

PRACTICE EXAM 5: RED SEAL 310T SIMULATION (135 QUESTIONS)

1. A technician is working on a truck's exhaust system and must cut through a rusted exhaust pipe near the diesel particulate filter. The DPF was regenerated earlier that day. What specific hazard must the technician consider before cutting?

- A. The DPF substrate may release asbestos fibers when the exhaust system is disturbed by the cutting operation
- B. The exhaust pipe near the DPF may contain accumulated diesel fuel that will ignite when contacted by the cutting tool
- C. The DPF and surrounding exhaust components may still be at extremely high temperatures from the recent regeneration event, creating a severe burn hazard and a fire risk if the hot components contact combustible materials
- D. The DPF's catalyst coating releases toxic fumes when heated by a cutting tool that must be captured by a dedicated fume extraction system

2. A technician is tasked with replacing a windshield on a heavy-duty truck. The urethane adhesive manufacturer specifies a minimum cure time of 6 hours before the vehicle can be driven. The shop foreman asks the technician to release the truck after only 2 hours because the customer is waiting. What should the technician do?

- A. Refuse to release the vehicle before the specified cure time, explaining that the windshield is a structural component and an uncured adhesive bond could fail in a collision or allow the windshield to separate during driving, creating a safety hazard for the occupants and other road users
- B. Release the vehicle with a written disclaimer that the shop is not responsible for any adhesive failure before the full cure time
- C. Apply a fast-cure accelerator spray to the adhesive and release the vehicle after an additional 30 minutes
- D. Release the vehicle with instructions for the driver to avoid highway speeds until the following morning

3. A technician working under a raised vehicle notices hydraulic fluid slowly dripping from the hoist cylinder. The vehicle is currently supported by the hoist at full working height. What is the immediate safety concern and correct action?

A. The dripping fluid is a routine maintenance issue that should be noted for repair at the next hoist service interval

B. The fluid drip indicates a minor seal weep that will not affect the hoist's ability to hold the vehicle safely

C. The technician should place a drip pan under the leak and continue working since the mechanical safety locks are engaged

D. The technician must stop all work, lower the vehicle to the ground if the mechanical safety locks can maintain the vehicle safely during the lowering process, and remove the hoist from service until the leak is repaired — a leaking hoist cylinder indicates a potential failure that could allow the hoist to descend unexpectedly

4. A shop has a designated smoking area located 10 metres from the building entrance. A technician is carrying a container of brake cleaner (a flammable solvent) past the smoking area on the way to the parts washer. What hazard is present?

A. The brake cleaner container will absorb cigarette smoke odor that will contaminate the solvent for future use

B. The flammable vapors from the brake cleaner can be ignited by the lit cigarettes or other ignition sources in the smoking area, creating a flash fire hazard as the technician passes through the area with the open or partially sealed container

C. The brake cleaner will react chemically with cigarette smoke and produce a toxic gas in the outdoor environment

D. The smoking area's proximity to the building entrance violates fire code requirements for designated smoking locations

5. A technician needs to remove a set of dual tires from a heavy-duty drive axle. The tires are inflated to 110 psi. Before loosening the wheel nuts, what must the technician verify?

- A. The tire valve cores are functional and will not leak when the tire is removed from the wheel
- B. The tire tread depth meets the minimum specification before the tires are removed from the vehicle
- C. The brake drums are cool enough to handle before the wheels are removed from the hub
- D. The vehicle is on a level surface, the opposite wheels are chocked, and the vehicle is properly supported by jack stands or a hoist rated for the vehicle's weight — the tires should never be removed while the vehicle is supported only by a hydraulic jack

6. A technician is arc welding a bracket onto a truck frame rail. The frame rail is coated with undercoating material. Before welding, what must the technician do?

- A. Remove the undercoating from the weld area and surrounding surfaces because undercoating is combustible and can produce toxic fumes when heated by the welding arc, and the coating prevents proper weld penetration and fusion to the base metal
- B. Apply an additional layer of undercoating over the weld area after welding to prevent corrosion at the weld joint
- C. Adjust the welder to a higher amperage setting to burn through the undercoating and achieve adequate penetration
- D. Verify that the undercoating is an approved weldable type by checking the product's Safety Data Sheet before proceeding

7. A technician is performing a repair that requires removing the truck's batteries from the battery box. The batteries are 12-volt flooded lead-acid type. What is the correct disconnection sequence?

- A. Disconnect the positive cable first, then the negative cable, to prevent voltage backfeed through the vehicle's chassis
- B. Disconnect both cables simultaneously by having two technicians work on the positive and negative terminals at the same time
- C. Disconnect the negative (ground) cable first, then the positive cable — this sequence prevents accidental short circuits because if the wrench contacts the frame while removing the negative cable, no circuit is completed since the frame is already the negative path

D. The disconnection sequence does not matter as long as the battery disconnect switch has been turned off first

8. A shop is equipped with an automatic fire suppression system (sprinkler system). A technician notices that several boxes of paper shop manuals and cardboard packaging materials have been stacked directly below a sprinkler head, within 18 inches of the deflector. What is the concern?

A. The cardboard will absorb moisture from the sprinkler head during normal conditions and degrade the manuals

B. The stacked materials obstruct the sprinkler's spray pattern, preventing the water from reaching the fire area below and potentially allowing a fire to grow unchecked in the obstructed zone — a clearance of at least 18 inches must be maintained below sprinkler heads to ensure unobstructed spray coverage

C. The materials will catch fire from the heat of the sprinkler head's thermal element during normal building temperature fluctuations

D. The weight of the stacked materials may damage the sprinkler piping and cause an accidental discharge

9. A heavy-duty diesel engine equipped with a common rail fuel injection system has a diagnostic fault code indicating "Fuel Rail Pressure — Deviation from Commanded." The code becomes active only during hard acceleration from a stop. At idle and light loads, the system functions normally. What is the most likely cause?

A. The rail pressure sensor is reading incorrectly at higher pressures due to a calibration drift that only manifests at elevated pressure levels

B. The electronic fuel injectors are leaking internally at a rate that only exceeds the pump's supply capacity during high fuel demand acceleration events

C. The fuel return line has a restriction that creates backpressure at high fuel flow rates, confusing the rail pressure control algorithm

D. The high-pressure fuel pump cannot maintain commanded rail pressure under the high fuel demand of acceleration — the pump is worn internally or the low-pressure supply system is unable to keep up with the pump's inlet demand, causing a pressure deviation during peak fuel delivery events

10. A technician measures the intake manifold boost pressure on a heavy-duty diesel engine at full load and finds it to be 15 psi below the manufacturer's specification. The turbocharger appears to be functioning and produces audible spool-up. What could cause reduced boost despite a functioning turbocharger?

A. The exhaust gas temperature sensors are reading lower than actual, causing the ECM to retard injection timing and reduce exhaust energy

B. An exhaust leak between the exhaust manifold and the turbocharger turbine inlet is allowing exhaust gas to escape before it reaches the turbine wheel, reducing the energy available to drive the turbine and consequently reducing compressor output

C. The air filter restriction indicator has triggered a fault code that limits the ECM's boost pressure target

D. The engine oil pressure is slightly below specification, reducing the oil film thickness in the turbocharger bearings and increasing bearing friction

11. A diesel engine is scheduled for a valve adjustment. The technician rotates the crankshaft to bring cylinder 1 to TDC on the compression stroke. How does the technician confirm that cylinder 1 is on the compression stroke rather than the exhaust stroke?

A. Both intake and exhaust valves on cylinder 1 are fully closed with no pressure on the rocker arms — the piston is at TDC with both valves seated, which only occurs at TDC of the compression stroke; at TDC of the exhaust stroke, one or both valves are partially open during overlap

B. The intake valve on cylinder 1 is fully open and the exhaust valve is fully closed at TDC compression

C. The exhaust valve on cylinder 1 is fully open and the intake valve is beginning to open at TDC compression

D. The technician cannot distinguish between TDC compression and TDC exhaust without a scan tool reading of camshaft position

12. A heavy-duty diesel engine has been diagnosed with a failed injector on cylinder number two. The technician removes the injector and finds heavy carbon buildup on the injector tip that extends into the nozzle holes. What does this carbon buildup indicate about the injector's failure mode?

A. The injector was receiving fuel at a higher pressure than designed, causing the fuel to carbonize on the tip from excessive atomization

B. The engine was operating on biodiesel fuel that produces more carbon deposits than standard petroleum diesel

C. The injector had a poor spray pattern — the nozzle holes were partially blocked or the needle valve was not seating properly, causing fuel to dribble rather than atomize cleanly, and the unatomized fuel burned incompletely on the injector tip, building up carbon that further degraded the spray pattern in a worsening cycle

D. The engine's air intake system was severely restricted, causing a rich air-fuel ratio that deposited carbon on all injector tips equally

13. A technician is inspecting the flywheel housing alignment on a heavy-duty diesel engine using a dial indicator. The manufacturer's maximum allowable total indicator reading (TIR) for bore concentricity is 0.008 inches. The technician measures 0.012 inches TIR. What is the consequence of operating the engine with this misalignment?

A. The fuel injection timing will be retarded by the amount of the misalignment, reducing engine power output

B. The crankshaft main bearings will experience accelerated wear from the misaligned housing applying a lateral force

C. The flywheel ring gear will contact the starter pinion at an angle, causing premature starter drive and ring gear wear

D. The transmission input shaft will not align properly with the crankshaft centerline, causing premature pilot bearing wear, clutch disc misalignment, accelerated input shaft bearing wear, and potential vibration through the drivetrain

14. A fleet of heavy-duty trucks uses the same engine model. One truck consistently consumes 15% more fuel than the fleet average on the same route. The engine has no fault codes, the injectors have been tested and are within specification, and the air intake system is not restricted. What engine-related conditions should be investigated?

- A. The engine's compression values, the turbocharger efficiency, the injection timing, and the cooling system operating temperature — low compression reduces combustion efficiency, a worn turbocharger delivers less air, retarded timing wastes fuel energy, and a cold-running engine from a stuck-open thermostat reduces combustion efficiency and increases fuel consumption
- B. The engine's valve cover gasket, which if leaking would allow unmetered air to enter the cylinder head and affect fuel mixture
- C. The engine's harmonic balancer, which if slipped would cause the ECM to miscalculate injection timing
- D. The engine oil viscosity, which if too heavy would create parasitic drag on the rotating assembly and increase fuel consumption

15. A heavy-duty diesel engine's oil cooler has failed, allowing coolant to mix with the engine oil. The technician notices the failure because the oil level has risen above the maximum mark and the oil appears milky. Beyond replacing the oil cooler, what additional service is required?

- A. Replace the oil filter only and refill with the correct oil — the new oil will flush the remaining coolant from the system during the first oil change interval
- B. Drain and flush the entire lubrication system including the oil cooler passages, replace the oil filter, refill with the correct oil, run the engine briefly, then drain and refill again to ensure all coolant contamination is removed — also inspect the coolant system for the cause of the cooler failure and verify coolant integrity
- C. Add a coolant-neutralizing additive to the new oil that chemically bonds with the residual coolant and converts it to a harmless compound
- D. Replace the engine bearings preventively since coolant in the oil would have caused immediate bearing damage regardless of the duration of the contamination

16. A heavy-duty diesel engine exhibits a condition called "diesel runaway" — the engine accelerates uncontrollably and does not respond to the ignition key or fuel shutoff. What is causing this condition, and how is it stopped?

- A. The fuel injection pump governor has failed and is delivering maximum fuel — the engine is stopped by disconnecting the battery to cut power to the fuel injection solenoids

B. The turbocharger has catastrophically failed and is injecting metal fragments into the combustion chambers that are acting as hot spots for uncontrolled ignition

C. The engine's electronic throttle control system has malfunctioned and is commanding full fuel delivery — disconnecting the scan tool from the diagnostic connector resets the system

D. The engine is ingesting a combustible substance through the air intake (typically crankcase oil from a failed turbocharger seal or breather system failure) and burning it as fuel — the engine runs on this uncontrolled fuel source regardless of the diesel fuel shutoff; the engine is stopped by blocking the air intake to suffocate the combustion or by stalling it in gear with the brakes applied

17. A heavy-duty diesel engine has a diagnostic trouble code for "Crankcase Pressure — Above Normal." The engine's blow-by tube is venting visible vapor. The engine has 600,000 km on the odometer. What does this code indicate?

A. The crankcase ventilation filter is plugged, creating backpressure that triggers the sensor even though internal engine wear is within acceptable limits

B. The oil fill cap gasket is missing, allowing atmospheric pressure to enter the crankcase and create a false pressure differential reading

C. The piston rings, cylinder liners, or both have worn to the point where combustion gases are leaking past the ring-to-liner seal into the crankcase at a rate that exceeds the ventilation system's capacity — the crankcase pressure sensor detects this elevated pressure and the ECM sets the code as an indicator that the engine is approaching overhaul condition

D. The valve cover gasket has failed, allowing pressurized oil vapor to escape and triggering the crankcase pressure sensor

18. A technician is servicing a diesel engine's cooling system and needs to pressure-test the system. The radiator cap is rated at 15 psi. To what pressure should the technician pressurize the system during the test?

A. To the cap's rated pressure of 15 psi — pressurizing above the cap's rating will cause the cap's pressure relief valve to open and vent, making the test inaccurate, and pressurizing significantly above the rating risks damaging system components not designed for higher pressure

- B. To 20 psi (5 psi above the cap rating) to stress-test the system and identify marginal leaks that would not appear at normal operating pressure
- C. To 10 psi (5 psi below the cap rating) to provide a safety margin that protects the hoses and heater core from overpressure
- D. To 30 psi to simulate the maximum pressure spike that can occur during a rapid engine warm-up cycle

19. A diesel engine's fuel system uses a primary fuel filter and a secondary fuel filter in series. During a routine filter change, the technician notices that the primary filter housing contains a significant amount of water in its collection bowl. What does this indicate?

- A. The secondary filter has failed and is allowing water to backflow into the primary filter housing through the fuel supply line
- B. Water is present in the fuel supply — either from condensation in the fuel tank, contaminated fuel from the supplier, or a failed fuel tank vent that is allowing rainwater to enter — the fuel/water separator (primary filter) has captured the water as designed, but the tank should be inspected to determine the water source and prevent recurrence
- C. The primary filter housing gasket is leaking and allowing condensation from the shop air to enter the filter bowl
- D. The fuel transfer pump is cavitating and the heat from the cavitation is condensing moisture from the fuel vapor

20. A heavy-duty diesel engine has a persistent white smoke condition from the exhaust even after the engine has fully warmed to operating temperature. The smoke has a sweet odor. What is the most likely cause?

- A. Injector timing is retarded, causing incomplete combustion that produces white smoke from unburned fuel vapor
- B. The fuel quality is poor, with a low cetane number that causes delayed ignition and white exhaust
- C. The turbocharger oil seal has failed, allowing engine oil to enter the exhaust stream and produce white smoke

D. Coolant is leaking into the combustion chambers through a cracked head, blown head gasket, or cracked liner — the coolant vaporizes during combustion and exits as white steam with a characteristic sweet odor

21. A heavy-duty diesel engine's variable geometry turbocharger (VGT) has a condition where the actuator does not respond to ECM commands. The technician checks the actuator's electrical connector and finds corrosion on the pins. After cleaning the connector, the actuator responds normally. What preventive measure should be taken?

A. Replace the entire VGT assembly since the corrosion indicates the turbocharger has been exposed to excessive moisture

B. Install a heat shield between the turbocharger and the actuator to prevent future moisture condensation on the connector

C. Apply dielectric grease to the cleaned connector pins before reconnecting to prevent future corrosion by sealing the connector interface against moisture intrusion while maintaining electrical conductivity

D. Reroute the actuator wiring away from the turbocharger to a cooler location to reduce the thermal cycling that contributes to condensation and corrosion

22. A technician is diagnosing a heavy-duty diesel engine that has low power and excessive black smoke. The turbocharger boost pressure is within specification. The air filter is not restricted. The exhaust backpressure is within specification. What should the technician investigate next?

A. The fuel injection system — injector performance, injection timing, and fuel rail pressure — because adequate air (confirmed by normal boost) combined with excessive fuel (from leaking injectors, advanced timing, or a stuck-open injector) produces the rich condition that causes black smoke and may paradoxically reduce power if combustion efficiency is compromised

B. The engine coolant temperature, which if too high could cause the fuel to pre-ignite and produce black smoke

C. The engine oil level, which if overfull could be drawn into the intake manifold through the crankcase ventilation and burned as fuel

D. The exhaust gas recirculation rate, which if too low could allow combustion temperatures to rise and produce black smoke

23. During a compression test on a six-cylinder diesel engine, the technician obtains the following readings: cylinders 1-5 read 380-395 psi, and cylinder 6 reads 395 psi. What is the assessment?

- A. Cylinder 6 is over-compressed and the injector on that cylinder should be checked for a restricted nozzle
- B. All six cylinders are within an acceptable range of each other (variation of 15 psi or less) and the compression is adequate — no further investigation is needed
- C. The readings are too high for a diesel engine and indicate that the head gasket thickness is incorrect
- D. The variation between the highest and lowest readings exceeds the maximum allowable specification

24. A heavy-duty diesel engine has an oil leak at the rear of the engine. The technician cannot determine whether the leak is from the rear main seal, the oil pan gasket, or the transmission input shaft seal. What diagnostic method can help identify the source?

- A. Add a fluorescent UV dye to the engine oil and operate the engine — then inspect the rear of the engine with a UV lamp to trace the fluorescent trail from the leak source to the drip point, identifying which seal or gasket the oil is originating from
- B. Pressurize the crankcase with 5 psi of air and apply soap solution to each suspected area while observing for bubbles
- C. Remove the transmission and visually inspect each seal individually while the engine is running
- D. Add a fluorescent UV dye to the engine oil, operate the vehicle for several days, then inspect with a UV lamp to trace the fluorescent leak trail back to its origin point, which identifies whether the oil is coming from the rear main seal, the oil pan gasket, or the transmission seal

25. A diesel engine's DPF has been cleaned and reinstalled. After reinstallation, the engine's exhaust backpressure reading at idle is higher than the pre-cleaning value. What is the most likely cause?

- A. The DPF cleaning was incomplete and residual ash remains in the filter channels, maintaining elevated backpressure

B. The DPF substrate was damaged during the cleaning process and broken substrate material is partially blocking the exhaust channels

C. The exhaust system gaskets or clamps between the DOC and DPF were not properly sealed during reinstallation, creating a turbulent flow condition that the backpressure sensor reads as elevated pressure

D. The DPF's differential pressure sensor tubes were reconnected in the wrong orientation (inlet and outlet swapped), causing the sensor to read a higher-than-actual pressure differential

26. A heavy-duty diesel engine equipped with a HEUI fuel injection system is experiencing hard starting and rough idle. The technician measures the injection control pressure (ICP) and finds it significantly below the specification at cranking speed. What should be investigated?

A. The high-pressure oil pump, the injection pressure regulator (IPR) valve, and the oil supply system — HEUI injectors require high-pressure engine oil to generate injection pressure, and if the oil system cannot deliver adequate ICP at cranking speed, the injectors cannot atomize fuel properly for reliable ignition

B. The fuel filter, which may be restricted and limiting the fuel volume available to the HEUI injectors during cranking

C. The glow plug system, which may not be generating adequate cylinder temperature for the HEUI injection event

D. The crankshaft position sensor, which controls the HEUI injection timing and may be producing a weak signal at the low cranking speed

27. A technician is reassembling a heavy-duty diesel engine after an overhaul. During the assembly of the connecting rod bearings, the technician uses Plastigage to verify bearing oil clearance. The Plastigage strip measures 0.006 inches. The specification calls for 0.002 to 0.004 inches. What does this indicate?

