

PRACTICE EXAM 15: RED SEAL TRUCK AND TRANSPORT MECHANIC SIMULATION (135 QUESTIONS)

1. A technician working on a fleet of natural gas-powered trucks must enter the maintenance bay where a natural gas vehicle is parked. The shop's gas detection system is not installed yet. What is the primary hazard specific to natural gas vehicles in an enclosed maintenance bay?

A. Natural gas is heavier than air and will pool at floor level where it can be ignited by floor-level electrical outlets, battery chargers, and other ignition sources creating a fire and explosion risk

B. Natural gas is odourless in its pure form and the odorant added for leak detection dissipates in enclosed spaces making it impossible to detect a leak by smell after the first few minutes of gas accumulation

C. Natural gas displaces oxygen in the upper areas of the shop because methane is lighter than air and a large leak can create an oxygen-deficient atmosphere at ceiling level where exhaust ventilation is less effective

D. Natural gas is lighter than air and rises to the ceiling where it can accumulate in dangerous concentrations near overhead lighting, electrical panels, and other ignition sources creating an explosion hazard

2. A technician is assigned to inspect a truck that has been involved in a rollover. The truck is upright but the cab structure is visibly deformed. Before entering the cab to assess the interior damage, what hazard must be assessed first?

A. The engine coolant system may have ruptured during the rollover and the leaked ethylene glycol on the cab floor creates a toxic vapour hazard when the cab interior is heated by sunlight or engine heat

B. The cab's structural integrity must be assessed — the deformed cab structure may be unstable and could collapse further if the technician enters and applies additional loading to the compromised cab frame

C. The truck's battery cables may have shorted during the rollover creating an electrical fire risk inside the deformed cab that could ignite if the technician disturbs the damaged wiring during the inspection

D. The air bag system may have deployed partially and the unexploded airbag modules in the deformed cab could activate during the inspection if the technician contacts the damaged steering column or dash area

3. A shop has a used oil collection tank that is full. The licensed waste hauler cannot pick up the used oil for another two weeks. A technician suggests storing the overflow in open 20-litre pails until the hauler arrives. Why is this storage method unacceptable?

A. The open pails create a fire hazard because the used oil's flash point decreases during storage from the accumulated crankcase blow-by contaminants that lower the oil's ignition temperature below safe storage limits

B. The open pails violate the waste storage regulations because used oil must be stored in approved sealed containers that prevent evaporation, spills, and contamination from rainwater entering the stored waste oil

C. Open containers of used oil create environmental and safety violations — the oil can spill, be contaminated by rainwater, evaporate volatile compounds, and the open containers do not meet waste storage regulations

D. The open pails will contaminate the shop air with hydrocarbon vapours that exceed the workplace exposure limits within 48 hours and the vapours create a respiratory hazard for all technicians in the shop

4. A technician discovers that a coworker has been using compressed air to clean the inside of brake drums during brake service. The coworker argues this is faster than using the approved brake washing station. How should this be addressed?

A. The practice must stop immediately — compressed air disperses brake dust into the breathing zone creating an inhalation hazard from the particulate matter, and the approved wet cleaning method must be used for all brake work

B. The coworker's method is acceptable if performed outdoors where the wind disperses the brake dust away from the breathing zone and the outdoor environment prevents the particulate from accumulating at harmful concentrations

C. The compressed air method is acceptable if the coworker wears a P100 respirator because the respirator provides adequate protection against the brake dust particles during the brief cleaning operation at each wheel

D. The supervisor should evaluate whether the brake dust from the specific brake linings in use contains asbestos before requiring the wet cleaning method because non-asbestos brake dust is not regulated for airborne exposure

5. A fleet maintenance shop is implementing a lockout/tagout program for vehicle maintenance. A technician argues that removing the ignition key is sufficient lockout for all vehicle maintenance tasks. Why is this argument incorrect?

A. The ignition key does not control all vehicle systems — some circuits are powered directly from the battery regardless of key position and the vehicle could move from a failed parking brake even with the key removed

B. Federal regulations require a physical lockout device on the steering column in addition to key removal because the key alone does not meet the minimum regulatory standard for energy isolation during maintenance

C. The ignition key controls only the engine starting circuit and does not isolate the electrical system — battery power remains available for starter activation through a wiring fault even with the key removed from the switch

D. Removing the key does not isolate all energy sources — the battery system, air brake stored energy, suspended loads, hydraulic stored energy, and spring brakes all retain energy that the key removal does not control

6. A technician is disposing of used coolant from a heavy-duty truck. The coolant is contaminated with oil from a failed oil cooler. How does the oil contamination change the disposal requirements?

