in a position that directs air only to the defroster and floor outlets without opening the panel vent passage.

121. C — The heater core produces adequate heat at idle (low blower speed moves less air across the core) but the outlet temperature drops at highway speed (higher blower speed moves more air across the core). The increased air volume passing over a restricted heater core with limited coolant flow cannot be heated to the same temperature.

122. A — Two conditions commonly produce elevated high-side pressure: a restricted condenser (debris blocking the fins or a failed condenser fan reducing airflow, which prevents adequate heat rejection) and a system overcharge (excess refrigerant floods the condenser with liquid, reducing its effective heat rejection area and raising the high-side pressure).

123. D — An APU diesel engine that develops a knocking noise after 30 minutes of operation is likely overheating. Small APU engines have limited cooling capacity, and a restricted coolant circuit, low coolant level, or failed cooling fan can allow the engine temperature to rise over 30 minutes to the point where thermal expansion changes internal clearances and produces the knocking noise.

124. D — The pump delivers rated flow at the pump discharge (ruling out a pump problem) and pressure is adequate at the relief valve (ruling out a pressure problem). The slow tilt must result from lost flow between the pump and the cylinder. The tilt cylinder's internal piston seal is the most likely cause — fluid bypasses the piston internally, reducing the effective flow driving the piston.

125. B — In a closed-centre system with a variable-displacement piston pump, the pump automatically adjusts its displacement to match system demand. When no function is activated, the pump destrokes to minimum displacement and maintains a low standby pressure. The system consumes minimal energy in standby because the pump delivers only enough flow to maintain the pressure setting.

126. A — Boom oscillation at the stopping point when the operator releases the control indicates the counterbalance valve is closing too abruptly. The sudden flow cutoff traps the oil's momentum as a

pressure wave that bounces between the valve and the cylinder — extending the boom slightly, then the valve reopens, then closes again, creating the oscillation until the energy dissipates.

127. C — Progressive increase in pump noise and system temperature over the past month indicates a condition that is worsening over time. A PTO gear mesh problem or fluid degradation would produce relatively constant symptoms. A drop in reservoir oil level creates a vortex at the suction that entrains air — the aerated oil cavitates in the pump (noise) and the air-laden oil generates friction heat (temperature rise).

128. B — Both cylinders share the same valve body. If pump flow intended for cylinder 1 also slightly reaches cylinder 2, an internal cross-leak in the valve body between the two circuits is the cause. A casting porosity, a worn bore, or a crack between the A/B and C/D port passages allows pressurized fluid from the active circuit to bleed into the inactive circuit.

129. A — The pump motor does not run when the lower button is pressed. Before investigating the hydraulic components, check the electrical circuit — the relay, switch, wiring, and safety interlocks. If the motor cannot energize, no hydraulic flow is produced regardless of valve or cylinder condition. The electrical fault must be resolved first.

130. D — On an open-centre system, the gauge reading 0 kPa with the DCV in neutral is completely normal. The pump flow circulates freely through the open-centre spool passage back to the reservoir at near-zero pressure because no load is applied. The gauge correctly reads the low return-line pressure of the unloaded open-centre circuit.

131. C — The nitrogen pre-charge was set too low. When the hydraulic system pressurizes the accumulator, the low-pressure nitrogen bladder is compressed completely — the bladder is crushed flat against the gas end cap. With the bladder fully compressed, there is no spring-rate energy storage — the accumulator is simply full of incompressible hydraulic fluid and cannot store or release energy.

132. D — Cold lithium-ion cells have significantly higher internal resistance than warm cells. The BMS monitors the cells' ability to accept charge current and reduces the regenerative braking force when cold cell resistance would cause the charge current to exceed the safe limit. As the cells warm during operation, their resistance drops and the BMS allows more regenerative braking.

133. B — The ISG requires the 48-volt battery to supply adequate current for cranking the diesel engine. If the 48-volt battery's state of charge or health is insufficient, the ISG cannot spin the engine fast

enough for automatic restart. The ISG controller disables auto-restart to prevent incomplete cranking attempts that could damage the starter-generator.

134. A — High-voltage cables that have dropped from their designed routing and hang closer to the road surface are at immediate risk of contact with road debris, water, ice, curbs, or the road surface itself. Any contact can damage the cable insulation, compromising the 300-800 VDC insulation barrier and creating a potentially lethal electrical hazard.

135. C — The propulsion control system monitors multiple inputs to determine when engine start is needed. A power demand that exceeds the electric motor and battery's combined output capability triggers an automatic engine start — even at 65% SOC, the instantaneous power demand (such as a sudden acceleration request or a steep grade) may exceed the electric-only capability.