A. The bearing oil clearance is acceptable because Plastigage has a measurement tolerance of ± 0.003 inches

B. The Plastigage reading is only valid when measured at operating temperature and should be disregarded for cold assembly measurements

C. The journal diameter is slightly undersized, which will self-correct during the initial break-in period as the bearing overlay wears to match

D. The bearing oil clearance is excessive — the clearance of 0.006 inches exceeds the 0.004-inch maximum specification, which will allow excessive oil flow through the bearing, reduce oil pressure, and cause a knocking noise from the excess clearance under load; the journal and bearing combination must be corrected

28. A diesel engine's DEF dosing system has a condition where crystalline deposits are forming in the decomposition tube between the DEF injector and the SCR catalyst. What causes these deposits, and what is the concern?

A. The deposits are caused by the DEF's urea component reacting with the stainless steel decomposition tube at high temperatures, forming a harmless crystalline oxide

B. The deposits form when DEF is injected into exhaust gas that is below the minimum temperature for complete decomposition — the urea solidifies instead of converting to ammonia, and the accumulating crystals restrict exhaust flow, reduce SCR efficiency, and can damage the decomposition tube and sensors

C. The deposits are a normal byproduct of the SCR chemical reaction and are automatically purged during the next DPF regeneration event

D. The deposits form when the DEF concentration is above the 32.5% specification, causing excess urea to precipitate out of solution

29. A heavy-duty diesel engine is running at idle with the transmission in neutral. The technician notices that the engine RPM fluctuates between 675 and 725 RPM in a slow, rhythmic pattern. The scan tool shows no active fault codes. What is the most likely cause of this minor RPM fluctuation?

A. A loose engine mount that allows the engine to rock at a frequency that interferes with the crankshaft position sensor signal

B. The idle control algorithm is hunting for the target RPM due to a minor variable — such as the A/C compressor cycling on and off, the power steering pump loading and unloading, or the air compressor cycling between loaded and unloaded states — and the ECM is adjusting fuel delivery to compensate for these varying parasitic loads

C. The engine's flywheel has a cracked tooth on the ring gear that causes a momentary signal interruption once per revolution

D. The ECM is cycling the fuel injectors in a diagnostic pattern to test their response time during idle conditions

30. A heavy-duty truck is equipped with automatic moisture ejector valves on each air reservoir. During a pre-trip inspection, the technician operates the ejector on the wet tank and a significant amount of water is expelled. What does this indicate about the air dryer's performance?

A. The automatic moisture ejectors are designed to handle the moisture that the air dryer cannot remove, and the water discharge indicates normal system operation

B. The air dryer is not adequately removing moisture from the compressed air before it reaches the reservoirs — the dryer may have a saturated desiccant cartridge, a malfunctioning purge cycle, or the compressor may be passing excessive oil that has contaminated the desiccant

C. The wet tank's internal coating has deteriorated and is producing water as a byproduct of the coating breakdown

D. The moisture ejectors are venting condensation that formed inside the tank from ambient temperature changes during overnight parking

31. A driver reports that the air pressure gauges on the dashboard show the primary circuit at 120 psi but the secondary circuit at only 85 psi. The compressor is running and the system appears to be functioning otherwise. What is the most likely cause of the pressure imbalance?

A. The governor is preferentially directing compressor output to the primary circuit through a faulty distribution valve

B. The compressor discharge line has a check valve that is partially restricting flow to the secondary circuit while allowing full flow to the primary

C. The pressure gauges are calibrated differently and the actual pressures are equal in both circuits

D. The secondary circuit has an air leak that is consuming air faster than the system can replenish it, while the primary circuit maintains its pressure because it is sealed — the dual-circuit protection system is functioning correctly by isolating the leak to one circuit

32. A technician is performing a brake efficiency test on a heavy-duty truck using a roller brake tester (dynamometer). The results show that the left front brake produces 40% more braking force than the right front brake. What is the most likely cause of this imbalance?

A. The right front brake has a condition that is reducing its output compared to the left — such as a contaminated (greasy or glazed) lining, a restricted air supply, an out-of-adjustment slack adjuster, a worn S-cam bushing, or a weak return spring that is partially applying the brake and leaving insufficient reserve for the test application

B. The left front brake chamber is a larger diameter than the right, delivering more force for the same air pressure

C. The left front tire has more traction on the roller surface than the right, producing a higher reading regardless of brake force

D. The ABS system is modulating the right front brake during the roller test, reducing the measured output

33. A heavy-duty truck's emergency (spring) brakes apply automatically when system air pressure drops below approximately 20-40 psi. A driver reports that the spring brakes applied gradually during normal driving, starting with increased pedal effort and progressing to full spring brake application. What does the gradual onset indicate?

A. The parking brake valve has a leak that is slowly venting spring brake hold-off air at a rate proportional to vehicle speed

B. The spring brake chambers have weakened springs that are gradually overcoming the hold-off air pressure during extended driving

C. A slow, progressive air system leak is gradually reducing system pressure over time — the pressure dropped slowly enough that the driver first noticed increased pedal effort (from reduced service brake air), then the low-pressure warning activated, and finally the spring brakes applied when pressure dropped below the release threshold

D. The spring brake modulator valve is proportionally releasing spring brake hold-off air based on a detected ABS fault

34. A transit bus equipped with air disc brakes on all axle positions requires brake pad replacement. The technician notices that the inner pad on the right front caliper is worn to minimum thickness while the outer pad has 50% of its lining remaining. What is the most likely cause of this uneven wear?

- A. The brake rotor has excessive thickness variation (DTV) that causes the inner pad to contact more frequently
- B. The caliper slide pins are seized or corroded, preventing the caliper from floating freely on its guides — the inner pad applies directly from the caliper mechanism, but the caliper cannot slide to pull the outer pad against the rotor with equal force; the inner pad does all the work while the outer pad barely contacts the rotor
- C. The inner pad friction material has a lower hardness rating than the outer pad due to a manufacturing defect
- D. The ABS modulator on the right front wheel is applying slightly more pressure to the inner pad circuit through an internal valve bias

35. A heavy-duty truck's air system build-up time meets the specification, but the air dryer purge cycle does not occur when the compressor unloads. The system reaches cut-out pressure normally. What is the most likely cause?

- A. The air dryer's internal check valve is stuck open, preventing the pressure differential needed to trigger the purge cycle
- B. The compressor's unloader mechanism is not fully unloading, keeping the compressor running and preventing the governor from sending the purge signal
- C. The governor cut-out pressure is set below the air dryer's minimum activation pressure, preventing the dryer from recognizing the cut-out signal
- D. The governor signal line to the air dryer purge valve is disconnected, blocked, or leaking — the governor signals the compressor to unload correctly (the system reaches cut-out) but the signal is not reaching the air dryer to trigger the purge cycle

36. A truck's air system is equipped with an alcohol evaporator (air system antifreeze injector) on the air dryer discharge. What is the purpose of this device?

- A. The alcohol evaporator injects a small amount of methanol or isopropyl alcohol into the compressed air downstream of the air dryer to lower the freezing point of any residual moisture, preventing ice formation in valves and lines during cold-weather operation
- B. The alcohol evaporator sterilizes the compressed air by killing bacteria and mold that grow in the warm, moist environment inside the air tanks
- C. The alcohol evaporator improves the air dryer desiccant's moisture absorption capacity by pre-treating the air with an alcohol-based drying agent
- D. The alcohol evaporator lubricates the downstream valve components with an alcohol-based lubricant that replaces the petroleum oil removed by the air dryer

37. A tractor-trailer combination's trailer brakes are not applying when the driver presses the brake pedal. The trailer spring brakes work normally when the red button is pulled. The air system pressure is adequate. What is the most likely cause?

- A. The trailer ABS module has a fault that is blocking all service brake application signals
- B. The trailer's spring brake valve is interfering with the service brake circuit through an internal cross-port leak
- C. The trailer's service (control) gladhand is not connected, or the service gladhand seal is missing or damaged, preventing the brake application signal from reaching the trailer's relay valve — without the signal through the service gladhand, the relay valve has no command to deliver air to the service brake chambers
- D. The tractor's foot valve secondary circuit has failed, preventing the brake signal from reaching the trailer circuit

38. A technician discovers that the automatic slack adjuster on one wheel of a drive axle has been manually adjusted by a previous technician. The pushrod stroke was 2.5 inches before the manual adjustment and is now 1.5 inches. What is the concern with this approach?

- A. Manual adjustment does not affect the automatic adjustment mechanism and the slack adjuster will function normally

B. If the ASA's internal mechanism is functional, the manual adjustment has over-adjusted the brake — on the next brake application, the ASA will advance its internal mechanism further because it detected movement during the manual adjustment, potentially causing the shoes to drag on the drum from over-tightened adjustment

C. The manual adjustment has reset the ASA's internal mechanism and the adjuster will now maintain the 1.5-inch stroke correctly going forward

D. Manual adjustment is the recommended procedure for ASAs when the pushrod stroke exceeds 2.0 inches

39. A heavy-duty truck's brake system uses a front axle limiting valve (ratio valve) that reduces the air pressure delivered to the front brakes relative to the rear brakes at lower application pressures. What is the purpose of this valve?

A. To prevent the front brakes from overheating during sustained downhill braking by limiting their application pressure

B. To extend the life of the front brake linings by reducing their application force during light braking situations

C. To maintain equal brake lining wear rates between the front and rear brakes regardless of load distribution

D. To prevent the front wheels from locking before the rear wheels during light to moderate braking when the front axle carries proportionally less weight — at higher application pressures (heavy braking), the valve allows full pressure to the front brakes because weight transfers forward during hard stops

40. A school bus driver reports that the stop arm does not fully extend when activated. The arm moves partway out and stops. The air system pressure is adequate. What should the technician investigate?

A. The stop arm's pivot mechanism for binding, corrosion, or physical damage that is preventing full extension, and the air actuator for adequate stroke — also check the air control valve and supply line for restrictions that would limit the actuator's ability to push the arm to its fully extended position

B. The bus's ABS system, which interlocks with the stop arm deployment and may be preventing full extension due to a detected fault

C. The engine RPM, which may be too low to maintain adequate air pressure for full stop arm extension during idle

D. The bus's transmission position sensor, which must read "Park" or "Neutral" before the stop arm control circuit allows full deployment

41. A technician is testing the one-way check valves in a heavy-duty truck's air brake system. One check valve between the supply tank and the primary reservoir is found to be stuck open. What is the consequence of this condition?

A. The check valve being open has no effect during normal operation because it is in the normal flow path

B. Air from the primary reservoir will leak back through the stuck-open valve during a compressor unloading cycle, reducing primary circuit pressure

C. If the supply tank develops a leak or the air dryer purge cycle occurs, air from the primary reservoir can flow backward through the stuck-open check valve and be lost — the check valve's purpose is to isolate the primary reservoir from upstream losses, and a stuck-open valve defeats this protection

D. The compressor will build excessive pressure in the primary circuit because the check valve cannot regulate the maximum pressure

42. A heavy-duty truck with drum brakes has a vibration felt through the brake pedal during moderate braking. The vibration is rhythmic and corresponds to wheel speed. What is the most likely cause?

A. A rotor thickness variation (DTV) issue on the front disc brakes that is transmitting a pulsation through the brake pedal

B. An out-of-round brake drum that contacts the shoes at varying points during each rotation, creating a pulsating braking force that the driver feels as a rhythmic vibration in the brake pedal

C. A loose wheel bearing that allows the hub to wobble during braking, changing the shoe-to-drum contact pattern

D. A worn U-joint on the driveshaft that creates a vibration in the drivetrain that is more noticeable during braking

43. A tractor-trailer combination has a condition where the trailer brakes release normally at highway speed but remain partially applied at very low speeds (below 10 km/h). The trailer ABS lamp is not illuminated. What is the most likely cause?

A. The trailer's relay valve has a crack in its piston that allows a small amount of supply air to leak into the delivery port at low flow conditions — at highway speed, the dynamic air flow through the valve clears the small leak, but at very low speeds or stationary conditions, the small leak accumulates enough pressure in the brake chambers to partially apply the brakes

B. The trailer ABS is applying a low-speed stability correction that is not severe enough to illuminate the ABS lamp

C. The trailer's parking brake spring has weakened and is partially overcoming the hold-off air at low speeds where the dynamic load on the axle is reduced

D. The trailer tires are a larger diameter than specified, causing the wheel speed sensors to read a slower speed than actual and triggering a low-speed ABS correction

44. A heavy-duty truck has a condition where the air compressor runs continuously without unloading — the governor never signals the compressor to unload and the system pressure continues to rise until the safety valve opens at 150 psi. What is the most likely cause?

A. The compressor unloader mechanism is functioning but the governor cannot sense system pressure because its sensing line is disconnected, blocked, or cracked — without accurate pressure feedback, the governor never reaches its cut-out threshold and never sends the unload signal

B. The air dryer's purge valve is stuck closed, trapping air in the system and causing pressure to build continuously

C. The compressor's discharge valve is stuck closed, preventing compressed air from leaving the compressor and creating a false high-pressure reading

D. The governor is receiving the correct pressure signal but its internal cut-out mechanism has failed and cannot respond to the pressure level by signaling the compressor to unload

45. A technician discovers that a brake drum has been resurfaced (machined) to a diameter that is 0.020 inches below the drum's maximum allowable diameter stamped on the casting. Is this drum acceptable for continued service?

- A. The drum is not acceptable because its inside diameter exceeds the maximum allowable dimension — machining the drum increased its diameter further beyond the limit, making the drum walls thinner than the minimum safe thickness for adequate heat absorption and structural integrity
- B. The drum is acceptable because the machining restored a fresh friction surface that will improve braking performance
- C. The drum is acceptable for light-duty applications only and must be replaced if the vehicle operates at gross vehicle weight
- D. The drum must be measured again after installation because the mounting process may change its diameter

46. A heavy-duty truck's air system has a condition where the wet tank drain produces clean, dry air when manually drained — no water or oil is present. However, the technician finds water accumulation in the primary and secondary reservoirs downstream. What does this indicate?

- A. The primary and secondary reservoirs have internal corrosion that is generating moisture independently of the air supply
- B. The water is entering the primary and secondary reservoirs through the brake chamber diaphragms during rain or vehicle washing
- C. The one-way check valves between the wet tank and the downstream reservoirs are stuck open, allowing moisture that should be trapped in the wet tank to flow downstream — alternatively, the air dryer may be functioning but the wet tank's drainage schedule is keeping it clean while moisture passes through to the downstream tanks that are not drained as frequently
- D. The moisture is condensation from temperature cycling inside the downstream tanks and is unrelated to the air dryer or wet tank condition

47. A technician is testing a truck's charging system. With the engine running at 1,500 RPM and all loads off, the battery terminal voltage reads 14.1 volts. The technician then turns on all available electrical loads (headlights, HVAC blower on high, heated mirrors, marker lights). The voltage drops to 13.6 volts. What is the assessment?

- A. The charging system is functioning correctly — the alternator is maintaining voltage within the acceptable range (13.8 to 14.4 volts is ideal, but 13.6 volts under full load is acceptable on many heavy-

duty systems) and the voltage regulator is compensating for the increased load by increasing field current

B. The alternator is failing because the voltage dropped when loads were applied, indicating the output capacity is insufficient

C. The voltage regulator has malfunctioned and is allowing the voltage to drop below the minimum charging threshold

D. The batteries are absorbing the excess charging current, which is why the terminal voltage appears to drop under load

48. A heavy-duty truck's instrument cluster shows intermittent gauge fluctuations — all gauges move erratically for a brief moment and then return to normal. The problem occurs several times per hour during driving. What is the most likely cause?

A. The instrument cluster has a failing internal power supply that momentarily drops out under vibration

B. The engine ECM is sending erratic data on the CAN bus that the cluster is displaying faithfully

C. An intermittent CAN bus communication fault — a loose connector, a damaged wire, or a corroded connection on the CAN bus backbone that briefly disrupts communication to the cluster; when communication drops, the gauges momentarily lose their data source and deflect, then recover when communication is restored

D. The alternator has a failing diode that produces an AC voltage spike intermittently, disrupting the cluster's electronics

49. A technician is diagnosing a truck that has a parasitic draw of 450 milliamps with the vehicle fully shut down. The specification is 50-85 milliamps. The technician removes fuses one at a time. When the fuse for the "Body Module — Sleeper" circuit is removed, the draw drops to 70 milliamps. What is the next step?

A. Replace the fuse with a higher-amperage fuse to prevent it from being affected by the high draw

B. Inspect the sleeper circuit for the specific device that is drawing 380 milliamps when it should be in sleep mode — common culprits include an aftermarket inverter, a TV or entertainment system that is not

fully shutting off, a refrigerator or cooler that is plugged in, or a module that is not entering sleep mode due to a keep-alive signal fault

C. Replace the body module immediately since it controls the sleeper circuit and must be the source of the draw

D. Disconnect the battery and reconnect it after 5 minutes to reset the sleeper circuit's sleep timer

50. A heavy-duty truck's backup lights do not illuminate when the transmission is shifted into reverse. The backup alarm sounds normally. The backup light bulbs are intact and the fuse is not blown. Where should the technician focus the diagnosis?

A. The reverse signal switch on the transmission, which must be faulty since the alarm works but the lights do not

B. The body controller module, which may have disabled the backup lights due to a detected fault in the light circuit

C. The turn signal switch, which on some vehicles shares a circuit with the backup lights and may be interfering

D. The backup light circuit downstream of the point where the alarm and light circuits separate — since the alarm works (confirming the reverse signal is reaching the junction point), the fault is in the section of wiring, the connector, or the ground circuit that is dedicated to the backup lights after the circuit branches from the common reverse signal path

51. A technician is testing a truck's battery bank consisting of four 12-volt batteries configured in series-parallel for a 24-volt system. What is the correct method for load testing this configuration?

A. Disconnect all four batteries from each other and from the vehicle, then load-test each battery individually using the standard half-CCA load for 15 seconds — each battery must pass independently because a weak battery in any position affects the entire bank's performance

B. Load-test the entire bank as a 24-volt unit using the combined CCA rating divided by two

C. Load-test only the two batteries on the positive side of the series connection, as they carry the primary starting load

D. Load-test each series pair (two batteries in series) as a 24-volt unit, then compare the results of the two pairs

52. A truck's left turn signal flashes normally at the tractor but the left turn signal on the trailer does not flash — it remains steady on. The right turn signal works correctly on both the tractor and trailer. What is the most likely cause?

A. The trailer's left turn signal bulb has been replaced with an incorrect wattage that causes it to illuminate but not flash

B. The flasher module is faulty and is sending a continuous signal on the left circuit instead of a pulsed signal

C. The left turn signal wire in the tractor-to-trailer wiring has a short to the marker light circuit (which is continuously powered when the marker lights are on), causing the trailer's left turn signal to receive continuous power instead of the flashed power from the turn signal circuit — the trailer lamp stays on from the continuous marker power

D. The trailer's left turn signal ground is shared with the stop lamp ground, and a grounding issue is causing the turn and stop functions to interfere

53. A technician is performing a voltage drop test on the starter motor ground circuit. The reading from the starter motor case to the battery negative post is 0.6 volts during cranking. What does this indicate?

A. The ground circuit voltage drop is within the normal specification of 0.5 volts maximum and no action is required

B. The ground circuit has excessive resistance — the maximum allowable voltage drop for the ground path is typically 0.3 volts, and the 0.6-volt reading indicates a corroded ground cable connection, a deteriorated cable, or a poor engine-to-frame ground strap that must be identified and corrected

C. The starter motor case is not properly grounded because it is isolated by its mounting bolts

D. The battery negative post is corroded and needs cleaning to reduce the voltage drop reading

54. A heavy-duty truck has a condition where the dash-mounted voltmeter reads 12.4 volts with the engine running at 1,500 RPM. The technician measures battery terminal voltage directly and reads 14.1 volts. What is the most likely cause of the discrepancy?