A. The oil contamination has no effect on the disposal requirements because used coolant is always classified as hazardous waste regardless of contamination level and is disposed of through the same regulated waste stream

B. The oil-contaminated coolant cannot be recycled through the standard coolant recycling program — it must be disposed of as oil-contaminated waste through the used oil waste stream or a hazardous waste hauler

C. The oil-contaminated coolant can be poured into the used oil collection tank because the coolant's glycol component is compatible with used oil and both fluids are recycled through the same petroleum re-refining process

D. The oil contamination actually improves the coolant's recyclability because the oil lubricates the recycling equipment and the combined waste is processed more efficiently through the standard coolant recycling program

7. A technician is performing an engine valve adjustment on a running diesel engine. The engine is at idle and the valve covers have been removed. What is the primary hazard of this procedure?

A. The rotating valve train components (rocker arms, pushrods, cam followers) are exposed and can catch loose clothing, jewelry, long hair, or tools creating an entanglement hazard at the rotating camshaft speed

B. The hot engine oil splashing from the exposed valve train creates a burn hazard to the technician's hands and face from the 120°C oil contacting exposed skin during the adjustment at engine operating temperature

C. The exhaust gases escaping from the open valve covers contain carbon monoxide that accumulates in the technician's breathing zone directly above the engine creating an inhalation hazard at idle engine speed

D. The valve springs are under compression and a spring retainer can fail during the running adjustment launching the spring and retainer at high velocity toward the technician's face from the stored spring energy

8. A fleet shop has a policy requiring all technicians to wash their hands before eating, drinking, or using the restroom. A technician argues that wearing nitrile gloves during work eliminates the need for handwashing because the gloves prevent skin contact with chemicals. Why is the technician's argument incorrect?

A. Nitrile gloves are permeable to certain solvents and fuels — chemicals can penetrate the glove material and contact the skin without visible glove damage creating a false sense of protection during the work period

B. Nitrile gloves protect against chemical contact during work but the glove removal process can transfer contaminants from the outer glove surface to the bare hands if the removal technique is not performed correctly

C. Nitrile gloves may develop microscopic tears during work that allow chemical contact, the removal process can transfer contaminants to bare hands, and chemicals on the glove exterior can transfer to the face or mouth

D. Nitrile gloves provide adequate chemical protection for all automotive fluids and the handwashing policy is an outdated requirement that was written before the widespread adoption of chemical-resistant nitrile glove technology

9. A heavy-duty diesel engine has been returned to the shop with a complaint of a sudden loss of power. The scan tool shows the engine ECM has commanded a severe power derate — the engine produces only 60% of rated power. The fault code indicates "aftertreatment system — inducement active." What has triggered this derate?

A. The DPF differential pressure has exceeded the maximum threshold indicating the filter is critically loaded and the ECM derates the engine to reduce exhaust temperature and prevent the DPF from melting

B. The engine's aftertreatment system has detected a critical compliance failure — either the DEF tank is empty, the DEF quality is incorrect, the SCR efficiency is below threshold, or a tampering condition has been detected

C. The turbocharger's VGT actuator has failed and the ECM derates the engine to prevent the turbocharger from overspeeding without the VGT's exhaust flow control capability during uncontrolled full-load operation

D. The exhaust gas temperature has exceeded the maximum safe limit for the aftertreatment components and the ECM reduces fuelling to lower the exhaust temperature below the catalyst and substrate damage threshold

10. A diesel engine equipped with a common rail fuel system has a complaint of a harsh metallic rattle during cold start that disappears after 30 seconds of idle. The rattle is loudest at the front of the engine. Once warm, the engine runs quietly. What is the most likely cause?

A. The high-pressure fuel pump's internal components contract in the cold creating momentary clearance that produces the rattle until thermal expansion restores the designed clearances within the first 30 seconds of operation

B. The front crankshaft main bearing has excessive clearance that allows the crankshaft to impact the cap during cold-start oil starvation — the oil reaches the bearing within 30 seconds and cushions the shaft eliminating the rattle

C. The piston pin clearance is at the upper specification limit and the cold clearance produces the rattle until the piston aluminium expands from combustion heat and closes the pin-to-bore gap within the first 30 seconds

D. The timing gear train has excessive backlash that produces the rattle during the cold-start period when the cold oil cannot dampen the gear mesh vibration — the warmer oil provides adequate damping after 30 seconds

11. A diesel engine's oil pressure drops from 350 kPa to 200 kPa over a 30-minute period of idling. The oil level remains constant and the oil temperature has stabilized at the normal operating temperature. What is causing the progressive pressure drop?

A. The oil pressure relief valve spring is weakening from heat soak during the extended idle and the reduced spring tension allows the valve to open at progressively lower pressures as the spring temperature increases

B. The oil cooler thermostat is slowly opening during the idle period allowing more oil to flow through the cooler — the additional cooler volume reduces the pressure at the gauge because the cooler adds flow path length

C. The oil pump gears are experiencing thermal expansion that reduces the pump's internal clearances and the tighter clearances reduce the pump's volumetric output causing the progressive pressure decline during idle

D. The engine's bearing clearances are at the upper specification limit and as the oil reaches full operating temperature and thins to its lowest viscosity the bearings accept more flow than the pump can supply at idle speed

12. A heavy-duty diesel engine has a complaint of a faint ticking noise that is audible only with a stethoscope placed on the injection pump housing. The ticking rate matches the engine RPM exactly (one tick per revolution). What is the most likely source?

A. The injection pump drive gear has a single chipped tooth that produces one tick per revolution as the damaged tooth meshes with the engine's timing gear during each complete pump shaft rotation at the engine speed

B. The injection pump's internal cam ring has a flat spot that allows one plunger to impact its barrel at a different rate than the others creating one distinct tick per pump revolution audible through the pump housing material

C. The injection pump has a worn delivery valve seat on one cylinder that allows a pressure pulse to reflect back through the pump housing once per revolution when that cylinder's delivery valve closes during each pump rotation

D. The injection pump's drive shaft has developed a keyway wear that allows the shaft to shift once per revolution under the varying torsional load of the individual plunger compressions during the pump's rotational cycle

13. A diesel engine equipped with a turbocharger has a fault code for "boost pressure below commanded value." The turbocharger appears to function — the compressor wheel spins freely and the wastegate operates correctly. The intercooler has been pressure-tested and holds pressure. What often-overlooked component could cause this code?

A. The exhaust manifold gaskets have eroded between runners allowing exhaust pressure to escape before reaching the turbine reducing the energy available to drive the compressor to the commanded boost pressure level

B. The air intake filter restriction indicator has not been checked — a severely restricted air filter limits the air mass entering the compressor reducing the boost pressure below the ECM's commanded target at the specified RPM

C. The EGR valve is stuck partially open at all times and the continuous exhaust gas recirculation displaces fresh air in the intake manifold reducing the effective boost pressure below the ECM's commanded value at each load point

D. The crankcase ventilation system's CCV filter is severely restricted creating excessive crankcase pressure that pushes oil past the turbocharger compressor seal which fouls the intercooler and reduces the effective boost delivery

14. A diesel engine's coolant system has been tested and the coolant concentration is verified at the correct 50/50 ratio. The coolant test strip shows adequate freeze protection and the pH is within

specification. However, a supplemental coolant additive (SCA) test shows the SCA level is depleted. What role do SCAs play that the base coolant's freeze and pH protection cannot provide?

A. SCAs provide additional antifreeze protection beyond what the ethylene glycol provides and the depleted SCA level reduces the coolant's freeze protection point by approximately 5°C below the 50/50 ratio's designed level

B. SCAs provide pH buffering that maintains the coolant's alkalinity above the corrosion threshold and the depleted SCA level means the pH will drop rapidly toward the acid corrosion range within the next operating period

C. SCAs provide cavitation protection for the cylinder liner surfaces by maintaining a protective film that prevents the liner vibration from creating vapour bubble implosion damage on the coolant-side liner wall surfaces

D. SCAs provide liner cavitation protection — the additives maintain a chemical barrier on the cylinder liner's coolant-wetted surfaces that prevents cavitation erosion from the liner vibration's pressure wave impact during combustion

15. A diesel engine has been running at rated speed and load on a chassis dynamometer. The technician performs an injector cut-out test by disabling each injector one at a time through the scan tool. When cylinder 5 is cut, the engine RPM drops by 80 RPM. When cylinder 2 is cut, the RPM drops by only 30 RPM. What does the smaller RPM drop on cylinder 2 indicate?