A. The voltmeter on the dashboard is receiving its power through a circuit with significant voltage drop — the difference between the actual battery voltage (14.1V) and the displayed voltage (12.4V) equals 1.7 volts lost in the wiring, connectors, and fuses between the battery and the voltmeter's power supply point on the instrument cluster

B. The dashboard voltmeter is calibrated for a 24-volt system and is displaying half the actual battery voltage

C. The alternator is overcharging the battery but the voltage regulator is intercepting the signal to the dashboard gauge

D. The battery has an internal short between two cells that is causing a voltage difference between the posts and the internal bus bars

55. A truck's headlight circuit uses a relay to switch the headlight load. The relay clicks when the headlight switch is turned on, but neither headlight illuminates. The relay coil resistance and switching function have been tested and are functioning correctly. What should the technician check next?

A. The headlight switch, which may not be providing the correct ground path for the relay coil

B. The alternator output, which may not be providing adequate voltage for the headlight bulbs to illuminate

C. The dimmer switch, which may be in a position that does not connect to either the high-beam or low-beam relay outputs

D. The power supply to the relay's load side — the relay switches correctly, but if battery power is not reaching the relay's input terminal (from a blown fusible link, a disconnected cable, or a missing fuse upstream of the relay), the relay has no power to pass through to the headlights even when its contacts close

56. A heavy-duty truck equipped with a body controller module (BCM) has a condition where the wiper motor operates at only one speed — high. The washer function works normally. The wiper switch tests correctly at the BCM input. What is the most likely cause?

- A. The BCM's wiper motor output driver for the variable speed control has failed, defaulting to the high-speed relay output — the BCM receives the correct switch signal but can only command the high-speed output
- B. The wiper motor armature has a short between windings that bypasses the speed-control resistance built into the motor
- C. The wiper linkage has seized at a point that only allows the motor to overcome at full speed
- D. The wiper fuse has degraded and is limiting current to the motor at lower speeds but allowing full current at the high-speed bypass

57. A technician is diagnosing a truck with an illuminated ABS warning lamp. The scan tool retrieves a fault code for "Right Rear Wheel Speed Sensor — Signal Erratic." The sensor resistance is within specification and the air gap is correctly set. What additional condition should be checked?

- A. The ABS modulator valve for the right rear wheel, which may be causing a feedback signal that the ECU interprets as erratic
- B. The sensor's wiring harness for intermittent damage — rubbing, pinching, or exposed conductors — that could cause signal interference during driving that does not appear during a static test
- C. The reluctor ring on the right rear wheel for damaged, missing, or chipped teeth, or for metallic debris accumulated on the ring that would disrupt the sensor's signal pattern as the ring rotates — a static resistance and gap test does not reveal reluctor ring damage, which only manifests when the wheel is rotating
- D. The brake drum on the right rear for excessive runout that causes the hub to wobble and move the reluctor ring in and out of the sensor's detection range during rotation

58. A truck's electric fuel shutoff solenoid does not energize when the ignition key is turned to the RUN position. The engine will not start. The fuse for the solenoid circuit is intact. The technician measures 0 volts at the solenoid connector with the key on. What is the next diagnostic step?

- A. Replace the fuel shutoff solenoid since it is not receiving voltage and may have an internal short that is pulling the voltage to zero

B. Trace the circuit backward from the solenoid connector toward the ignition switch, checking for voltage at each connector and junction point to locate the open circuit that is preventing voltage from reaching the solenoid

C. Check the engine's crankshaft position sensor, which may provide a ground path for the fuel solenoid circuit

D. Test the fuel shutoff solenoid's coil resistance to verify it is within specification before investigating the supply circuit

59. A heavy-duty truck has a condition where the marker lights and clearance lights work correctly but the headlights do not illuminate at all — no low beam and no high beam. All headlight fuses are intact. What circuit element is common to both the low-beam and high-beam circuits but not shared with the marker/clearance circuit?

A. The body controller module, which controls all exterior lighting through a single output that separates into individual circuits at the fuse panel

B. The headlight switch, which must have a position that enables the headlight circuits independently of the marker circuit

C. The battery positive cable, which feeds both the headlight and marker circuits from the same terminal

D. The headlight relay, the headlight-specific fuse or fusible link, or a headlight-specific wiring path that provides the power supply to both beam circuits but is separate from the marker/clearance power supply — an open in this common headlight feed disables both beams while leaving the marker circuit unaffected

60. A technician measures 0.2 volts between CAN H and CAN L at the diagnostic connector with the ignition on. The expected voltage difference is approximately 2.0 volts (CAN H at ~3V minus CAN L at ~1.5V). What does the 0.2-volt reading indicate?

A. The CAN bus is shorted — CAN H and CAN L are at nearly the same voltage because they are connected together at some point, eliminating the differential signal that carries the data; a short between CAN H and CAN L prevents all communication on the bus

B. The bus is in a sleep state and the reduced voltage is normal for the modules' low-power mode

- C. The CAN bus has lost one of its two terminating resistors, causing the voltage levels to collapse
- D. The measurement technique is incorrect and the readings should be taken relative to chassis ground rather than differentially

61. A heavy-duty truck has a condition where the electric horn sounds a weak, distorted tone when the horn button is pressed. Direct battery power applied to the horn produces a normal, full-volume tone. What does this confirm?

- A. The horn's internal diaphragm is fatigued and produces a distorted tone under sustained use but functions normally for brief test applications
- B. The horn relay is the source of the distortion because it introduces electrical noise into the horn's power supply
- C. The horn circuit has excessive resistance (voltage drop) in the power or ground path between the battery and the horn — the reduced voltage produces the weak, distorted tone; direct battery power bypasses the circuit resistance and delivers full voltage, confirming the horn itself is not the fault
- D. The horn button is corroded and sending a pulsating signal to the relay coil, causing the relay to chatter and deliver intermittent power to the horn

62. A truck's scan tool cannot communicate with the transmission control module (TCM). The tool communicates normally with the engine ECM, ABS module, and all other modules on the CAN bus. The transmission functions normally during driving. What should the technician investigate?

- A. The scan tool's firmware, which may not support the transmission model's communication protocol
- B. The TCM's individual CAN bus connection — the drop wire, connector, or the TCM's internal CAN transceiver — since all other modules communicate normally, the CAN bus backbone is functional and the fault is isolated to the TCM's connection to the bus or an internal TCM communication fault
- C. The diagnostic connector, which may have a pin specifically assigned to the TCM that has been damaged
- D. The TCM power supply fuse and ground connection, since a module without power cannot communicate even though it may retain enough residual capacitor charge to operate the transmission briefly

63. A truck equipped with electronic dash gauges has a fuel level gauge that reads full at all times, even when the tank is known to be half-empty. The technician disconnects the fuel level sender wire at the tank. What should happen to the gauge reading if the gauge circuit is functioning correctly?

A. The gauge should move to the empty position or the low end of its scale if it is a grounded-sender system — an open circuit (disconnected sender) removes the sender's resistance from the circuit, and on most truck systems, an open sender drives the gauge to the empty position; if the gauge remains at full with the sender disconnected, the fault is in the wiring or the gauge, not the sender

B. The gauge should remain at full because the disconnected sender defaults to the maximum resistance value

C. The gauge should move to the middle of its scale because the ECM substitutes a default half-tank value when the sender signal is lost

D. The gauge should oscillate between empty and full as the ECM attempts to reestablish communication with the disconnected sender

64. A technician discovers that an aftermarket LED light bar installed on a truck's roof is causing interference with the truck's AM radio reception whenever the light bar is turned on. What is causing the interference?

A. The LED light bar draws too much current from the battery, reducing the voltage available to the radio's tuner circuit

B. The LED light bar's mounting bracket is creating a ground loop with the roof-mounted radio antenna

C. The LED light bar uses incandescent-compatible dimming that creates a variable resistance detectable by the AM radio

D. The LED light bar's internal driver circuit generates electromagnetic interference (EMI) that radiates from the light bar and its wiring, interfering with the AM radio's antenna and receiver — LED drivers use high-frequency switching that produces broadband EMI particularly disruptive to AM frequencies

65. A truck's anti-theft system has immobilized the engine — the starter cranks but the engine will not start because the anti-theft module is not recognizing the key. The key is the correct key for the vehicle. What should the technician try first?

- A. Check the key for damage to its transponder chip or RFID element, verify the key's battery (if equipped), and attempt the manufacturer's key relearn or reprogramming procedure — the anti-theft system's key recognition may have lost synchronization and a relearn may restore communication between the key and the module
- B. Bypass the anti-theft system by jumpering the starter solenoid directly to crank and start the engine
- C. Replace the anti-theft module with an aftermarket universal module that is compatible with all key types
- D. Disconnect the anti-theft module from the CAN bus to prevent it from sending the engine disable command

66. A technician measures the charging voltage on a 24-volt heavy-duty truck system. The reading at the battery terminals with the engine running is 28.4 volts. What is the assessment?

- A. The voltage is dangerously high and indicates a failed voltage regulator that is allowing the alternator to overcharge
- B. The reading is below the minimum charging voltage for a 24-volt system and the alternator is not charging adequately
- C. The charging voltage of 28.4 volts is within the normal range for a 24-volt system — the target range is typically 27.6 to 28.8 volts, which is exactly double the 13.8 to 14.4 volt target for a 12-volt system
- D. The reading indicates one battery in the series pair has a shorted cell, skewing the total system voltage upward

67. A heavy-duty truck has an intermittent no-start condition. When the problem occurs, the starter does not crank and there is no click from the solenoid. Moving the shift lever back and forth in neutral several times resolves the problem and the engine starts normally. What is the most likely cause?

- A. The transmission gear position sensor is worn or misadjusted and does not consistently detect the neutral position
- B. The neutral safety switch (or range sensor) is intermittently failing to close the starter control circuit in the neutral position — the switch allows the starter to crank only when it detects that the transmission

is in neutral (or park); a worn or misadjusted switch may not make consistent contact in neutral, and moving the lever reseats the switch contacts

C. The clutch interlock switch is sticking in the open position and the transmission lever movement physically releases the stuck switch

D. The ignition switch has a worn detent that does not consistently hold in the START position

68. A truck equipped with an electronic logging device (ELD) has a condition where the ELD loses communication with the engine ECM intermittently. The ELD is connected to the 9-pin diagnostic connector. When communication is lost, the ELD displays "No ECM Data." All other vehicle electronic systems function normally. What is the most likely cause?

A. The engine ECM's firmware is not compatible with the ELD's data request format

B. The ELD's firmware needs updating to support the current engine model's communication protocol

C. The alternator's AC ripple is interfering with the data link signal at the diagnostic connector

D. The ELD's connector cable or the 9-pin diagnostic connector has a loose, damaged, or corroded pin on the CAN data link pins (C or D), causing intermittent communication loss between the ELD and the CAN bus — since all vehicle systems work normally, the CAN bus backbone is intact and the fault is at the ELD's physical connection point

69. A heavy-duty truck with a hydraulic clutch actuation system has a condition where the clutch pedal slowly sinks to the floor when held in the depressed position. Releasing the pedal returns it to its normal position. What is the most likely cause?

A. The clutch master cylinder has an internal seal leak — fluid bypasses the primary piston seal under sustained pressure, allowing the pedal to slowly sink; when the pedal is released, the spring returns the piston and the seal reseats, which is why the pedal returns to its normal position

B. The clutch slave cylinder pushrod is binding on its guide, creating resistance that causes the pedal to feel heavy

C. The clutch disc torsional damper springs have weakened and are allowing the pressure plate to push the release mechanism backward

D. The pilot bearing is dry and creating friction that pulls the release bearing forward when the pedal is held

70. A truck equipped with an 18-speed manual transmission has a condition where the splitter shift works in low range but does not work in high range. The main-box shifts and range shifts function correctly. What is the most likely cause?

A. The splitter air valve is partially stuck, delivering sufficient pressure for the low-range splitter shift but insufficient for the high-range shift

B. The splitter shift mechanism has a worn component that is unable to overcome the higher rotational forces present in the high-range gears

C. The splitter synchronizer functions differently in low and high range, and the high-range synchronizer has worn beyond its effective range while the low-range synchronizer remains functional

D. The high-range splitter shift requires higher air pressure than the low-range shift due to the increased gear loads at higher speeds

71. A technician replaces the clutch on a heavy-duty truck and forgets to lubricate the transmission input shaft splines before installing the clutch disc. What is the potential consequence?

A. The clutch disc will not center properly on the input shaft, causing vibration during engine operation

B. The clutch disc hub will bind on the dry splines and may not slide freely during engagement and disengagement — the result is clutch drag (failure to fully release), difficulty shifting, and premature wear on the splines as the disc cannot move axially on the shaft as designed

C. The transmission input shaft seal will fail prematurely because the dry splines generate friction heat that degrades the seal

D. The clutch disc will spin on the input shaft without transmitting torque, causing the clutch to slip under load

72. A heavy-duty truck's driveshaft has a vibration that is present at 90 km/h in 10th gear. The technician shifts to 8th gear and accelerates to 90 km/h — the vibration is still present. The technician

then maintains 10th gear and slows to 80 km/h — the vibration disappears. What does this diagnostic test reveal about the vibration source?

- A. The vibration is engine-related because it occurs at a specific RPM that corresponds to 90 km/h in 10th gear only
- B. The vibration is transmission-related because it changes with the selected gear ratio at the same vehicle speed
- C. The vibration is unrelated to the drivetrain and is caused by an aerodynamic resonance at the specific vehicle speed of 90 km/h
- D. The vibration is driveshaft or component-related at a speed downstream of the transmission — it occurs at the same vehicle speed (90 km/h) regardless of engine RPM or gear selection, which means the vibrating component rotates at a speed determined by vehicle speed, not engine speed (this includes the driveshaft, U-joints, carrier bearing, axle components, wheels, and tires)

73. A heavy-duty truck with an automatic transmission has a complaint of harsh, jarring shifts between all gears. The transmission fluid is at the correct level and appears clean. The truck has recently had the engine ECM reprogrammed. What should the technician investigate?

- A. The engine ECM reprogramming may have altered the torque management parameters that the TCM relies on for smooth shift control — during shifts, the TCM requests the engine ECM to momentarily reduce engine torque to cushion the engagement; if the engine calibration was changed, the torque reduction may be insufficient or incorrectly timed, causing harsh shifts
- B. The transmission fluid is the wrong type for the application and must be drained and replaced with the correct specification
- C. The transmission's valve body has a stuck pressure regulator that is delivering excessive line pressure to the clutch packs
- D. The torque converter lockup clutch is engaging during every shift instead of only during highway cruising

74. A technician discovers that a truck's ring and pinion gear set produces a howling noise during acceleration between 60 and 80 km/h but is quiet at all other speeds and during deceleration. What does this speed-specific, load-specific noise pattern indicate?

- A. The ring and pinion backlash is set incorrectly, causing noise across all speed ranges
- B. The pinion bearing preload is insufficient, allowing the pinion to deflect under the torque load of acceleration at that speed range
- C. The gear tooth contact pattern is incorrect — the contact is too high, too low, or too concentrated on the toe or heel of the drive side of the teeth, causing noise specifically during the acceleration loading condition in the speed range where the gear mesh frequency resonates with the axle housing
- D. The differential spider gears are worn and produce noise proportional to the speed difference between the left and right wheels

75. A transit bus equipped with an Allison automatic transmission has a condition where the lockup clutch does not engage during highway cruising. The transmission fluid temperature is normal and no fault codes are present. What should the technician check?

- A. The torque converter stator one-way clutch, which if seized would prevent the converter from reaching the lockup engagement speed threshold
- B. The lockup clutch solenoid, the TCM's lockup command signal, and the lockup clutch apply circuit — verify that the TCM is commanding lockup by monitoring the solenoid state with a scan tool, then check the solenoid for proper resistance and operation, and verify hydraulic pressure in the lockup apply circuit
- C. The engine cooling fan, which if running continuously would prevent the engine from reaching the RPM threshold required for lockup activation
- D. The speedometer calibration, which if reading higher than actual speed would prevent the TCM from detecting that the vehicle has reached lockup speed

76. A truck's transfer case makes a grinding noise only when the vehicle is in 4WD mode and turning at low speed. The noise is not present in 2WD or when driving straight in 4WD. What is the most likely cause?

- A. The transfer case's internal gears are worn and produce noise only when loaded by the 4WD engagement

B. The front axle driveshaft U-joints are worn and produce noise only when they are loaded by the 4WD torque transfer

C. The front drive axle differential is producing the noise from worn side bearings that are loaded during 4WD turns

D. Driveline wind-up is occurring because the transfer case does not have a center differential — in 4WD mode, the front and rear axles are locked to the same speed, but during turns the front and rear wheels need to rotate at different speeds; the resulting wind-up creates stress in the drivetrain that manifests as a grinding or binding noise during low-speed turns on dry pavement

77. A truck equipped with a manual transmission is in for clutch service. The technician finds that the pilot bearing (the bearing that supports the tip of the transmission input shaft in the center of the flywheel) is dry, rough, and damaged. If the pilot bearing is not replaced during the clutch service, what symptom will result?

A. The transmission input shaft will not be properly supported at its front end, causing the shaft to wobble slightly — this produces a noise or vibration when the clutch pedal is released (clutch engaged) because the shaft is loaded through the pilot bearing, and the wobble causes the clutch disc to track unevenly on the flywheel and pressure plate surfaces

B. The starter motor will not be able to crank the engine because the pilot bearing prevents the flywheel from rotating freely

C. The clutch will slip under load because the damaged pilot bearing friction prevents the input shaft from spinning up to engine speed

D. The transmission will jump out of gear during deceleration because the pilot bearing's lateral play allows the input shaft to shift axially

78. A heavy-duty truck has an automatic transmission that slips in reverse but holds firmly in all forward gears. What is the most likely cause?

A. The torque converter is worn and cannot transmit torque in the reverse direction due to the reversed fluid flow pattern

B. The transmission's forward clutch pack has welded partially, preventing the fluid from reaching the reverse circuit

C. The reverse clutch pack or reverse band is worn, has a leaking apply piston seal, or has insufficient hydraulic apply pressure — the reverse holding element cannot clamp firmly enough to prevent slippage under the load of reverse operation while all forward elements remain functional

D. The park pawl mechanism is partially engaged during reverse, creating a braking force that mimics a slipping condition

79. A truck's automatic transmission produces a whining noise in Park and Neutral with the engine running. The noise pitch increases with engine RPM. The noise is not present when the engine is off. What is the most likely source?

A. The transmission's output shaft bearing, which is loaded even in Park and Neutral due to the vehicle's weight

B. The transmission's front pump, which is driven by the engine through the torque converter whenever the engine is running — the pump turns in Park, Neutral, and all gear positions, and a worn pump produces a whine proportional to engine RPM regardless of the selected gear position

C. The park pawl engagement spring, which vibrates at the frequency of the engine RPM when the transmission is in Park

D. The torque converter's lockup clutch, which is partially engaged in Park and Neutral and creates a whining friction noise

80. A heavy-duty truck with a tandem drive axle has the rear differential lock engaged. The driver reports that when making a right turn on dry pavement, the truck feels like it is fighting itself and the rear tires are scrubbing. After disengaging the lock, the problem disappears. Why does this occur?

A. The locked differential forces the left and right wheels on the rear axle to rotate at the same speed even though the outside wheel needs to turn faster than the inside wheel during a turn — the locked axle cannot accommodate the speed difference, creating binding and tire scrub at every turn

B. The rear axle lubricant viscosity is too high, creating resistance that is only noticeable when the diff lock is engaged

C. The rear axle bearings are preloaded excessively by the lock mechanism, creating additional drag during turns

D. The locked differential reverses the torque bias, sending more torque to the inside wheel during turns instead of the outside wheel

81. A technician is reassembling a drive axle after a ring and pinion gear replacement. The technician measures the pinion bearing preload using an inch-pound torque wrench on the pinion nut. The reading is 15 inch-pounds. The specification calls for 20 to 30 inch-pounds with new bearings. What does this indicate?

A. The pinion bearing preload is too low — the crushing of the collapsible spacer (or the shim thickness behind the pinion bearing) must be increased to achieve the specified preload; insufficient preload allows the pinion to move axially, changing the gear mesh pattern and causing noise and accelerated wear

B. The pinion nut must be retorqued to a higher value to increase the bearing preload to specification

C. The preload reading is within the acceptable tolerance for used bearings being reinstalled during a ring and pinion change

D. The pinion bearing races need to be replaced because the low preload reading indicates the races have worn oversize in the bore

82. A bus equipped with an automated manual transmission (AMT) has a condition where the transmission will not shift out of first gear. The engine runs normally and the check transmission lamp is illuminated. The scan tool retrieves a fault code for "Output Shaft Speed Sensor — No Signal." What is the relationship between this sensor fault and the transmission being stuck in first gear?

A. The output shaft speed sensor provides the TCU with the vehicle speed data needed to determine when to upshift — without this signal, the TCU cannot verify that the vehicle has reached the speed threshold for the next gear and defaults to first gear as a protective limp-home mode

B. The output shaft speed sensor controls the clutch engagement speed and without it the clutch cannot release for an upshift

C. The fault code has caused the TCU to enter a diagnostic mode that locks the transmission in first gear for testing purposes

D. The output shaft speed sensor is unrelated to the gear selection and the first-gear lock is caused by a separate mechanical fault that coincided with the sensor failure

83. A truck equipped with a PTO has a condition where the PTO engages at idle but disengages (pops out) when the engine RPM is increased to operating speed. What is the most likely cause?

A. The PTO shift mechanism has a worn detent spring or worn engagement notch that cannot hold the PTO gear in mesh against the forces generated at higher RPM — at idle, the mesh forces are low and the worn detent can hold; at operating RPM, the increased gear loading overwhelms the weak detent and the gear pops out of engagement

B. The PTO gear lubricant has dried out, causing the gear to heat up and expand at higher RPM until it pushes itself out of mesh

C. The PTO is the wrong ratio for the transmission model and the gear mesh interference increases with RPM

D. The engine vibration at operating RPM creates a harmonic that resonates with the PTO shift rail and pushes it out of position

84. A technician replaces the clutch on a truck equipped with a compression release engine brake (Jake Brake). After the repair, the engine brake produces less braking force than before the clutch replacement. What might the technician have overlooked?

A. The engine brake slave piston lash adjustment — on engines with compression release brakes, the slave piston lash is a separate adjustment from the standard valve lash; if the technician did not verify and reset the engine brake lash during or after the clutch replacement, the lash may have been disturbed, reducing the exhaust valve opening during the braking event and therefore the amount of compressed air released

B. The engine brake solenoid wiring, which may have been disconnected during the clutch replacement and not reconnected

C. The engine oil level, which may have dropped during the clutch replacement and is now too low to supply adequate oil to the engine brake hydraulic circuit

D. The flywheel, which stores rotational energy that the engine brake must overcome — if a lighter replacement flywheel was installed, the engine brake has less energy to absorb

85. What is the consequence of operating a vehicle with a driveshaft that has been welded for repair (a field weld on the tube to repair a dent or crack)?

- A. A field-welded driveshaft will function identically to the original as long as the weld is performed by a certified welder using the correct filler material
- B. The weld will strengthen the driveshaft beyond its original rating, improving the safety margin for the application
- C. The welding process creates a heat-affected zone that alters the metallurgical properties of the tube, and the weld itself adds mass at a localized point that destroys the factory balance — the result is a driveshaft that is weakened at the weld, out of balance, and at risk of catastrophic failure at speed; driveshafts should be replaced, not field-welded
- D. The weld is acceptable as a temporary repair for 30 days or 5,000 km, whichever comes first, after which the shaft must be professionally rebalanced

86. A heavy-duty truck has a complaint where the steering wheel vibrates violently when the front tires hit a large bump at highway speed. The vibration continues for several seconds after the bump before dampening out. All steering linkage components are within specification. What is the most likely cause?

- A. The front tires are out of balance, which is excited by the bump impact and takes several seconds to settle
- B. The steering gear has excessive internal play that amplifies the bump input into a sustained oscillation
- C. The steering damper has failed — its hydraulic dampening function cannot absorb the bump-induced oscillation energy, allowing the front wheels to oscillate at their natural frequency for several seconds before road friction and system friction finally dampen the motion
- D. The king pin bushings are worn, allowing the steering knuckle to oscillate on the axle during the bump event

87. A truck equipped with power steering has a condition where the steering groans or moans during full-lock turns in either direction. The fluid level is correct and the belt tension is adequate. What is the most likely cause?

- A. The power steering pump is being held at maximum pressure for an extended duration during the full-lock condition, and the pump relief valve is buzzing or the pump cavitates slightly under this sustained maximum-demand condition — the groan is the pump working at its maximum output with nowhere for the fluid to go because the steering gear has reached the end of its travel

B. The steering gear's internal seals are worn and are vibrating under the full-lock pressure condition

C. The steering column U-joints are binding at the extreme steering angles achieved during full-lock turns

D. The tie rod ends are at the limit of their articulation range and are mechanically binding during full-lock turns

88. A truck's steer axle has a measured toe setting of 3 mm toe-in. The manufacturer's specification is 1.5 to 3.0 mm toe-in. However, the truck still exhibits inside-edge tire wear on both steer tires. The toe is at the upper limit of the specification range. What should the technician investigate?

A. The tire inflation pressure, which if chronically overinflated would cause inside-edge wear regardless of the toe setting

B. The steering gear, which may have excess play that allows the toe to change during driving

C. The shock absorbers, which if worn would cause the tires to bounce and wear the inside edges from intermittent contact

D. The king pin and bushing condition — worn king pins change the effective camber angle, and excessive negative camber (top of wheel tilting inward) loads the inside edge of the tire; the toe setting may be within specification, but a camber problem from worn king pins is overriding the toe and causing the inside-edge wear pattern

89. A heavy-duty truck's frame is being inspected and the technician discovers that a previous repair involved welding a steel plate over a section of the frame rail to reinforce a cracked area. The weld was not performed according to the frame manufacturer's approved procedure. What is the concern?

A. The reinforcing plate may have been the wrong thickness for the application, providing either too much or too little additional strength

B. The unauthorized welding may have created heat-affected zones in the high-strength frame steel that are weaker than the original material, and the reinforcing plate may be masking continued crack propagation beneath it — the repair may have introduced more risk than it resolved

C. The reinforcing plate changes the frame's flex characteristics at that point, potentially transferring stress to adjacent sections

D. The paint on the reinforcing plate does not match the original frame coating and will corrode at a different rate

90. A truck with air ride suspension on the trailer tandem axles has a condition where the ride height is correct when the trailer is loaded but the trailer rides too high when it is empty. The height control valves have been tested and function correctly. What is the most likely cause?

A. The air springs have stiffened from age and are not compressing adequately under the reduced weight of the empty trailer

B. The height control valve sensing arms are correctly adjusted for loaded conditions but do not account for the frame-to-axle distance change when the trailer is unloaded

C. The air dryer is overpressurizing the trailer air system, forcing more air into the springs than the height control valves can vent

D. The height control valve linkage is adjusted for the loaded ride height — when the trailer is empty and the springs support less weight, the frame sits higher on the springs; the linkage position at this higher ride height may be outside the valve's effective sensing range, preventing the valve from venting enough air to lower the empty trailer to the correct ride height

91. A straight truck has a single steer axle and a single rear drive axle. During a frame inspection, the technician measures the distance from the center of the steer axle to the center of the drive axle on both sides of the vehicle. The left side measures 4,572 mm and the right side measures 4,562 mm. What does this 10 mm difference indicate?

A. One or both axles are not perpendicular to the frame rails — the truck will dog-track (the rear axle follows a path that is offset from the front axle), causing the vehicle to appear to travel at a slight angle to its actual direction of travel, increasing tire wear and fuel consumption

B. The measurement difference is within the normal manufacturing tolerance for heavy-duty truck frames and requires no corrective action

C. The frame rails are not parallel to each other, but the axles are correctly positioned perpendicular to their respective rail

D. The measurement is invalid because the reference points must be the king pin centers, not the axle centers

92. A truck equipped with leaf spring suspension on the steer axle has one spring shackle that has noticeably more up-and-down movement than the shackle on the opposite side. What does this indicate?

- A. The spring on the loose side has broken its center bolt, allowing the spring to shift on its seat
- B. The shackle hanger bracket is cracking where it is mounted to the frame, creating a loose pivot point
- C. The shackle pins and bushings on the loose side are worn, allowing excessive movement at the pivot point — worn shackle bushings contribute to steering wander, uneven tire wear, and a clunking noise over bumps as the shackle swings freely in the worn bushing
- D. The spring on the loose side has taken a set (sagged) and the reduced arch creates the appearance of excessive shackle movement

93. A truck driver reports a shimmy (rapid oscillation) that occurs only during braking and is not present during normal driving. The front tires are balanced and the steering linkage is tight. What should the technician inspect?

- A. The power steering pump, which may be losing pressure during braking due to a reduced engine RPM
- B. The front brake drums for out-of-round or the front brake rotors for excessive lateral runout — during braking, the out-of-round drum or warped rotor creates a pulsating braking force at each wheel that alternately pushes the steering knuckle forward and backward, transmitting a shimmy through the steering linkage to the steering wheel
- C. The brake chamber diaphragms for uneven elasticity that causes one side to apply before the other
- D. The rear axle alignment, which may be causing the vehicle to yaw during braking and transmit the motion to the steering through the chassis

94. A truck equipped with a sliding fifth wheel has a condition where the fifth wheel will not lock in the adjusted position after sliding. The lock pins do not fully engage the holes in the slider track. The fifth wheel slides freely when unlocked. What is the most likely cause?

- A. The slider track holes are worn oversized, allowing the pins to enter but not seat deeply enough to lock
- B. The lock pin mechanism return springs are too stiff and are preventing the pins from fully engaging
- C. The fifth wheel plate is too heavy for the slider mechanism and the weight prevents the pins from aligning
- D. The slider track rails have debris, corrosion buildup, or slight deformation at the pin hole locations that physically prevents the lock pins from fully seating — the track must be cleaned, inspected, and any damage repaired to allow full pin engagement

95. A technician is inspecting a truck's wheel bearings by grasping the tire at the 12 and 6 o'clock positions and rocking it in and out. A slight clicking sound and barely perceptible movement are detected. What is the assessment?

- A. The bearing end play is within acceptable limits for a heavy-duty truck hub — a very small amount of movement is normal and indicates the bearing is properly adjusted with the specified end play clearance; the slight click is the rollers shifting in the race as the load reverses
- B. The bearing is about to fail catastrophically and the wheel must be removed immediately for bearing replacement
- C. The bearing has excessive end play that requires immediate adjustment to prevent accelerated wear
- D. The clicking indicates a cracked inner bearing race that requires hub disassembly for visual confirmation

96. A tractor-trailer combination's trailer tracks to the left of the tractor's path during straight-line highway driving. The tractor tracks straight. What is the most likely cause?

- A. The tractor's fifth wheel is offset to the right of center on the frame, causing the trailer to angle to the left
- B. The trailer has uneven tire pressures between the left and right sides of the tandem axles

C. The trailer's tandem axle alignment is off-square with the trailer frame — one or both axles are not perpendicular to the trailer's centerline, causing the trailer to follow a path that angles to the left of the tractor's path; this condition is called dog-tracking and causes accelerated tire wear on all trailer tires

D. The trailer's fifth wheel king pin plate is bent from a previous docking impact, causing the trailer to sit at an angle on the tractor's fifth wheel

97. A heavy-duty truck has a condition where the wheel nut indicators (the small pointed devices on the wheel nuts that show rotation) on one wheel have all moved from their original aligned positions. What does this indicate?

A. The wheel nuts were installed with incorrect torque and the indicators reflect the uneven clamping force

B. One or more wheel nuts on that wheel have loosened and rotated from their original torqued position — the misaligned indicators are a visual warning that the wheel's clamping force has been compromised and the nuts must be inspected, re-torqued, and the cause of the loosening investigated

C. The wheel nut indicators have been damaged by road debris and have shifted on the nut surface

D. The indicators were incorrectly installed during the last tire service and do not reflect actual nut movement

98. A truck's steer axle has a condition where the steering wheel is off-center (not straight) during straight-line driving. The vehicle tracks straight and does not pull to either side. The alignment has been verified as within specification. What is the most likely cause?

A. The steering wheel was removed and reinstalled in the wrong position on the splined steering shaft — the wheel is physically clocked incorrectly relative to the straight-ahead steering gear position

B. The steering gear has internal wear that has shifted the center position of the pitman arm output

C. The intermediate steering shaft has a U-joint at an incorrect angle that creates a phase offset between the wheel and gear

D. The drag link has been adjusted to an incorrect length, which has changed the tie rod geometry without affecting the vehicle's tracking but has shifted the steering wheel's resting position off-center

99. A trailer equipped with spring suspension has a condition where one spring clip (the U-shaped clamp that keeps the spring leaves aligned) is broken. The spring leaves have shifted laterally. What is the risk of continued operation?

- A. The shifted leaves will cause a squeak during suspension travel but will not affect axle alignment or braking
- B. Minimal risk — the spring clip is a secondary retention device and the center bolt carries the primary leaf alignment load
- C. The shifted spring leaves may contact the tire, brake lines, or other components, and the misaligned spring cannot properly locate the axle, potentially causing alignment changes that affect tire wear and vehicle tracking
- D. The shifted leaves will cause the spring to lose its rated load capacity by approximately 10% per shifted leaf

100. A heavy-duty truck has recently been converted from standard steel wheels to aluminum wheels. Since the conversion, the driver reports a slight vibration at highway speed that was not present with the steel wheels. All tires were balanced on the new wheels. What should the technician check?

- A. The aluminum wheels may require different balance weights (clip-on versus adhesive) due to the different rim flange profile, and the balance may need to be rechecked using the appropriate weight type
- B. The aluminum wheels may have more inherent runout than the steel wheels, requiring a match-mounting process to minimize the combined tire-and-wheel runout
- C. The hub pilot bore on the aluminum wheels may have a slightly different dimension than the steel wheels, causing a centering error that produces vibration despite correct balance — verify the wheel-to-hub fit, check for hub-centric rings if required, and confirm the pilot bore matches the hub pilot pad
- D. The aluminum wheels dissipate heat differently than steel wheels, changing the tire temperature profile and altering the rolling characteristics at highway speed

101. A truck's steering effort increases significantly when the engine is first started on a cold morning but returns to normal after 5 to 10 minutes of driving. The power steering fluid level is correct. What is the most likely cause?

- A. The power steering pump belt slips when cold because the belt rubber stiffens in low temperatures, reducing the belt's grip on the pulleys until it warms up and becomes more pliable
- B. The power steering fluid viscosity increases dramatically in cold temperatures, making it harder for the pump to draw and circulate the thick fluid until the fluid warms to normal operating viscosity
- C. The steering gear's internal seals contract in the cold, creating tighter clearances that increase friction until thermal expansion loosens them
- D. The steer axle king pin grease thickens in the cold, increasing the mechanical resistance to steering until the grease warms and softens

102. A flatbed trailer used for lumber hauling has a condition where the crossmembers supporting the deck boards have bent downward. The main frame rails are undamaged. What caused this condition?

- A. The deck boards have deteriorated and are no longer distributing the load evenly across the crossmembers
- B. The trailer's air ride suspension is overinflated, creating excessive upward force on the frame rails that causes the crossmembers to deflect downward between the rails
- C. Forklift traffic during loading has exceeded the crossmembers' rated capacity — the concentrated point load of a loaded forklift's wheels exceeds the crossmember's design load, causing permanent bending deformation
- D. The concentrated point loads from lumber bundles placed between the rails exceeded the crossmembers' rated load capacity, bending them permanently downward — crossmembers are designed for distributed loads across the full floor width, and concentrated loads between the rails create bending forces that exceed their structural design

103. A truck driver reports a clunking noise from the right front wheel area when turning left. The noise is not present during right turns or straight-line driving. The steering linkage and ball joints are tight. What is the most likely cause?

- A. The right front shock absorber upper mount is loose — during a left turn, weight transfers to the right side, compressing the right suspension and loading the shock absorber; if the upper mount is loose, the shock body shifts under this load and produces a clunk as it contacts the limit of the loose mounting

- B. The right front brake drum is loose on the hub and shifts during the weight transfer of the left turn
- C. The right front wheel bearing is worn and allows the hub to shift when lateral forces are applied during left turns
- D. The right front spring U-bolt has loosened, allowing the axle to shift on the spring seat when weight transfers to the right during the left turn

104. A truck's heated windshield (a windshield with embedded heating elements) is not clearing frost. The driver activates the heated windshield switch but the windshield remains cold. The fuse for the heated windshield circuit is intact. What should the technician check?

- A. The defroster duct system, which may be blocked and preventing warm air from reaching the windshield to supplement the electric heating
- B. The heated windshield timer module, which may have failed and is not allowing current to flow to the heating elements
- C. The heated windshield relay, the wiring between the relay and the windshield connector, and the windshield's heating element resistance — verify that the relay is energizing and delivering power to the windshield; if power is reaching the windshield but it does not warm, the heating element may have an open circuit from a break in one of the embedded conductors
- D. The A/C compressor, which must be running simultaneously with the heated windshield to provide the temperature differential needed for the heating elements to function

105. A bus driver reports that the driver's seat air suspension makes a repetitive hissing noise during driving. The seat height remains stable and the ride quality is normal. What is the most likely cause?

- A. The seat's air spring has developed a slow leak that the height control valve compensates for — the hissing is the sound of air escaping through the leak, and the valve adds replacement air to maintain ride height; the seat functions normally because the valve compensates, but the continuous leak and fill cycle wastes air and will eventually wear out the valve
- B. The seat's air supply pressure is too high, causing the pressure relief valve to vent continuously
- C. The seat's shock absorber has failed and the hissing is the sound of hydraulic fluid bypassing through the damper's internal passages

D. The seat's height control valve is oversensitive and is constantly adding and venting small amounts of air in response to normal road vibration

106. A truck's interior dome light stays illuminated when all doors are closed and the dome light switch is in the "door" position (door-activated mode). What is the most likely cause?

A. One of the door jamb switches is stuck in the closed (door-open-sensing) position or has a wiring fault that keeps the dome light circuit grounded even with the door closed — the dome light receives its ground path through the door switch, and a stuck or grounded switch completes the circuit at all times

B. The dome light switch has failed in the "on" position instead of being in the "door" position as the driver believes

C. The dome light bulb is wired backward in its socket, causing it to remain on regardless of the switch position

D. The body controller module has a software glitch that commands the dome light on continuously

107. A transit bus has a condition where cold air from the outside enters the cab around the driver's footwell area during winter driving. The driver's door weather seals have been checked and are intact. What else should be inspected?

A. The windshield seal, which may have a gap at the lower corner near the A-pillar that allows cold air to enter

B. The floor grommets where control cables, wiring, and plumbing pass through the cab floor — missing, deteriorated, or incorrectly installed grommets leave openings that allow cold outside air to enter the cab footwell from below the vehicle during driving, particularly at higher speeds where air pressure forces the cold air up through the gaps

D. The heater core, which may be partially blocked and not producing enough heat to counteract the cold air infiltration

C. The HVAC fresh air intake door, which may be stuck in the open position and allowing unheated outside air to enter the cab

108. A heavy-duty truck's cab has a persistent diesel fuel odor inside the cab that is strongest when the HVAC system is running on the fresh air setting. What should the technician inspect?

- A. The engine's injector return lines, which if leaking near the turbocharger could allow fuel vapor to enter the cab through the engine heat
- B. The HVAC fresh air intake location and its proximity to fuel system components — a fuel leak near the HVAC intake (from a fuel line, fuel filter, or fuel tank vent) allows fuel vapor to be drawn into the cab by the HVAC system's fresh air intake, and the cab's positive air pressure from the blower distributes the odor throughout the interior
- C. The engine exhaust system for a leak upstream of the DPF that could introduce fuel vapor into the cab
- D. The fuel tank sender unit seal, which may be leaking fuel vapor that is entering the cab through the frame rail and floor pan

109. A technician is inspecting a trailer and discovers that the emergency (supply) gladhand coupling at the nose of the trailer is cracked. The coupling is currently holding air with no visible leak. Is the trailer acceptable for operation?