A. Cylinder 2 is contributing less power than cylinder 5 — the smaller RPM drop when cylinder 2 is disabled indicates that cylinder was already producing less power from a combustion problem before the cut-out test isolated it

B. Cylinder 2 has a higher compression ratio than cylinder 5 from carbon buildup and the higher compression produces more parasitic drag when the injector is disabled — the engine actually speeds up slightly offsetting the power loss

C. Cylinder 2's injector has a faster-than-specification closing time that causes the ECM to redistribute the fuel from the cut cylinder to the remaining cylinders more quickly than when cylinder 5 is cut creating a smaller apparent loss

D. Cylinder 2's scan tool disable function is not fully cutting the fuel delivery and the residual fuel injection maintains partial combustion in the cylinder during the test creating the smaller RPM drop from the incomplete cut-out

16. A diesel engine's EGR system has a delta-pressure sensor that measures the pressure differential across an orifice in the EGR pipe to calculate the EGR flow rate. The sensor has a fault code for "signal stuck." The technician replaces the sensor but the code returns. What should be checked next?

A. The ECM's input circuit for the delta-pressure sensor for a fault that prevents the ECM from reading the new sensor's varying signal — the ECM's input may have a damaged pull-up or pull-down resistor creating the stuck reading

B. The orifice in the EGR pipe for blockage from carbon deposits that prevents any pressure differential from developing across the measurement point — without a differential the sensor correctly reads zero regardless of EGR flow

C. The sensing tubes that connect the delta-pressure sensor to the upstream and downstream ports on the EGR pipe for blockage from carbon soot or moisture that prevents the pressure differential from reaching the sensor element

D. The EGR valve actuator position for a fault that holds the valve closed at all times preventing any EGR flow through the orifice — without flow there is no differential pressure and the sensor correctly reads a constant zero value

17. A diesel engine has been running with a clogged air filter for an extended period before the restriction was discovered and the filter replaced. What potential engine damage should be inspected after prolonged operation with a severely restricted air intake?

A. The cylinder liners for scoring from abrasive particles that bypassed the collapsed filter element under the high vacuum condition created by the severe restriction at the air filter housing inlet

B. The turbocharger compressor for oil contamination from the high intake vacuum pulling oil past the compressor seal — the prolonged vacuum may have drawn oil into the intake and through the intercooler to the cylinders

C. The exhaust manifold for thermal cracking from the elevated exhaust temperatures caused by the rich fuel-to-air ratio that results from the restricted air supply reducing the available oxygen for complete combustion

D. The piston rings for accelerated wear because the restricted air supply creates a richer fuel-to-air ratio that washes the cylinder wall oil film with excess fuel reducing the lubrication between the rings and liner surfaces

18. A heavy-duty diesel engine equipped with dual turbochargers in a parallel configuration (one turbo per cylinder bank on a V-configuration engine) has a complaint of reduced power. The left turbocharger produces 180 kPa of boost while the right produces 140 kPa. What does this boost imbalance between the two turbos indicate?

A. The left turbocharger's wastegate is stuck closed preventing any exhaust bypass and the full exhaust energy drives the left turbo to 180 kPa which is above the specification while the right turbo operates at the correct 140 kPa

B. The right turbocharger has a performance issue — a restricted compressor inlet, a wastegate stuck partially open, worn bearings, or a damaged compressor/turbine wheel is reducing its boost output below the left turbo's matching level

C. The intake manifold has an internal baffle that distributes boost unevenly between the two banks and the baffle position has shifted from vibration creating the pressure imbalance between the left and right intake runners

D. The right cylinder bank has lower compression than the left from worn rings or valves and the reduced exhaust energy from the weaker bank's less-efficient combustion cannot drive the right turbocharger to the same boost level

19. A diesel engine's oil analysis report shows elevated levels of fuel dilution — 5% diesel fuel in the oil sample. The oil viscosity has dropped below the minimum specification from the fuel contamination. The engine has no apparent fuel system leaks. What is the most common source of fuel entering the engine oil?