- A. The coupling is acceptable since it is currently holding air and functioning without a leak
- B. The coupling is only a concern during coupling and uncoupling operations and can be replaced at the next scheduled service
- C. The cracked coupling can be repaired with an epoxy adhesive designed for air system components
- D. The cracked coupling must be replaced before the trailer operates — a crack in a pressurized component can propagate rapidly under the thermal cycling, vibration, and pressure fluctuations of normal operation, potentially causing a sudden failure that exhausts the trailer's air supply and applies the spring brakes without warning

110. A trailer equipped with disc brakes on all positions has a condition where one brake caliper is producing a continuous grinding noise even when the brakes are not applied. The driver reports the noise has been present for approximately 500 km. What is the most likely cause?

- A. The ABS modulator on that wheel is partially applying the brake through a leaking internal seal
- B. The brake pad on that caliper has worn completely through its friction material and the steel backing plate is now grinding directly against the rotor surface — the pad wear indicator (if equipped) has been ignored and the pad has worn beyond the point where the indicator would have alerted the driver, resulting in metal-to-metal contact that is rapidly damaging the rotor
- C. The caliper slide pins have seized, causing the caliper to ride unevenly and the pad edge to contact the rotor during wheel rotation
- D. The rotor has developed a high spot from heat distortion that contacts the pad at one point during each rotation

111. A tanker trailer is being inspected and the technician finds that the external dome (manhole cover) gasket on one compartment is visibly deteriorated — the gasket is cracked, compressed, and no longer seals against the dome rim. What is the concern?

- A. The deteriorated gasket will allow product vapors to escape during transport, creating an environmental and inhalation hazard for anyone near the trailer
- B. The deteriorated gasket will allow moisture to enter the tank compartment and contaminate the product
- C. The deteriorated gasket will allow rainwater to pool on the dome surface and cause corrosion of the manhole rim
- D. The deteriorated gasket may allow the dome to open under internal pressure during transport, and it may also allow product spillage during loading, tank pressure changes, or vehicle rollover — the gasket must be replaced to maintain the integrity of the tank's sealed compartment

112. A trailer's air suspension dump valve has been accidentally left in the dump position. The trailer has been driven 200 km with the suspension fully deflated. What damage may have occurred?

- A. The air springs may have been damaged by the direct metal-to-metal contact between the frame and axle, the bump stops (rubber stops that limit compression travel) may be crushed or destroyed, and the frame, axle, and suspension components may have sustained damage from the unsprung operation — additionally, any speed-sensitive ABS calibration may be affected by the reduced ride height

- B. No significant damage — the air springs will reinflate when the dump valve is restored and the system will function normally
- C. Only the air springs need to be inspected because they are the only components affected by the deflated condition
- D. The trailer axle alignment has been permanently altered by driving without air spring support

113. A trailer has a condition where one brake chamber (service side) has a torn diaphragm. Air leaks audibly from the diaphragm area when the brakes are applied. What is the consequence of operating the trailer with this condition?

- A. The torn diaphragm allows application air to escape instead of pushing the pushrod, dramatically reducing or eliminating braking force at that wheel position and creating a brake imbalance that can cause the trailer to pull during braking
- B. The torn diaphragm is a minor leak that slightly increases brake application time but does not significantly affect braking force
- C. The torn diaphragm allows contaminants to enter the air system through the chamber, affecting air quality in the entire brake circuit
- D. The torn diaphragm only affects the spring brake function and does not impact service brake operation

114. A trailer's electrical J560 connector at the nose has a pin that is physically pushed back into the connector body. The pin is for the auxiliary circuit (ABS power). What is the consequence?

- A. The trailer's marker lights will not function because the auxiliary circuit provides the ground return for the marker light circuit
- B. The trailer's ABS system will not receive power from the tractor, disabling the anti-lock function for all trailer wheel positions — the ABS ECU cannot operate without its power supply, and all anti-lock protection is lost even though the foundation brakes continue to function normally
- C. The trailer's stop lamps will remain illuminated continuously because the pushed-back pin creates a short to the stop lamp circuit

D. The trailer's spring brakes will not release because the auxiliary circuit controls the spring brake hold-off valve

115. A flatbed trailer used for steel coil transport has reinforced coil wells (depressions in the deck designed to cradle the steel coils). During an inspection, the technician finds fatigue cracks at the welds where the coil well reinforcement meets the main crossmembers. What is the significance?

A. The cracks are cosmetic and do not affect the structural capacity of the coil wells because the main crossmembers carry the load independently

B. The welded reinforcement has no structural purpose and is only a positioning guide for the coils

C. The cracks are only significant if the coils being transported exceed the trailer's maximum gross weight rating

D. The fatigue cracks indicate that the reinforcement welds are failing under the cyclic loading of steel coil transport — the coil wells support concentrated loads of 20,000 to 40,000 pounds per coil, and cracked welds may fail catastrophically during transport, allowing a coil to break through the trailer floor or shift uncontrolled

116. A reefer trailer's TRU (transport refrigeration unit) is running and cooling normally, but the driver reports that the cargo temperature is reading differently on the TRU display versus the handheld temperature probe used to verify the load at the dock. The TRU reads -18°C and the probe reads -12°C at the same location in the trailer. What is the most likely cause?

A. The TRU's temperature display is calibrated for the evaporator discharge air temperature, not the cargo air temperature, and the two readings are expected to differ

B. The handheld probe is inaccurate and needs calibration against a known reference standard

C. The TRU's return air temperature sensor (which reads the air returning from the cargo space to the evaporator) may be reading the temperature of the air near the evaporator rather than the average cargo temperature — the sensor may be affected by cold air short-circuiting from the evaporator discharge directly to the sensor without passing through the cargo, giving a colder reading than the actual cargo temperature throughout the trailer

D. The difference is within the acceptable tolerance for transport refrigeration temperature measurement and both readings are considered valid

117. A truck's HVAC system has a condition where the air from the dashboard vents smells strongly of coolant. There is no visible coolant on the floor or under the dashboard. What does this odor indicate?

- A. The coolant reservoir cap is loose and the HVAC fresh air intake is drawing coolant vapor from the engine compartment
- B. The heater core has a small leak that is vaporizing the leaking coolant before it can form visible drips — the coolant vapor is carried by the airflow through the HVAC system and into the cab as a sweet-smelling mist; the leak is typically too small to produce visible dripping but large enough to produce the odor, and it will worsen over time
- C. The engine coolant has been contaminated with a scented additive that is producing the odor through normal heater core heat exchange without any leak
- D. The blend door is stuck in the full-heat position, causing the coolant in the heater core to overheat and release vapor through the core's normal microscopic porosity

118. A truck's A/C system has been retrofitted from R-12 to R-134a. After the retrofit, the system cools adequately in spring and fall but cannot maintain cab temperature during the hottest summer days. What is the most likely explanation?

- A. The retrofit fittings are leaking slightly, allowing refrigerant to escape during high-ambient-temperature operation when system pressures are highest
- B. The R-134a refrigerant has a lower boiling point than R-12 and cannot absorb as much heat at the elevated ambient temperatures of summer
- C. The retrofit installer did not replace the condenser — the original R-12 condenser may not have adequate capacity for R-134a at high ambient temperatures because R-134a operates at higher pressures and requires more condenser surface area for effective heat rejection
- D. R-134a systems require a larger compressor than R-12 systems, and the original compressor is undersized for the retrofit application during extreme heat conditions

119. A truck's cab has a condition where the HVAC blower motor runs continuously at low speed even when the HVAC control panel is turned off. Turning the control panel to higher speeds overrides the continuous low-speed operation. What is the most likely cause?

- A. The blower motor relay has a stuck contact that provides a ground path to the motor through the relay's normally-closed contact, which keeps the motor running at a reduced speed through the blower resistor — when the control panel commands higher speeds, the normal control circuit overrides the relay's stuck path
- B. The blower motor has an internal short between the high-speed and low-speed windings
- C. The HVAC control panel has a failed off switch that cannot interrupt the low-speed circuit
- D. The body controller module is commanding a minimum fan speed as a cabin ventilation feature that cannot be overridden by the manual controls

120. A truck's A/C system is performing normally except that the compressor cycles on and off more frequently than expected. The system cools adequately during each on cycle. The refrigerant charge has been verified as correct. What is the most likely cause?

- A. The compressor clutch has too much air gap, causing it to slip slightly during each engagement cycle
- B. The condenser fan is cycling on and off with the compressor, creating a thermal oscillation in the high-side pressure
- C. The evaporator temperature sensor or low-pressure cycling switch is triggering compressor disengagement at a threshold that is too close to the engagement threshold — the narrow differential between the cut-out and cut-in temperatures causes the compressor to cycle rapidly as the evaporator temperature oscillates through a small range
- D. The expansion valve is oversized for the system, flooding the evaporator too quickly and triggering the freeze protection before the system reaches a stable operating temperature

121. A fuel-fired coolant heater (Webasto/Espar type) produces a strong fuel odor during operation. The heater functions and produces heat. What is the most likely cause?

- A. The heater's fuel supply line fitting is slightly loose, allowing a small amount of fuel to weep at the connection and vaporize from the heater's external surface temperature
- B. The combustion exhaust pipe from the heater has a leak, crack, or loose connection that is allowing combustion gases (which contain unburned fuel vapor) to escape near the vehicle rather than being expelled at the designated exit point

- C. The heater's fuel nozzle is partially clogged, causing incomplete combustion that produces unburned fuel vapor in the exhaust
- D. The heater's combustion chamber gasket has deteriorated, allowing raw fuel to escape the combustion chamber before igniting

122. A truck's A/C system has a condition where the compressor clutch engages normally and the system cools, but a liquid sloshing sound can be heard from behind the dashboard during acceleration, deceleration, and turns. What is the most likely cause?

- A. The A/C system has an overcharge of refrigerant that is flooding the evaporator with liquid refrigerant that sloshes audibly inside the evaporator housing during vehicle movement
- B. The heater core has an air pocket trapped inside that produces a sloshing sound as the coolant and air mixture shifts during vehicle movement
- C. The compressor oil charge is excessive and liquid oil is accumulating in the evaporator, producing the sloshing sound
- D. The evaporator condensate drain tube is clogged, allowing water to accumulate in the evaporator housing — the trapped water sloshes audibly during acceleration, deceleration, and turns as the vehicle's motion shifts the water inside the housing

123. A transit bus's roof-mounted A/C unit has adequate cooling in the front of the bus but the rear of the bus is significantly warmer. The A/C unit appears to be running at full capacity. What should the technician investigate?

- A. The A/C unit's conditioned air distribution ductwork running the length of the bus roof — a collapsed duct section, a disconnected duct joint, or a blocked diffuser in the rear section would prevent cooled air from reaching the rear of the bus while the front section (nearest the unit) receives adequate airflow
- B. The rear windows, which if left partially open would allow warm outside air to enter and overwhelm the A/C in the rear section
- C. The rear emergency exit seals, which if deteriorated would allow warm air infiltration concentrated at the rear of the bus

D. The A/C unit's compressor, which may be undersized for the bus length and cannot cool the full interior volume

124. A hydraulic system on a utility truck has a condition where the outrigger cylinders extend at different rates — the left outrigger reaches full extension approximately 3 seconds before the right outrigger. Both are controlled by the same directional valve and supplied by the same pump. What is the most likely cause?

A. The directional control valve has a worn spool that favors the left port with slightly more flow than the right port

B. The left outrigger cylinder has a smaller bore diameter than the right, requiring less fluid volume to extend fully

C. The right outrigger cylinder has a partially restricted hose, fitting, or port that limits the flow rate to that cylinder, causing it to extend more slowly than the unrestricted left cylinder even though both receive supply from the same valve

D. The hydraulic fluid has separated into layers of different viscosity, and the right cylinder's supply line draws from a thicker layer

125. A hydraulic system's gear pump is producing a rhythmic knocking noise that corresponds to pump shaft rotation speed. The noise was not present previously. What is the most likely cause?

A. The pump's inlet strainer is partially clogged, causing the pump to cavitate with each revolution as it draws fluid through the restriction

B. A broken or chipped tooth on one of the pump's internal gears produces an impact noise once per revolution as the damaged tooth contacts its mating gear — the damage also introduces metallic debris into the system that will damage downstream components if not addressed

C. The pump mounting bolts have loosened, allowing the pump to shift position and produce a knocking sound as it contacts the mounting bracket with each revolution

D. The hydraulic reservoir is overfilled, creating backpressure on the pump outlet that produces a rhythmic pressure spike with each pumping cycle

126. A hydraulic crane has a condition where the boom extends smoothly but jerks during retraction. The counterbalance valve on the retract circuit has been recently replaced. What is the most likely cause of the jerky retraction?

- A. The new counterbalance valve has a different pilot ratio than the original, creating an oscillation between the pilot pressure and the load-holding function during retraction
- B. The crane's slewing mechanism is interfering with the retraction circuit through a shared hydraulic line
- C. The retraction cylinder's rod seal is worn, allowing fluid to bypass at specific rod positions
- D. The replacement counterbalance valve is set to a different cracking pressure or pilot ratio than the original, causing it to open and close erratically during retraction rather than modulating smoothly — the valve alternately holds and releases the load, producing the jerky motion

127. A technician is filling a new hydraulic reservoir on a truck-mounted system. The manufacturer specifies the reservoir capacity as 40 liters. The technician fills the reservoir to the full mark, which is below the 40-liter total capacity. Why is the reservoir not filled to its physical capacity?

- A. The reservoir must maintain an air space above the fluid level to allow for thermal expansion of the fluid during operation, to provide a volume for fluid displaced from extended cylinders when they retract, and to allow air to separate from the returning fluid before it is drawn back into the pump — filling to physical capacity eliminates this essential air space and can cause fluid to overflow when cylinders retract or the fluid warms up
- B. The reservoir manufacturer uses a standardized capacity rating that is always 10% larger than the usable volume
- C. The excess reservoir space is designed to accommodate a larger pump upgrade in the future
- D. The fluid level must be below the return line port to prevent backpressure on the returning fluid

128. A hydraulic system has a condition where the fluid temperature rises from ambient to 80°C within 15 minutes of operation. The system has an oil cooler and the cooler appears to have adequate airflow. The reservoir level is correct. What should the technician measure?

- A. The ambient air temperature and humidity to determine if environmental conditions are preventing adequate cooler performance
- B. The cooler's inlet and outlet temperatures — if the temperature difference between inlet and outlet is small, the cooler is not transferring heat effectively despite having airflow; possible causes include internal fouling, a bypass valve stuck open, or incorrect plumbing that routes fluid around the cooler
- C. The pump speed to verify it is not exceeding the manufacturer's maximum RPM specification, which would generate more heat than the cooler can reject
- D. The return line filter differential pressure to verify the filter is not restricting flow and converting the hydraulic energy to heat

129. A hydraulic tailgate lift has a condition where it raises a load normally but the lift platform descends too rapidly when the down valve is activated. The descent speed makes it difficult to control the platform's lowering rate. What is the most likely cause?

- A. The hydraulic pump is oversized for the application and delivers too much flow during the lowering cycle
- B. The flow control valve in the lowering circuit is set too open or has failed, allowing fluid to return from the cylinder to the reservoir at a rate that is too fast for controlled lowering — the flow control restricts the exhaust rate of the cylinder to limit descent speed, and a failed or maladjusted flow control allows uncontrolled gravity-driven descent
- C. The cylinder rod seals are worn, allowing fluid to bypass from the cap side to the rod side inside the cylinder
- D. The hydraulic fluid viscosity is too low for the current ambient temperature, allowing the fluid to flow through the control valve faster than designed

130. A truck-mounted hydraulic system uses a return-line filter with a condition indicator. The indicator shows the filter is clean (not loaded). However, the technician notices that the hydraulic fluid appears dark and contaminated when viewed through the reservoir sight glass. How can the fluid be contaminated if the return filter is clean?

- A. The contamination is entering the system through the reservoir breather cap, which is damaged or not filtering incoming air adequately

B. The contamination is being generated by a source upstream of the return filter — such as a worn pump, a deteriorating cylinder seal, or corrosion inside the reservoir — and the return filter is capturing the contamination, but the captured particles have darkened the fluid that is already in the reservoir from before the filter was last changed

C. The return filter is bypassing internally despite the indicator showing clean, and unfiltered fluid is returning to the reservoir

D. The contamination is thermal degradation of the fluid from chronic overheating — the dark color indicates the oil has oxidized and broken down, not that it is loaded with particles; the return filter removes particles but cannot filter out the molecular-level chemical degradation products that cause the dark color

131. A hydraulic system on a refuse truck has a condition where all functions operate normally when the engine is at 1,500 RPM but several functions become sluggish when the engine drops to idle (600 RPM). The system uses an engine-driven gear pump. What is the explanation?

A. A gear pump's output is directly proportional to its rotational speed — at idle RPM, the pump turns slower and produces less flow than at 1,500 RPM; if the system's functions require more flow than the pump can deliver at idle speed, the functions operate sluggishly because the reduced flow takes longer to fill the cylinders and move the actuators

B. The hydraulic fluid viscosity increases at the lower oil temperature associated with idle operation, restricting flow through the system

C. The relief valve is set too close to the system's normal operating pressure, and the reduced pump speed at idle causes the pressure to fluctuate around the relief setting

D. The PTO drive ratio changes between idle and operating RPM, reducing the effective pump speed below the proportional relationship with engine RPM

132. A battery electric transit bus has a condition where the battery management system (BMS) has activated a thermal management fault and has limited the battery's maximum discharge rate. The bus accelerates normally from stops but cannot maintain highway speed. What is causing this limitation?

A. The traction motor has reached its maximum continuous torque rating and cannot produce additional force regardless of battery capacity

B. The inverter has detected an internal fault and is limiting the frequency of the AC output to protect its semiconductor switches

C. The battery pack's thermal management system is not maintaining cell temperatures within the optimal range — the BMS limits the discharge rate to prevent overheating or overcooling of the cells, which reduces the maximum power available to the traction motor and limits the bus's top speed while allowing normal low-speed operation

D. The DC-DC converter is drawing excessive power for the 12-volt system, reducing the high-voltage power available for propulsion

133. A hybrid electric delivery truck has a series hybrid architecture. The diesel engine has been running for 30 minutes but the battery state of charge has not increased above 15%. Normally, the engine recharges the battery to 60% within 20 minutes. What should the technician investigate?

A. The diesel engine's power output, which may be derated due to an emission system fault that is limiting the engine's RPM and load

B. The generator (traction generator) that is driven by the diesel engine — if the generator has a fault (winding failure, bearing failure, or inverter control fault), it may not be converting the engine's mechanical output to electrical energy efficiently, and the battery receives less charging current than expected despite the engine running normally

C. The high-voltage battery pack, which may have degraded to the point where it cannot accept charging current at the normal rate

D. The traction motor, which may be consuming all of the generator's output for propulsion and leaving nothing for battery charging

134. A technician is preparing to disconnect a high-voltage battery connector on a hybrid electric bus. The connector uses an interlock circuit (a small connector integrated into the high-voltage connector that breaks a signal circuit when the connector is separated). What is the purpose of this interlock?

A. The interlock prevents the connector from being physically removed without using a special tool that only certified technicians possess

B. The interlock provides a feedback signal to the high-voltage vehicle controller to verify the connector is properly mated — when the connector is separated, the interlock circuit opens and the BMS

immediately detects the break, commanding the high-voltage contactors to open and de-energizing the bus before the technician's hands contact the high-voltage terminals

C. The interlock locks the connector in place mechanically and cannot be separated without first pressing a release tab

D. The interlock circuit monitors the temperature of the connector terminals and opens the contactors if the terminals overheat during normal operation

135. A battery electric truck has a condition where regenerative braking provides strong deceleration during the first portion of a trip but becomes progressively weaker as the trip continues, requiring the driver to use the friction brakes more heavily toward the end of the route. The battery SOC at the end of the trip is 95%. What is causing the reduction in regenerative braking?

A. As the battery approaches full charge (95% SOC), the BMS progressively limits the regenerative braking current to prevent overcharging the battery — the battery cannot accept additional energy when it is nearly full, so the VCU reduces the motor's generating effort and the regenerative braking force decreases, requiring the friction brakes to compensate for the reduced regenerative contribution

B. The traction motor's temperature increases during the trip, reducing its efficiency as a generator and producing less regenerative braking force

C. The brake pedal sensor has a calibration drift that gradually changes the regenerative braking proportion over time

D. The inverter's capacitors gradually lose charge during the trip, reducing the regenerative braking circuit's ability to convert and store energy

Practice Exam 5: Answer Key and Explanations

1. C — A DPF that has recently undergone regeneration reaches internal temperatures exceeding 500°C, and the surrounding exhaust components retain extreme heat for an extended period afterward. Cutting into or near these components without allowing adequate cool-down time risks severe contact burns to the technician, ignition of combustible materials in the work area, and potential fire from hot metal fragments produced by the cutting operation contacting flammable shop materials.

2. A — The windshield on a modern vehicle is a structural component — it contributes to the cab's rollover strength and supports airbag deployment forces. An adhesive bond that has not fully cured cannot withstand the forces of a collision or even the flexing of normal driving. Releasing the vehicle before the specified cure time puts the occupants at risk of windshield separation during a collision and exposes the shop to liability. The technician has a professional and legal obligation to refuse the premature release regardless of schedule pressure.

3. D — A leaking hoist cylinder indicates that the hydraulic seal is failing. If the leak progresses to a complete seal failure while the vehicle is raised, the hoist will descend — potentially crushing anyone underneath. The mechanical safety locks provide backup support, but the hoist must be removed from service until the leak is repaired. The technician must evaluate whether the safety locks can maintain the vehicle safely during the lowering process and proceed with extreme caution.

4. B — Brake cleaner and similar flammable solvents produce heavier-than-air vapors that can travel along the ground to an ignition source. Carrying an open or partially sealed container of flammable solvent through an area with lit cigarettes creates a direct fire hazard — the vapors can reach the ignition source and flash back to the container. The technician should use a sealed container and route around the smoking area, or the smoking area should be relocated away from any path where flammable materials are transported.

5. D — Before any wheel removal on a heavy-duty vehicle, the vehicle must be properly secured to prevent movement and collapse. The vehicle must be on a level surface (to prevent rolling), the wheels remaining on the ground must be chocked (to prevent movement), and the vehicle must be supported by jack stands rated for its weight or by a properly functioning hoist with safety locks engaged. A hydraulic jack alone is never acceptable as the sole support because jacks can leak, fail, or be accidentally released.

6. A — Undercoating is a petroleum-based or rubber-based material that is combustible and produces toxic fumes (including hydrogen cyanide and carbon monoxide) when heated by a welding arc. The coating must be completely removed from the weld area and the surrounding zone to prevent fire, toxic fume exposure, and poor weld quality. Undercoating also prevents proper fusion between the weld filler and the base metal, producing a weak joint that can fail under load.

7. C — Disconnecting the negative (ground) cable first is the universal safe practice for battery removal. If the wrench contacts the frame or any metal while removing the negative cable, no circuit is completed because the frame is already the negative path — there is no short circuit, no spark, and no arc. If the positive cable were removed first and the wrench contacted the frame, the wrench would complete a

circuit between the positive terminal and the grounded frame, producing a high-current short circuit, sparks, and potential battery explosion from hydrogen gas ignition.

8. B — Fire sprinkler systems distribute water in a specific spray pattern designed to cover the area below the sprinkler head. Materials stacked within 18 inches of the sprinkler deflector obstruct this spray pattern, creating a shadow zone where water cannot reach a fire. Building and fire codes require a minimum clearance below sprinkler heads (typically 18 inches) to ensure unobstructed coverage. The stacked materials must be relocated to restore the required clearance.

9. D — A fuel rail pressure deviation that occurs only during high fuel demand (hard acceleration) while the system functions normally at idle and light loads indicates that the pressure source cannot keep up with the peak demand. The high-pressure pump may have internal wear that limits its maximum output, or the low-pressure supply system (transfer pump, fuel filters, supply line) may not be delivering adequate fuel volume to the high-pressure pump's inlet during peak demand. At idle, the demand is low enough that even a compromised supply system can maintain pressure.

10. B — An exhaust leak between the exhaust manifold and the turbocharger turbine inlet allows exhaust gas to escape to the atmosphere before it can drive the turbine wheel. The energy lost through the leak is energy that is not available to spin the turbine, and consequently the compressor produces less boost. The turbocharger spools up audibly because it is still receiving some exhaust energy, but the reduced energy input limits its output below the specification. Inspecting the manifold-to-turbo connection for cracks, loose fasteners, or blown gaskets identifies the leak.

11. A — At TDC of the compression stroke, both valves must be closed because the cylinder is sealed for compression. The cam lobes for both the intake and exhaust valves are on their base circles, and the rocker arms have no load — the feeler gauge can be inserted freely for adjustment. At TDC of the exhaust stroke, the engine is in the valve overlap period — the exhaust valve is closing and the intake valve is opening, so one or both valves are partially open and the rocker arms are loaded by the cam lobes. Checking for free rocker arms confirms TDC compression.

12. C — Heavy carbon buildup on an injector tip is evidence of poor fuel atomization. When the nozzle holes are partially blocked or the needle valve does not seat cleanly, fuel dribbles from the tip in large droplets rather than atomizing into a fine mist. These large droplets do not combust completely — they partially burn on the hot injector tip, depositing carbon. The carbon further restricts the nozzle holes, worsening the spray pattern in a self-reinforcing degradation cycle that progressively reduces the cylinder's power output and increases emissions.

13. D — The flywheel housing bore must be concentric with the crankshaft centerline to ensure that the transmission input shaft aligns with the crankshaft. A TIR of 0.012 inches (exceeding the 0.008-inch maximum) means the housing bore is offset from the crankshaft center by enough to create misalignment at the input shaft pilot bearing, the clutch disc, and the transmission input shaft bearing. This misalignment causes accelerated wear on these components, clutch disc runout, vibration, and premature transmission bearing failure.

14. A — When the air system, fuel injectors, and air intake are all verified as correct, the fuel efficiency deficit must come from the engine's fundamental ability to convert fuel energy into mechanical work. Low compression (from worn rings or valves) means less of the fuel's energy is captured. A worn turbocharger that delivers less boost than specification reduces the air available for efficient combustion. Retarded injection timing wastes fuel energy as heat rather than work. And a thermostat stuck open keeps the engine cold, reducing thermal efficiency.

15. B — Coolant contamination in the engine oil is a serious condition that requires thorough flushing — not just a single oil change. Coolant in the oil attacks bearing surfaces, degrades oil additives, and can cause sludge formation. A single drain-and-fill leaves contaminated oil in the oil cooler passages, the oil filter housing, the valve train, and the internal galleries. The double drain-and-fill procedure (drain, flush, refill, run briefly, drain again, refill) removes residual coolant from these internal passages.

16. D — Diesel runaway occurs when the engine ingests a combustible substance through the air intake — most commonly engine oil from a failed turbocharger seal or a crankcase breather system failure. The engine burns this oil as fuel independently of the diesel fuel injection system. Turning off the ignition or shutting off the diesel fuel has no effect because the engine is running on the ingested oil, not on diesel. The only way to stop the engine is to cut off its air supply (blocking the intake) or to stall it mechanically (engaging the highest gear and applying the brakes with the vehicle stationary).

17. C — The crankcase pressure sensor detects pressure above the normal ventilation system's capacity. At 600,000 km, the most common cause of elevated crankcase pressure is combustion gas blow-by from worn piston rings and cylinder liners. The blow-by volume exceeds what the crankcase ventilation system was designed to handle, causing pressure to build in the crankcase. The ECM sets the code as an indicator of internal engine condition — it is a maintenance alert that the engine is approaching or has reached overhaul condition.

18. A — The cooling system pressure test should be performed at the pressure cap's rated pressure — in this case, 15 psi. Testing at the cap's rating simulates the system's maximum normal operating pressure, which is the condition under which leaks are most likely to appear. Pressurizing above the cap's rating

causes the cap's relief valve to open, making the test invalid, and risks damaging components (hoses, heater core, gaskets) that are designed for the cap's rated maximum.

19. B — The primary fuel filter (fuel/water separator) is designed to capture water that is present in the fuel supply. The collection of water in the separator bowl confirms it is performing its function. However, the source of the water must be identified to prevent recurring contamination. Common sources include condensation inside a partially filled fuel tank (temperature cycling causes moisture in the air space to condense), contaminated fuel from the supplier, and a failed or missing fuel tank vent cap that allows rainwater entry.

20. D — White smoke that persists after the engine reaches full operating temperature and has a sweet odor is coolant being vaporized in the combustion chambers. At operating temperature, the cylinders are hot enough to fully vaporize any fuel (eliminating unburned fuel as a cause) and the engine is performing normal combustion. The persistent white steam comes from coolant entering the cylinders through a cracked head, blown head gasket, or cracked liner. The sweet odor is characteristic of ethylene glycol coolant vapor and distinguishes this condition from fuel-related white smoke.

21. C — Dielectric grease is a non-conductive silicone-based grease that seals electrical connector interfaces against moisture intrusion while not interfering with the electrical connection between the mating pin and socket contacts. Applied to the cleaned connector pins, it fills the air space around the contacts and prevents moisture, road spray, and corrosion-promoting contaminants from reaching the metal surfaces. This is a standard preventive practice for any electrical connector in a harsh environment.

22. A — Normal boost pressure, unrestricted air filter, and normal exhaust backpressure confirm that the engine is receiving adequate air and the exhaust path is clear. With adequate air available, the remaining variable that determines the air-fuel ratio is the fuel delivery. If one or more injectors are delivering excess fuel (stuck open, leaking, or miscalibrated), the extra fuel produces a rich condition that creates black smoke — the air cannot fully oxidize the excess fuel. Alternatively, if injection timing is advanced, the fuel burns at the wrong point in the cycle, reducing efficiency and potentially producing smoke.

23. B — A compression test on a six-cylinder diesel engine with all readings between 380 and 395 psi shows excellent compression across all cylinders. The variation of 15 psi (less than 4% difference between the highest and lowest readings) is well within the acceptable range for a healthy engine. Uniform readings with minimal variation indicate that all cylinders have good ring seal, properly seating valves, and intact head gaskets. No further investigation is warranted.

24. D — UV fluorescent dye is injected into the engine oil and circulates throughout the lubrication system. At the leak point, the dye escapes with the oil and deposits a fluorescent trace on the external surface that is invisible under normal light but glows brightly under UV light. Because the dye accumulates at the leak source over time, even very slow leaks become clearly visible as a glowing trail that can be traced from the drip point back to the exact seal or gasket where the oil originates. This method definitively distinguishes between the rear main seal, oil pan gasket, and transmission seal.

25. C — A DPF that shows higher backpressure after cleaning than before suggests something went wrong during the reinstallation. If the exhaust system gaskets or clamps between the DOC and DPF were not properly sealed, turbulent flow at the leak point or misaligned components can create flow disruptions that the backpressure sensor reads as elevated pressure. Additionally, a misaligned DPF that is not seated squarely in its housing can partially block the exhaust channels. The reinstallation must be inspected for proper gasket sealing, clamp tightness, and component alignment.

26. A — HEUI (Hydraulic Electronic Unit Injector) systems use high-pressure engine oil (500-3,600 psi from a dedicated high-pressure oil pump) to drive the injection event. If the injection control pressure (ICP) is below specification at cranking, the injectors cannot generate adequate injection pressure to properly atomize the fuel for reliable ignition. The diagnostic focus must be on the oil side of the system: the high-pressure oil pump, the injection pressure regulator (IPR) valve, the oil level, the oil condition, and any internal oil leakage paths that prevent the system from building adequate ICP.

27. D — Plastigage provides a direct measurement of the oil clearance between the bearing and journal. A clearance of 0.006 inches exceeds the maximum specification of 0.004 inches by 50%. Excessive clearance allows oil to escape the bearing faster than the pump can supply it, reducing local oil pressure and the protective oil film. Under load, the journal will contact the bearing surface, producing a knocking noise and accelerating bearing wear. The journal and bearing combination must be corrected — either through a different bearing size or journal rework.

28. B — DEF crystallization occurs when DEF is injected into exhaust gas that has not reached the minimum temperature (approximately 200°C) required for complete urea decomposition. Instead of converting to ammonia, the urea solidifies as crystalline deposits in the decomposition tube. These deposits restrict exhaust flow (increasing backpressure and reducing engine performance), reduce SCR efficiency (less ammonia reaches the catalyst), and can damage exhaust temperature sensors and pressure sensors mounted in the decomposition area.

29. D — A minor, slow RPM oscillation at idle without fault codes is typically caused by the ECM's idle control algorithm responding to varying parasitic loads. The A/C compressor clutch engaging and disengaging adds and removes approximately 5-10 horsepower of load. The air compressor cycling

between loaded and unloaded states adds and removes a similar parasitic load. The power steering pump loads and unloads as the driver's hands rest on the wheel. The ECM adjusts fuel delivery to compensate for each load change, but the compensation is never instantaneous — the slight RPM oscillation is the normal hunting behavior of the idle control loop.

30. B — The air dryer's function is to remove moisture from the compressed air before it reaches the reservoirs. If the wet tank contains significant water, the dryer is not performing adequately. The three most common causes are a saturated desiccant cartridge (past its service life), a malfunctioning purge cycle (the purge is not regenerating the desiccant effectively — possibly from a disconnected governor signal or a leaking purge valve), or a compressor passing excessive oil that has contaminated the desiccant. A small amount of moisture in the wet tank is normal, but a significant amount indicates dryer failure.

31. D — The dual-circuit protection system isolates the primary and secondary circuits from each other. If the secondary circuit has a leak, air escapes from that circuit faster than the compressor can replenish it, and the pressure drops. The primary circuit maintains its pressure because it is sealed — the check valve and protection valve prevent the primary air from flowing to the leaking secondary circuit. The pressure imbalance directly reveals which circuit has the leak, and the intact circuit confirms the protection system is working as designed.

32. A — A 40% brake force imbalance between left and right on the same axle points to a condition on the weaker side that is reducing its output. Contaminated linings (grease or oil on the friction surface) reduce the coefficient of friction. A restricted air supply delivers less application pressure. An out-of-adjustment slack adjuster means the shoes are not contacting the drum with full force. Worn S-cam bushings allow the cam to shift rather than pushing the shoes outward. Any of these conditions reduces the right side's output while the left operates normally.

33. C — A gradual onset of spring brake application — preceded by increasing pedal effort and a low-pressure warning — describes a slow, progressive air system leak. The air escapes at a rate slow enough that the symptoms develop over minutes or tens of minutes rather than seconds. The increasing pedal effort occurs because the reducing system pressure provides less force at the brake chambers. The low-pressure warning activates at approximately 60 psi. The spring brakes apply at approximately 20-40 psi. The gradual sequence confirms a slow leak rather than a catastrophic failure.

34. B — The caliper on an air disc brake floats on guide pins. When the brake is applied, the mechanism pushes the inner pad against the rotor, and the reaction force slides the caliper on its pins to pull the outer pad against the rotor's opposite face. If the guide pins are seized (from corrosion, lack of lubrication, or contamination), the caliper cannot float. The inner pad applies with full force, but the

outer pad cannot be pulled into contact because the caliper is stuck. The inner pad wears rapidly while the outer pad barely contacts the rotor.

35. D — The air dryer purge cycle is triggered by the governor's unload signal through a dedicated signal line. If this line is disconnected, blocked, or leaking, the governor successfully signals the compressor to unload (the system reaches cut-out pressure normally) but the signal never reaches the air dryer's purge valve. Without the signal, the purge valve never opens, the desiccant is never regenerated, and moisture accumulates in the desiccant until it becomes saturated and passes moisture downstream to the reservoirs.

36. A — The alcohol evaporator introduces a small, metered amount of alcohol (methanol or isopropyl) into the compressed air after it leaves the air dryer. The alcohol lowers the freezing point of any residual moisture that may be present in the air lines and valves, preventing ice formation that could block air passages and prevent brake application or release. This is particularly important in Canadian winter operations where temperatures routinely drop below -20°C and even a small amount of moisture can freeze in a valve or fitting.

37. C — The trailer's brake application requires two air connections from the tractor: the supply (emergency) gladhand provides the air supply that fills the trailer's reservoirs and holds the spring brakes off, and the service (control) gladhand carries the brake application signal from the tractor's foot valve to the trailer's relay valve. If the service gladhand is not connected, no signal reaches the relay valve when the driver presses the brake pedal, and the relay valve has no command to deliver air to the service brake chambers. The spring brakes work because they respond to the supply line, not the service line.

38. B — An ASA that is functioning correctly continuously monitors the pushrod stroke during each brake application and advances its internal worm gear to compensate for lining wear. If a previous technician manually adjusted the ASA to shorten the stroke, the ASA's internal mechanism does not know it has been manually advanced. On the next brake application, the ASA detects movement at the adjuster (from the manual adjustment) and advances its mechanism further — potentially over-adjusting the brake to the point where the shoes drag on the drum. Diagnosing and correcting the root cause of the long stroke, not manual adjustment, is the correct approach.

39. D — At light to moderate application pressures, the front axle carries proportionally less of the vehicle's total weight (the weight has not yet transferred forward due to deceleration). If full brake pressure were applied to the front wheels under these conditions, the front tires would reach their traction limit and lock before the rear tires. The limiting valve reduces the front brake pressure at light application levels to match the front axle's lower weight contribution. At higher application pressures

(hard braking), weight transfers forward onto the front axle, increasing its traction. The valve allows full pressure at high applications to take advantage of this transferred weight.

40. A — The stop arm's deployment is controlled by an air actuator that pushes the arm outward to its fully extended position. If the pivot mechanism is corroded, bent, or physically obstructed, mechanical resistance prevents the actuator from pushing the arm all the way out. If the actuator's stroke is limited by a leak or restriction in its air supply, it runs out of force before the arm reaches full extension. Both the mechanical pivot and the pneumatic actuator and its supply circuit must be inspected.

41. C — The one-way check valve between the supply tank and the primary reservoir has one critical function: it allows air to flow from the supply tank into the primary reservoir during the compressor's loading cycle but blocks reverse flow. If the valve is stuck open, air from the primary reservoir can flow backward through the valve to the supply tank. This means any air loss upstream (from the dryer purge cycle, a supply-tank leak, or the compressor's discharge valve leaking) will drain air from the primary reservoir through the stuck-open check valve, defeating the circuit isolation protection.

42. B — A rhythmic brake pedal vibration that corresponds to wheel speed during braking is caused by a rotating component that produces an uneven braking force once per revolution. An out-of-round brake drum has a varying internal diameter — at the tight spots, the shoes contact the drum sooner and harder, increasing braking force; at the wide spots, the shoes barely contact the drum, reducing braking force. This alternating high-low force pattern creates the rhythmic pulsation felt through the brake pedal as the drum rotates.

43. A — A trailer relay valve with a cracked internal piston can allow a small amount of supply air to leak past the piston into the delivery port even when no brake application signal is present. At highway speed, the dynamic airflow through the system and the continuous minor pressure fluctuations from the moving vehicle may prevent this small leak from accumulating enough pressure to noticeably apply the brakes. At very low speeds or when stationary, the leak accumulates unchallenged, building enough pressure in the brake chambers to partially apply the brakes.

44. B — The governor senses system pressure through a small-diameter sensing line. If this line is disconnected, blocked by contamination, or has developed a crack, the governor receives no pressure feedback. Without knowing the current system pressure, the governor never detects that cut-out pressure has been reached and never sends the unload signal. The compressor continues pumping indefinitely until the safety valve opens at its preset relief pressure (approximately 150 psi), preventing catastrophic over-pressurization of the system components.