A. The fuel injectors have a worn nozzle seat or internal leak that allows fuel to dribble into the combustion chamber after the injection event — the unburned fuel washes past the piston rings into the crankcase during each stroke

B. The high-pressure fuel pump has an internal seal failure that allows fuel to leak from the pump's high-pressure chamber into the engine's lubrication circuit through the pump's mounting interface with the engine timing cover

C. The fuel return lines have developed internal cracks that leak fuel into the engine valley where it drains into the crankcase through the pushrod openings or other engine casting passages connecting the valley to the oil sump

D. The DPF's late-post injection strategy for active regeneration introduces fuel into the exhaust that does not fully burn — the unburned fuel washes past the cylinder walls into the crankcase during the extended injection events

20. A diesel engine equipped with a DPF has completed a service regeneration. The technician monitors the post-regeneration data and notices the DPF outlet temperature reaches 650°C during the regeneration event. The specification maximum for outlet temperature is 600°C. What is the concern with the elevated regeneration temperature?

A. The 650°C temperature has no operational concern because the DPF substrate is designed to withstand temperatures up to 1,000°C and the 50°C overshoot is well within the substrate's thermal design margin during regeneration events

B. The elevated temperature may damage the DOC catalyst surface downstream of the DPF because the catalyst's maximum continuous operating temperature is typically 600°C and the overshoot can sinter the catalytic material

C. The elevated temperature indicates excessive soot loading that should have triggered an earlier regeneration — the accumulated soot burns more aggressively producing the temperature overshoot from the concentrated fuel load

D. The elevated temperature may have damaged the SCR catalyst substrate downstream by exceeding its thermal limit — repeated over-temperature events during regeneration progressively degrade the SCR catalyst's NO_x conversion efficiency

21. A diesel engine's turbocharger has been replaced due to shaft bearing failure. During the failure investigation, the technician finds metal debris from the failed turbo bearing in the engine's intake manifold, intercooler, and intake ports. What must be done before starting the engine with the new turbocharger?

A. The intake manifold and intercooler must be cleaned or replaced to remove all metal debris — starting the engine with debris in the intake system will ingest the metal particles into the cylinders causing ring, liner, and valve damage

B. The engine can be started because the metal debris will pass through the combustion chambers and exit through the exhaust without causing damage — the particles are too small to damage the hardened cylinder components

C. Only the intercooler must be replaced because the turbocharger's oil carries the bearing metal into the boost side — the intake manifold can be blown clean with compressed air which is adequate for the larger manifold passages

D. The intake manifold should be flushed with solvent and the intercooler can be cleaned in place by running the engine at idle for 10 minutes with the intake hose disconnected to purge any remaining debris through the open intake

22. A diesel engine's coolant recovery system (surge tank and overflow) has been checked and the technician finds the surge tank is full to the top instead of at the designed cold-fill mark. The cooling system appears to function normally — no overheating, no leaks. What could cause the surge tank to be overfull?

A. The surge tank cap's vacuum valve has failed and cannot draw coolant back from the overflow bottle during cool-down — the coolant expelled during heat-up is not recovered creating a gradually rising overflow level

B. The engine's head gasket has a small combustion-to-coolant leak that pressurizes the cooling system with combustion gas — the gas pressure pushes coolant into the surge tank faster than it can circulate back into the engine

C. The radiator cap pressure relief is opening at a lower pressure than specification allowing coolant to transfer to the surge tank at lower system temperatures than designed — the excess volume accumulates in the surge tank

D. Combustion gas is entering the cooling system through a head gasket leak, a cracked head, or a cracked liner — the gas pressure displaces coolant into the surge tank and the overfull condition progresses with each heat cycle

23. A diesel engine's fuel system has been diagnosed with air entering the suction side (low-pressure side) of the fuel supply. The technician pressurizes the low-pressure system with 200 kPa of air and submerges the connections in soapy water. No bubbles are found. Why might this test fail to locate the air ingress?

A. An air ingress point on the suction side is a one-way leak — it draws air in under vacuum during pump operation but may seal under the positive pressure of the test because the pressure pushes the sealing surfaces together rather than apart

B. The 200 kPa test pressure is too low to force air through the same leak path that allows air to enter under the pump's suction vacuum and a higher test pressure of 400 kPa is needed to overcome the leak path's surface tension

C. The soapy water test can only detect leaks larger than 1 mm in diameter and the suction-side air leak is typically smaller than this threshold requiring an electronic leak detector for proper identification of the entry point

D. The fuel has partially sealed the leak path with a residue film and the pressurized air cannot penetrate the fuel residue during the test — the technician must clean all connections with solvent before repeating the pressure test

24. A diesel engine has been operating with a leaking exhaust manifold gasket between cylinders 3 and 4 for approximately 10,000 km. The leak produces a visible soot streak on the engine block surface near the gasket. Beyond replacing the gasket, what should the technician inspect?