45. D — A brake drum is stamped with a maximum allowable inside diameter. If the drum was already at or near this limit before machining, resurfacing it removes additional material from the inner surface, further increasing the diameter beyond the maximum. The drum walls are now thinner than the manufacturer's minimum safe dimension. Thin drum walls cannot absorb braking heat effectively, are prone to heat cracking and distortion, and may not be structurally strong enough to withstand the forces of brake application. The drum must be replaced.

46. C — The wet tank is clean but the downstream reservoirs contain water, which means moisture is getting past the wet tank into the downstream system. The most likely path is through check valves that should be blocking reverse flow but are stuck open — allowing moisture that should remain in the wet tank to migrate downstream. Alternatively, the air dryer may be removing most moisture during the purge cycle (keeping the wet tank clean) but not capturing all of it, and the residual moisture accumulates in the downstream tanks that are drained less frequently than the wet tank.

47. A — The charging system's performance is assessed by its ability to maintain voltage within the acceptable range under all load conditions. A voltage of 14.1 volts at no load and 13.6 volts at full load represents a manageable drop that keeps the system within the operating range on many heavy-duty platforms. The voltage regulator is successfully increasing field current to compensate for the added load, and the system is maintaining adequate charging voltage to prevent battery discharge during operation.

48. C — When all gauges fluctuate simultaneously for a brief moment, the common element is the data source — the CAN bus that delivers all gauge data to the instrument cluster. A momentary CAN bus interruption (from a loose connector, a vibration-sensitive wire, or a corroded pin) causes the cluster to lose its data feed for an instant. The gauges deflect to their default positions (typically zero or a full-scale reading) and then snap back to normal when communication is restored. The brevity and simultaneity of the event are the defining characteristics of a CAN bus glitch.

49. B — Removing the "Body Module — Sleeper" fuse dropped the parasitic draw from 450 mA to 70 mA, identifying that circuit as the source of 380 mA of excess draw. The next step is to identify which specific device on that circuit is consuming the current. Common culprits in sleeper circuits include aftermarket inverters that do not fully shut off, entertainment systems (TVs, radios) in standby mode, 12V refrigerators or coolers that remain powered, charging ports with devices connected, and modules that fail to enter sleep mode. Each device on the circuit must be disconnected individually until the offending load is identified.

50. D — The backup alarm sounds normally in reverse, confirming that the reverse signal (from the transmission switch) is reaching the circuit junction where the alarm and lights branch into separate

paths. The alarm circuit downstream of the junction is working. The backup light circuit downstream of the junction is not. The fault must be in the wiring, connector, or ground circuit that is specific to the backup lights after the branch point — a broken wire, a corroded connector, or an open ground connection in the light-specific portion of the circuit.

51. A — Each battery in a series-parallel bank must be capable of delivering its rated performance independently. A weak battery in any position degrades the entire bank — in series, it reduces the total voltage; in parallel, it draws current from the stronger battery. Load testing each battery individually ensures that every battery in the bank meets its CCA specification. Batteries that fail must be replaced, and ideally, matched with batteries of the same age, type, and CCA rating to prevent the mismatch-induced accelerated degradation that occurs when strong and weak batteries share a bank.

52. C — A left turn signal that stays steady on (not flashing) at the trailer while flashing correctly at the tractor indicates that the trailer's left turn lamp is receiving continuous power from a source other than the turn signal circuit. The most common cause is a cross-connection between the constantly-powered marker light circuit and the turn signal circuit in the trailer wiring. When the marker lights are on (which is most of the time during driving), the marker circuit backfeeds continuous power to the left turn lamp through the cross-connection, keeping it illuminated regardless of the turn signal flash.

53. B — The maximum allowable voltage drop for the starter ground circuit (from the starter case or engine block to the battery negative post) is typically 0.3 volts. A reading of 0.6 volts is double the specification, indicating significant resistance in the ground path. This resistance consumes voltage and reduces the current available to the starter. Common locations for ground-side resistance include corroded cable clamp connections, deteriorated ground straps between the engine and frame, and corroded battery negative post connections.

54. A — A 1.7-volt difference between the actual battery voltage (14.1V) and the dashboard voltmeter display (12.4V) means the gauge is not reading the true battery voltage — the signal reaching the gauge has been reduced by 1.7 volts of drop in the wiring between the battery and the gauge's power input point. Corroded connectors, deteriorated fusible links, and resistance in the instrument cluster's power supply wiring can all create this voltage drop. The gauge accurately displays the voltage it receives — but the voltage it receives is lower than the actual battery voltage.

55. D — The relay clicks (the coil energizes and the contacts close), but no lights illuminate. The relay has been verified as functional. This means the relay is switching correctly but has no power to pass through to the headlights. The relay's load-side input terminal must be connected to battery power through a fusible link, fuse, or direct cable. If this power source is open (blown fusible link,

disconnected cable, or failed fuse upstream of the relay), the relay closes its contacts into a dead circuit — no current flows because there is no voltage source on the relay's load input.

56. A — On modern trucks with BCM-controlled wiper systems, the BCM receives the switch input signal and commands the wiper motor through electronic driver circuits. If the BCM's variable-speed driver has failed, the BCM can only command the direct high-speed relay output (which bypasses the variable-speed control). The BCM receives the correct switch signal (the switch tests good at the BCM input) but can only produce the high-speed output regardless of which speed the switch commands.

57. C — A static bench test (resistance measurement and air gap verification) confirms the sensor's basic electrical integrity but does not test the signal it produces during actual wheel rotation. The reluctor ring rotates with the wheel and produces the magnetic field changes that the sensor converts to an electrical signal. If the ring has damaged, missing, or chipped teeth, or if metallic debris has accumulated on the ring, the signal pattern will be disrupted during rotation — producing the erratic signal the ECU detected. Only inspecting the reluctor ring reveals these dynamic faults.

58. B — The solenoid is not receiving voltage. The fuse is intact. The fault is an open circuit between the fuse and the solenoid connector — somewhere in the wiring, a connector, or a switch in the circuit, the path is broken. The systematic approach is to trace the circuit from the solenoid connector backward toward the battery, checking for voltage at each accessible point. The first point where voltage appears identifies the location of the open — the break is between that point and the last point where no voltage was found.

59. D — A circuit element that, when it fails, disables both low beam and high beam but does not affect the marker/clearance circuit must be common to both headlight circuits but separate from the marker circuit. On most heavy-duty trucks, the headlights have their own dedicated power feed — a specific fusible link, relay, or fuse panel circuit — that is independent of the marker light power feed. An open in this headlight-specific power feed kills both beams while leaving the marker circuit unaffected because the markers have their own power source.

60. A — The CAN bus carries data using a differential signal — the data is encoded in the voltage difference between CAN H and CAN L, not in the absolute voltage of either wire. Normal differential voltage is approximately 2.0 volts (CAN H at ~3.5V minus CAN L at ~1.5V during a dominant bit). A reading of 0.2 volts means CAN H and CAN L are at nearly the same voltage — they are shorted together either directly or through a very low resistance. This eliminates the differential signal and prevents all communication on the bus.

61. C — Direct battery power produces a normal tone, confirming the horn is mechanically and electrically sound. The weak, distorted tone through the vehicle's circuit means the circuit is not delivering full battery voltage to the horn. The difference is the resistance in the vehicle's power and ground path — corroded connections, deteriorated wiring, worn relay contacts, or a high-resistance ground point consume voltage and reduce the current reaching the horn. Less current produces weaker magnetic force in the horn's coil, resulting in a lower-amplitude, lower-frequency, distorted tone.

62. B — All other modules communicate normally on the CAN bus, confirming the bus backbone, termination, and diagnostic connector are functional. The fault is isolated to the TCM's connection to the bus. This could be the TCM's individual drop wire (the short cable connecting the TCM to the backbone), the TCM's connector, or the TCM's internal CAN transceiver. The transmission functions normally during driving because many modern TCMs can operate on pre-programmed defaults even with degraded CAN communication, but the scan tool cannot establish the bidirectional diagnostic communication needed for code retrieval and live data.

63. A — On most heavy-duty grounded-sender fuel gauge systems, the sender is a variable resistor that provides a ground path through its resistance. A full tank corresponds to one resistance value and an empty tank corresponds to another. If the sender wire is disconnected (open circuit), the gauge circuit loses its ground path through the sender. On most systems, this drives the gauge to the empty (low) reading because no current flows through the gauge coil without the sender's ground path. If the gauge stays at full with the sender disconnected, the fault is a short to ground in the wiring (bypassing the sender) or an internal gauge fault.

64. D — LED light bars use internal driver circuits that switch current on and off at high frequencies (typically 50 kHz to 500 kHz or higher) to regulate brightness and convert voltage. These high-frequency switching events produce broadband electromagnetic interference that radiates from the light bar, its wiring, and the power supply lines. AM radio is particularly susceptible to EMI because AM receivers detect amplitude variations in the radio signal — the LED driver's EMI produces amplitude noise that the AM receiver picks up and reproduces as static, buzzing, or interference lines.

65. A — Anti-theft immobilizer systems use a transponder chip or RFID element in the key to communicate a code to the anti-theft module. If the module does not recognize the code (from synchronization loss, a damaged transponder, or a weak key battery), it blocks fuel injection or ignition. The first diagnostic step is to verify the key's physical condition and attempt the manufacturer's relearn procedure, which re-establishes the code synchronization between the key and the module. This is a non-invasive procedure that often resolves the issue without component replacement.

66. C — A 24-volt system has exactly double the voltage targets of a 12-volt system. The normal charging range for a 12-volt system is 13.8 to 14.4 volts; for a 24-volt system, it is 27.6 to 28.8 volts. The reading of 28.4 volts falls within this range, confirming the charging system is operating normally. This is a straightforward scaling calculation that the exam expects technicians to know — simply double the 12-volt specifications for a 24-volt system.

67. B — The neutral safety switch (or transmission range sensor) is a safety interlock that only allows the starter to crank when the transmission is in neutral (or park on automatic transmissions). A worn or misadjusted switch may not consistently detect the neutral position — the internal contacts may be corroded, worn, or positioned at the edge of their detection range. Moving the shift lever back and forth mechanically repositions the switch contacts relative to the shifter, reseating them and restoring the circuit. This intermittent contact failure with a lever-movement fix is the hallmark of a worn neutral safety switch.

68. D — The vehicle's own electronic systems function normally, confirming the CAN bus backbone and all vehicle modules are communicating correctly. The ELD connects to the CAN bus through the 9-pin diagnostic connector — specifically through pins C and D (CAN H and CAN L). If the ELD's cable, adapter, or the connector pins themselves have a loose, damaged, or corroded connection at these data link pins, the ELD's communication with the bus is intermittent even though the bus itself is fully functional for the vehicle's internal systems.

69. A — A clutch pedal that slowly sinks when held depressed but returns to normal when released has a classic hydraulic seal leak. The master cylinder's primary piston seal allows fluid to bypass under sustained pressure, and the pedal gradually moves toward the floor as fluid escapes past the seal. When the pedal is released, the piston return spring pushes the piston back, and the seal reseats on the low-pressure return stroke. This pressure-dependent internal bypass is the defining symptom of a master cylinder with a worn primary seal.

70. C — On an 18-speed transmission, the splitter section has its own synchronizer that must match speeds between the two splitter positions. In low range, the rotational speeds and gear loads are different from high range. If the high-range splitter synchronizer has worn (from the higher loads and speeds encountered in high range), it cannot match speeds for the splitter shift in that range. The low-range synchronizer, experiencing lower loads, remains functional. The main-box and range shifts use separate mechanisms and are unaffected.

71. B — The transmission input shaft splines must have a light coating of the manufacturer-specified lubricant to allow the clutch disc hub to slide freely on the splines. The disc must be able to move axially on the shaft during engagement and disengagement — sliding toward the flywheel during

engagement and away during release. Dry splines create friction that resists this axial movement, preventing the disc from fully separating from the flywheel when the clutch is released. The result is clutch drag, difficulty shifting, and accelerated spline wear.

72. D — The vibration occurs at 90 km/h regardless of whether the engine is in 10th gear or 8th gear — meaning the engine RPM is different at the same vehicle speed in each gear, but the vibration is unchanged. This eliminates the engine and transmission as the source because both change speed when the gear changes. The vibration disappears at 80 km/h, confirming it is speed-specific. The vibrating component must rotate at a speed determined by vehicle speed, not engine speed — this includes the driveshaft, U-joints, carrier bearing, rear axle components, wheels, and tires.

73. A — The engine ECM reprogramming may have changed the torque management strategy that the TCM depends on for smooth shifts. During an automatic transmission shift, the TCM requests the engine ECM to momentarily reduce torque (by retarding timing or reducing fuel) to soften the clutch pack engagement. If the new engine calibration has altered the torque reduction amount, timing, or duration, the shift quality degrades — the clutch packs engage against full engine torque rather than reduced torque, causing the harsh, jarring shift feel.

74. C — A noise that occurs only during acceleration (drive side loading) and only within a specific speed range indicates a gear mesh frequency issue on the drive side of the teeth. The gear tooth contact pattern on the drive side is positioned incorrectly — too high, too low, or too concentrated at the toe or heel — causing the teeth to generate noise at the frequency where the gear mesh resonates with the axle housing structure. Correcting the pinion depth and backlash to reposition the contact pattern to the manufacturer's specification eliminates the noise.

75. B — The lockup clutch engagement requires the TCM to command the lockup solenoid, the solenoid to direct hydraulic pressure to the lockup clutch apply circuit, and adequate hydraulic pressure in that circuit to clamp the clutch. If the TCM is commanding lockup (verified by monitoring the solenoid state on the scan tool) but lockup does not occur, the solenoid may be mechanically stuck, the apply circuit may have a leak, or the hydraulic pressure may be insufficient. If the TCM is not commanding lockup, the TCM's logic inputs (speed, temperature, load) must be verified.

76. D — The grinding and binding during low-speed 4WD turns on dry pavement is driveline wind-up caused by the transfer case locking the front and rear axles together without a center differential. During turns, the front wheels travel a larger arc than the rear wheels and need to rotate faster. With both axles locked to the same speed, the speed difference cannot be accommodated, and the resulting torsional stress (wind-up) manifests as grinding, binding, and tire chirping during turns. The transfer case should only be in 4WD on slippery surfaces where tire slip can absorb the speed difference.

77. A — The pilot bearing supports the transmission input shaft at the point where it enters the flywheel. When the clutch is engaged (pedal released), engine torque is transmitted through the clutch disc to the input shaft, and the pilot bearing must smoothly support the shaft tip as it rotates at engine speed. A dry, rough, or damaged pilot bearing creates friction and vibration at this support point — the noise or vibration appears when the clutch is engaged because the shaft is loaded through the bearing, and disappears when the clutch is disengaged because the shaft is no longer driven.

78. C — An automatic transmission that slips in one specific gear but holds all others has a fault in the holding element (clutch pack or band) that is responsible for that gear. Each gear ratio is established by applying a specific combination of clutch packs and bands. The reverse clutch pack or band has worn friction material, a leaking apply piston seal, or is not receiving adequate hydraulic apply pressure. The worn element cannot clamp firmly enough to hold the gear under the torque load of reverse operation, while all forward elements remain functional.

79. B — The front pump (also called the input pump) is mechanically driven by the torque converter impeller hub, which is connected to the engine's flexplate/flywheel. The pump rotates whenever the engine is running — in Park, Neutral, and all gear positions — because the impeller always turns with the engine. A worn front pump produces a whine proportional to its rotational speed (engine RPM). The whine is present in Park and Neutral because the pump turns regardless of gear selection.

80. D — A locked rear differential forces both wheels on that axle to turn at identical speeds. During a right turn, the left (outside) wheel must travel a greater distance than the right (inside) wheel. With the diff lock engaged, the inside wheel cannot slow down and the outside wheel cannot speed up — both are locked to the same RPM. The result is that the tires scrub against the pavement as they are forced through the turn at mismatched speeds. The binding force creates stress on the axle shafts, differential, and tires.

81. A — Pinion bearing preload is the resistance to rotation created by the clamping force on the pinion bearings. The preload is set by the collapsible spacer (or shim stack) between the two pinion bearings. Insufficient preload (15 in-lb versus the 20-30 in-lb specification) means the bearings are not adequately loaded — the pinion can move axially under the separating forces generated during gear mesh. This axial movement changes the gear contact pattern dynamically, causing noise and accelerated wear on both the ring gear and pinion teeth.

82. A — The output shaft speed sensor provides the TCU with the vehicle speed data needed to calculate shift timing. Without this signal, the TCU cannot determine when the vehicle has reached the speed threshold for an upshift (or downshift). As a protective measure, the TCU defaults to first gear — the lowest, most conservative gear — and will not attempt any shifts because it has no speed reference

to validate that a shift is appropriate. This limp-home mode allows the vehicle to be driven to a service facility at reduced speed.

83. A — The PTO gear must remain securely meshed with the transmission gear during operation. The detent mechanism (a spring-loaded ball or plunger that seats in a notch on the shift rail) holds the shift rail in the engaged position. At idle, the gear mesh forces are low and even a worn detent can hold. At operating RPM, the increased gear loading creates a reaction force that pushes against the detent. A worn detent spring or a worn engagement notch cannot resist this increased force, and the shift rail pops out of position, disengaging the PTO.

84. A — On engines equipped with compression release (Jake) brakes, the engine brake mechanism has its own lash adjustment — the clearance between the slave piston and the exhaust valve crosshead. This lash is separate from the standard valve lash adjustment and must be set independently. During a clutch replacement, the engine brake lash is typically not disturbed, but if the technician adjusted the standard valve lash during the service without also checking the engine brake lash, an incorrect brake lash setting reduces the exhaust valve opening during the braking event, decreasing the volume of compressed air released and reducing braking force.

85. C — Driveshafts are precision-manufactured, heat-treated, and dynamically balanced components designed to operate at rotational speeds that can exceed 5,000 RPM. Field welding introduces multiple problems: the heat of welding creates a heat-affected zone that alters the tube's metallurgical properties (reducing its fatigue strength and potentially introducing brittle zones), the weld adds mass at a localized point that destroys the factory balance, and the weld may not achieve the material strength needed for the tube's torsional and bending loads. A field-welded driveshaft is weakened, unbalanced, and at risk of sudden failure at highway speed.

86. C — The steering damper absorbs the bump energy before it reaches the steering wheel. When the damper has failed, the hydraulic resistance that normally absorbs the bump force is absent, and the full force of the road impact is transmitted through the steering knuckle, drag link, pitman arm, and steering gear to the steering wheel. The prolonged vibration (several seconds) occurs because there is no damping to arrest the front wheel oscillation — the wheels oscillate at their natural frequency until road friction and system friction slowly dissipate the energy.

87. A — During a full-lock turn, the steering gear reaches its internal mechanical stop — the wheels cannot turn any further. The power steering pump continues to produce flow, but the fluid has nowhere to go because the gear is at its stop. The pump's output pressure rises to the relief valve setting, and the relief valve opens to bypass the fluid back to the reservoir. The groan or moan is the sound of the relief

valve operating and the pump working against the closed-off system at maximum pressure. Brief full-lock holds are normal; sustained full-lock operation overheats the fluid.

88. D — The toe setting is at the upper limit of the specification (3 mm toe-in, specification 1.5-3.0 mm) — technically within specification. However, inside-edge tire wear is characteristic of a camber problem, not a toe problem. Worn king pins and bushings allow the steering knuckle to shift on the axle, changing the effective camber angle. If the king pins have worn enough to introduce negative camber (the top of the wheel tilting inward), the inside edge of the tire bears a disproportionate load and wears prematurely — regardless of the toe setting.

89. B — An unauthorized weld on high-strength frame steel creates a heat-affected zone (HAZ) where the base metal's properties are altered by the welding heat. The HAZ is typically weaker and less fatigue-resistant than the original base metal. Furthermore, the reinforcing plate may mask continued crack propagation beneath it — the original crack may still be growing under the plate, but the plate prevents visual detection. The repair may have introduced additional risk by weakening the frame steel and hiding the ongoing damage from inspection.

90. D — The height control valve sensing linkage is calibrated for a specific frame-to-axle distance that corresponds to the loaded ride height. When the trailer is empty, the air springs support less weight and the frame sits higher on the springs. If the linkage's effective range does not accommodate the empty-trailer ride height — the sensing arm may be at the limit of its travel or the valve may not vent air fast enough at the extreme position — the valve cannot lower the trailer to the correct empty ride height. Readjusting the linkage length or the valve mounting position for the empty-trailer geometry resolves the issue.

91. A — Measuring the distance from the steer axle center to the drive axle center on both sides of the frame creates a diagonal measurement that reveals whether the axles are perpendicular to the frame rails. Equal measurements on both sides mean both axles are square. A 10 mm difference means one or both axles are angled relative to the frame — the rear axle may be shifted to one side, or the steer axle may be off-center. This condition causes the truck to dog-track — the rear follows a path offset from the front — producing accelerated tire wear and increased fuel consumption from the constant tire scrub.

92. C — The spring shackle connects the rear eye of the leaf spring to the frame hanger bracket. The shackle pivots on pins through bushings as the spring deflects during suspension travel. Worn pins and bushings allow the shackle to swing freely through a larger arc than designed, creating a clunking noise as the loose shackle reaches the limits of its free play during bump events. The excessive movement also allows the spring to shift position, affecting axle alignment and contributing to steering wander.

93. B — A shimmy that occurs only during braking and is absent during normal driving points to a braking-specific excitation source. An out-of-round drum or a warped rotor creates a pulsating braking force at each wheel revolution during brake application. This pulsation pushes the steering knuckle back and forth through the steering linkage, transmitting the oscillation to the steering wheel. The shimmy is absent during normal driving because the source of the pulsation (the uneven friction surface) is only engaged during brake application.

94. D — The slider locking pins must fully engage the holes in the slider rail to secure the axle position. Debris (road grime, ice, corrosion products) accumulated in the pin holes physically prevents the pins from seating fully. The track itself may also have minor deformation at the hole edges from the forces of normal operation. Cleaning the pin holes, inspecting for track damage, and verifying the pin mechanism's spring and plunger function addresses the most common causes of incomplete pin engagement.

95. A — A very slight amount of perceptible movement when rocking a heavy-duty truck hub at the 12 and 6 o'clock positions is consistent with properly adjusted bearing end play. The specification for most heavy-duty hubs is 0.001 to 0.005 inches of end play — this minuscule clearance is barely detectable by hand but prevents the rollers from being preloaded against the races. The slight click is the rollers shifting position as the load direction reverses during the rocking motion. Zero movement would indicate the bearing is adjusted too tight.

96. C — When a trailer follows a path that is offset to one side of the tractor's path during straight-line driving, the trailer's axles are not perpendicular to the trailer's centerline. This condition is called dog-tracking. The misaligned axles steer the trailer to one side, and the fifth wheel coupling allows the angular deviation. The trailer tires scrub sideways continuously, accelerating wear across all positions. The axle alignment must be corrected by repositioning the axles to be square with the trailer frame using the slider mechanism or by adjusting the suspension mounting hardware.

97. B — Wheel nut indicators are small pointed devices installed on the wheel nuts after torquing, aligned to point in a uniform direction. If any nut loosens and rotates, its indicator moves out of alignment with the others, providing an immediate visual warning during walkaround inspections. Misaligned indicators mean one or more nuts have rotated from their torqued position, and the wheel's clamping force has been compromised. The nuts must be inspected, re-torqued to specification, and the cause of the loosening investigated.

98. D — A steering wheel that is off-center during straight-line driving but does not cause a pull indicates that the steering geometry is correct (the wheels are pointing straight ahead) but the steering wheel is clocked incorrectly relative to the gear's center position. The most common cause is an

incorrectly adjusted drag link — the drag link length sets the relationship between the pitman arm position and the tie rod/knuckle position. If the drag link is too long or too short, the steering wheel rests off-center even though the wheels track straight. Adjusting the drag link length to center the steering wheel resolves the issue.

99. A — A broken spring clip allows the leaves to shift laterally relative to each other and relative to the axle. The shifted leaves may contact the tire sidewall (causing tire damage), the brake lines (causing a brake fluid or air leak), or other suspension components. Additionally, the spring can no longer properly locate the axle because the leaves are free to shift on the spring seat, potentially changing the axle's alignment relative to the frame. The clip must be replaced to restore leaf alignment and axle location.

100. C — When converting from steel to aluminum wheels, the hub pilot bore dimension on the aluminum wheel may differ slightly from the steel wheel. Hub-piloted wheel systems rely on the precision fit between the hub pilot pad and the wheel's center bore to center the wheel. If the aluminum wheel's bore is slightly larger than the hub pilot, the wheel cannot center precisely and will have a small amount of radial play that produces vibration despite correct balance. Hub-centric adapter rings may be needed to fill the dimensional gap.

101. B — Power steering fluid viscosity increases dramatically at low temperatures — the cold fluid becomes thick and resistant to flow. The power steering pump must work harder to draw the thick fluid from the reservoir and push it through the system's passages and the steering gear's internal orifices. This increased resistance reduces the pump's effective output and the system's response speed, which the driver perceives as heavy steering effort. As the fluid warms during driving, its viscosity decreases to the normal operating range and steering effort returns to normal.

102. D — Crossmembers on a flatbed trailer are designed to support distributed loads across the full floor width. When concentrated loads (such as heavy lumber bundles) are placed between the rails rather than across them, the crossmember spans the unsupported distance between the rails with the entire load concentrated at that point. The bending force from this concentrated load exceeds the crossmember's design capacity, causing permanent downward deformation. The damaged crossmembers must be replaced or reinforced to restore the floor's load-carrying capacity.

103. A — During a left turn, weight transfers to the right side of the vehicle, compressing the right front suspension and loading the right shock absorber. If the shock absorber's upper mount is loose, the shock body shifts under this load and produces a single clunk as it reaches the end of its free play within the loose mounting. The noise occurs only during left turns because weight transfers right only during left turns, loading the right side components. The mounting hardware must be tightened or the bushing replaced.

104. C — The heated windshield relay, its wiring, and the windshield's heating element are the three components in the power delivery chain. The relay must energize (verified by listening for a click or measuring voltage at its output) and deliver power through the wiring to the windshield connector. If power reaches the windshield but no heat is generated, the heating element has an open circuit — a break in one of the thin conductors embedded in the glass. Heating element failures are common at the edges of the windshield where the conductors connect to the bus bars.

105. B — The repetitive hissing during driving with stable seat height indicates a leak-and-compensate cycle. The air spring or a fitting is leaking, and the height control valve continuously adds replacement air to maintain the set ride height. The seat functions normally because the valve successfully compensates for the leak, but the continuous hissing is the sound of air escaping through the leak. The leak wastes system air and will eventually wear out the height control valve from the constant cycling. The air spring, fittings, and supply lines must be inspected for the leak.

106. A — The dome light circuit uses door jamb switches to control the ground path. When a door opens, its switch closes (completes the ground circuit), and the dome light illuminates. If a switch is stuck in the closed position — from corrosion, mechanical failure, or a wiring fault that permanently grounds the circuit — the dome light receives a constant ground path and stays on regardless of door position. Inspecting each door switch and its wiring identifies which switch is providing the false ground.

107. D — Floor grommets seal the openings where cables, wiring harnesses, and plumbing penetrate the cab floor. When these grommets are missing, deteriorated, or improperly installed, they leave gaps that allow cold outside air (driven by the vehicle's forward motion creating positive pressure under the cab) to enter the footwell from below. The air infiltration is most noticeable in winter and at higher vehicle speeds when the air pressure differential is greatest. Replacing the missing or deteriorated grommets seals the openings.

108. B — The HVAC fresh air intake draws outside air from a specific location on the cab exterior. If a fuel leak exists near this intake location — from a fuel line fitting, a fuel filter seal, a fuel tank vent, or any fuel system component in the intake's proximity — the blower draws fuel-laden air into the cab's ventilation system. The odor is strongest on the fresh air setting because that mode draws 100% outside air. Switching to recirculation reduces the odor because the system stops drawing contaminated air from outside. The fuel leak must be located and repaired.

109. D — A cracked gladhand coupling on a pressurized air system is a failure waiting to happen. Even though the coupling is currently holding air, the crack weakens the structure and can propagate rapidly under the thermal cycling (heating and cooling with each trip), vibration, and pressure fluctuations of

normal operation. A sudden, complete failure would exhaust the trailer's air supply, applying the spring brakes without warning — potentially on a highway at speed. The coupling must be replaced before the trailer operates.

110. B — A grinding noise from a brake caliper that is present without brake application indicates continuous contact between a metallic surface and the rotor. When a brake pad wears completely through its friction material, the steel backing plate contacts the rotor directly. This metal-to-metal contact rapidly damages the rotor surface (deep scoring and heat damage) and provides minimal braking force. The pad and rotor must both be replaced, and the brake system must be inspected for the reason the pad wear was not detected earlier.

111. C — The dome gasket seals the manhole cover against the tank rim, maintaining the integrity of the sealed compartment. A deteriorated gasket may allow product vapors to escape during transport (environmental and health hazard), allow spillage during loading or pressure events, and in an extreme scenario (such as a rollover), allow the dome to open and release the tank's contents. The gasket must be replaced to maintain the sealed integrity of the tank compartment as required by transportation of dangerous goods regulations.

112. A — Driving 200 km with the air suspension fully deflated means the trailer frame was resting directly on the axles (or bump stops) with no air spring cushioning. The air springs may have been damaged from being compressed flat against the axle or frame stops. The bump stops (designed for momentary contact, not sustained loading) may be crushed or destroyed. The frame, axle, and suspension mounting components may have sustained fatigue damage from the unsprung, undamped operation. A thorough inspection of all these components is required.

113. D — A torn service-side diaphragm allows application air to escape through the tear rather than pushing the pushrod. The brake at that wheel position loses most or all of its application force because the air pressure cannot build behind the diaphragm. This creates a brake imbalance — the vehicle has full braking force on all wheels except the affected position. During braking, the vehicle may pull toward the side with the stronger brakes, and the overall stopping distance increases because one wheel position is not contributing its share of braking force.

114. B — The auxiliary circuit pin on the J560 connector provides the power supply for the trailer's ABS ECU. If this pin is pushed back into the connector body, it cannot make contact with the tractor's corresponding pin, and no power reaches the trailer ABS system. Without power, the ABS ECU cannot operate, and all anti-lock protection is lost on the trailer. The foundation brakes still function normally (they are pneumatic and independent of the ABS electronics), but the trailer wheels are unprotected from lockup during hard braking.

115. A — Conspicuity tape is repaired using properly rated material that meets the original specification. The cracked lens should be replaced to maintain the correct color and intensity.

D — The fatigue cracks at the coil well reinforcement welds indicate that the weld joints are progressively failing under the extreme cyclic loading of steel coil transport. Steel coils weighing 20,000 to 40,000 pounds each impose concentrated dynamic loads that flex the reinforcement welds with every road bump, brake application, and turn. As the cracks grow, the welds lose their load-bearing capacity, and a complete weld failure could allow a steel coil to break through the trailer floor or shift uncontrolled during transport — a catastrophic safety hazard.

116. C — A temperature discrepancy between the TRU display and a handheld probe at the same location suggests the TRU's temperature sensor is not reading the true average cargo temperature. The most common cause is cold air short-circuiting — cold discharge air from the evaporator takes a direct path back to the return air sensor without passing through the cargo, giving the sensor a colder reading than the actual cargo temperature. Proper air circulation through the cargo (requiring correct loading patterns and unobstructed air channels) and sensor placement are essential for accurate temperature monitoring.

117. B — The heater core has a small internal leak that is vaporizing coolant before it can form visible drips. The coolant mist is carried by the HVAC airflow into the cab, producing the characteristic sweet coolant odor. This type of leak is too small to produce puddles on the floor or visible dripping under the dashboard, but the odor is unmistakable. As the leak progresses, it will eventually produce visible moisture on the passenger floor, fogging on the windshield (from glycol vapor depositing on the glass), and measurable coolant loss from the engine.

118. D — R-134a operates at higher condensing pressures than R-12, requiring more condenser surface area for effective heat rejection. When an R-12 system is retrofitted to R-134a without upgrading the condenser, the original condenser may provide adequate heat rejection at moderate ambient temperatures but fall short during peak summer heat when the temperature differential between the refrigerant and the ambient air is smallest. Upgrading to a larger or more efficient condenser designed for R-134a's higher operating pressures resolves the hot-weather performance deficit.

119. A — The blower motor resistor (or electronic speed controller) provides reduced voltage to the motor for the low and medium speed settings. When the control panel is off, no signal should reach the motor. If a relay in the blower circuit has a contact stuck in the normally-closed position, it provides an unintended ground or power path to the motor through the resistor, running the motor at a reduced speed. When the control panel commands higher speeds through the normal circuit, the higher-voltage path overrides the relay's stuck contact and the motor operates at the commanded speed.

120. C — The evaporator temperature sensor (or low-pressure cycling switch) controls the compressor's cycling to prevent the evaporator from freezing. When the differential between the cut-out temperature (compressor off) and the cut-in temperature (compressor on) is too narrow, the evaporator temperature oscillates through a small range very quickly, causing the compressor to cycle on and off every few seconds. Widening the differential (by adjusting the switch or replacing the sensor) allows the system to operate longer during each cycle before triggering the cutoff.

121. B — The combustion exhaust from a fuel-fired heater exits through a dedicated exhaust pipe that routes the combustion gases away from the vehicle and its occupants. If the exhaust pipe has a leak, crack, or loose connection, the combustion gases (which contain unburned fuel vapor, carbon monoxide, and other products) escape near the vehicle rather than being expelled at the designed exit point. The fuel odor comes from the incomplete combustion products in the leaking exhaust. The exhaust pipe must be inspected and sealed to prevent both the odor and the carbon monoxide exposure risk.

122. D — The evaporator condensate drain tube normally drains water from the HVAC housing to the ground under the vehicle. When the drain is clogged, water accumulates inside the housing. During driving, the vehicle's acceleration, deceleration, and cornering forces shift this trapped water back and forth inside the housing, producing an audible sloshing sound. The fix is straightforward — clearing the drain tube (often with compressed air or a flexible probe) restores normal drainage and eliminates the water accumulation.

123. A — A roof-mounted A/C unit distributes cooled air through ductwork running the length of the bus's ceiling. If a section of this ductwork has collapsed, disconnected, or become blocked, the cooled air cannot reach the sections downstream of the obstruction. The front of the bus (nearest the A/C unit) receives adequate cooling because the air has not yet reached the obstruction, but the rear section receives little or no conditioned air. Inspecting the ductwork for physical integrity along its entire length identifies the obstruction point.

124. C — Both outriggers are supplied by the same valve and pump, so the hydraulic supply side is equal. The asymmetric extension rate must be caused by a difference in the flow path to each cylinder. A partially restricted hose, fitting, or port on the right outrigger limits the flow rate reaching that cylinder, causing it to extend more slowly than the unrestricted left cylinder. Inspecting the right outrigger's dedicated hose and fittings for kinks, contamination, or damage identifies the restriction.

125. B — A rhythmic knocking noise that corresponds to pump shaft rotation speed and was not previously present indicates a new mechanical defect inside the pump. A broken or chipped gear tooth produces an impact noise once per revolution as the damaged tooth contacts its mating gear at the mesh point. The metallic debris from the damaged tooth is pumped into the system and can damage

downstream valves, cylinders, and motors. The pump must be replaced and the system flushed to remove the contamination.

126. D — The replacement counterbalance valve's pilot ratio or cracking pressure does not match the original specification for the circuit. The counterbalance valve must modulate smoothly — opening proportionally to the pilot pressure to allow controlled lowering. If the replacement valve has a different pilot ratio, it may open too quickly (causing the load to drop suddenly, which reduces pilot pressure, causing the valve to close, then the pilot pressure rebuilds and the valve opens again) creating the jerky oscillation. The correct OEM-specified valve must be installed.

127. A — The air space above the fluid level in the reservoir serves three critical functions: it provides room for thermal expansion of the fluid (hydraulic fluid expands as it heats during operation), it accommodates the volume of fluid displaced from extended cylinders when they retract (the returning fluid increases the reservoir level), and it provides a quiescent zone where air bubbles can separate from the returning fluid before it is drawn back into the pump inlet. Filling to the physical capacity eliminates this essential space and causes overflow, aeration, and potential pump damage.

128. C — The oil cooler is the heat rejection component. Measuring the temperature differential between the cooler's inlet and outlet reveals its effectiveness. A large temperature drop (inlet significantly hotter than outlet) confirms the cooler is rejecting heat effectively. A small temperature drop indicates the cooler is not transferring heat — from internal fouling (deposits on the tube surfaces), a stuck bypass valve (routing fluid around the cooler), or incorrect plumbing. The cooler test immediately determines whether the cooling circuit is the problem or whether the heat source is the issue.

129. B — A flow control valve in the lowering circuit restricts the rate at which fluid can return from the cylinder to the reservoir during gravity-driven lowering. By limiting the exhaust flow rate, the flow control regulates the descent speed to a safe, controllable rate. If the flow control valve has failed open or is set too wide, the restriction is reduced or eliminated, and the cylinder retracts at whatever rate gravity and the load dictate — which is typically too fast for controlled operation. Adjusting or replacing the flow control valve restores controlled descent speed.

130. D — The dark, contaminated appearance of the fluid despite a clean return filter indicates the contamination is not particulate (which the filter would capture) but chemical. Thermal degradation (oxidation) from chronic overheating causes the oil's molecular structure to break down, producing dark-colored breakdown products that pass through the return filter because they are dissolved in the fluid rather than existing as particles. The return filter is clean because there are few particles to capture — the contamination is at the molecular level and requires fluid replacement, not filtration.

131. A — A gear pump's output flow is directly proportional to its rotational speed — the pump displaces a fixed volume of fluid per revolution. At idle (600 RPM), the pump turns at approximately 40% of its speed at 1,500 RPM, producing approximately 40% of its maximum flow. If the hydraulic functions require more flow than the pump delivers at idle speed, the cylinders fill slowly and the actuators move sluggishly. At 1,500 RPM, the pump delivers its full flow rate and the functions operate at normal speed. This is a fundamental characteristic of fixed-displacement gear pumps.

132. C — The BMS limits the battery's discharge rate (the maximum current it allows the battery to deliver) when cell temperatures are outside the optimal range. If the thermal management system is not cooling (or heating, in cold weather) the cells adequately, the BMS progressively reduces the maximum discharge current to prevent thermal damage to the cells. This limits the power available to the traction motor — the bus can accelerate normally from stops (which requires only moderate current for a short duration) but cannot sustain the high continuous current needed for highway speed.

133. B — In a series hybrid, the diesel engine drives a generator that produces electricity. If the generator has a fault (winding failure, bearing damage, or inverter control fault), it cannot efficiently convert the engine's mechanical output to electrical energy. The engine runs normally but its output is wasted rather than being converted to electricity. The battery receives little or no charging current despite the engine running, and the SOC remains critically low. The generator and its control circuit must be diagnosed.

134. D — The interlock circuit is a safety feedback loop integrated into high-voltage connectors. A small signal circuit runs through the connector — when the connector halves are fully mated, the circuit is complete and the BMS/VCU knows the connection is secure. When the connector is separated (either intentionally during service or accidentally), the interlock circuit opens. The BMS immediately detects the break and commands the high-voltage contactors to open, de-energizing the bus before the technician's hands can contact the now-exposed high-voltage terminals. This is a critical safety feature that protects technicians during service.

135. A — Regenerative braking converts kinetic energy to electrical energy and sends it to the battery for storage. As the battery approaches full charge (95% SOC), the BMS must limit the incoming current to prevent overcharging — overcharging lithium-ion cells causes permanent damage, swelling, and potentially thermal runaway. Since the battery cannot accept the regenerative energy, the VCU reduces the motor's generating effort, which reduces the regenerative braking force. The driver notices progressively weaker deceleration when lifting off the accelerator and must compensate with the friction brakes.