A. The cylinder head bolt torque on the adjacent bolts for loss of clamping force from the thermal cycling at the leak location that may have stretched the bolts beyond their yield point from the repeated heat exposure

B. The exhaust manifold surface for warping from the uneven thermal loading caused by the leak — the leaking area runs cooler than the sealed areas creating differential thermal expansion that can warp the manifold over time

C. The engine block and cylinder head mating surfaces at the manifold for erosion damage from the escaping exhaust gas — the high-temperature gas can erode the cast iron or aluminium surfaces creating channels that prevent a new gasket from sealing

D. The turbocharger for reduced performance from the exhaust energy lost through the leaking gasket over 10,000 km — the reduced exhaust pressure at the turbine inlet may have allowed the turbo bearings to operate at reduced oil pressure

25. A diesel engine equipped with exhaust gas recirculation has a NO_x emission reading that is 40% above the specification on a portable emissions analyzer. The EGR valve moves correctly when commanded by the scan tool and the EGR flow matches the commanded value. What else could cause elevated NO_x with a correctly functioning EGR system?

A. The fuel injection timing has advanced from its specification creating earlier combustion that produces higher peak cylinder temperatures — the elevated temperature increases NO_x formation despite correct EGR flow

B. The EGR cooler has lost efficiency from internal fouling and the recirculated exhaust gas temperature is higher than designed — the hot EGR gas does not cool the combustion as effectively as properly cooled EGR would

C. The turbocharger is producing more boost than specification which increases the intake air density — the additional air raises the peak combustion temperature producing more NO_x despite the correct EGR flow percentage

D. The charge air cooler has lost efficiency from external fouling and the elevated intake air temperature raises the combustion temperature — the hotter intake charge increases NO_x formation regardless of the EGR system's function

26. A diesel engine's crankcase ventilation system routes blow-by gases through a heated tube from the valve cover to the intake manifold. During a cold-weather inspection at -25°C, the technician discovers the CCV tube is frozen shut with ice. The engine has been running for 2 hours. What has failed in the CCV heating system?

A. The CCV tube does not have a heating element — it relies on engine heat to prevent freezing and the -25°C ambient temperature has overwhelmed the engine's passive heating capacity creating the ice blockage during operation

B. The CCV tube's internal heater has a thermostat that activates the heating element at 5°C and the thermostat has failed preventing the heater from activating during the cold weather operation at -25°C ambient temperature

C. The CCV tube's heated element has been disconnected or the element has failed — the lack of active heating allows the moisture in the blow-by gases to freeze inside the tube at -25°C creating the ice blockage during operation

D. The CCV tube heater element has failed or been disconnected — without the active heating the water vapour in the blow-by gases freezes inside the tube at -25°C and the ice accumulation blocks the ventilation path completely

27. A diesel engine's fuel rail pressure sensor has been replaced. After the replacement, the engine starts and runs but the scan tool shows the fuel rail pressure 50 bar below the commanded value at all

operating conditions. The old sensor showed the correct pressure before replacement. What is the most likely cause?

A. The replacement fuel rail pressure sensor has a different calibration offset than the original and reads 50 bar lower than the actual pressure — the system pressure is correct but the new sensor reports it inaccurately

B. The fuel rail was depressurized during the sensor replacement and the HP pump's check valve has stuck from the depressurization allowing fuel to drain from the rail faster than the pump can replenish during all operating conditions

C. The sensor mounting torque was not set to specification and the sensor is not fully seated in the rail's boss — the partial seating creates a small fuel leak at the sensor interface that reduces the rail pressure by 50 bar

D. The replacement sensor has a different electrical output range than the original and the ECM's stored calibration for the old sensor does not match the new sensor's output creating a 50-bar reading offset at all conditions

28. A diesel engine has a complaint that the check engine lamp illuminates intermittently during highway driving and then extinguishes after 10 to 15 minutes. The scan tool shows an intermittent fault code for "exhaust gas temperature sensor 4 — rationality error." What does a rationality error indicate?

A. The sensor's wiring has an intermittent connection that drops the signal during driving — the ECM reads an implausible value during the dropout and sets the rationality code before the connection re-establishes and the lamp extinguishes

B. The EGT sensor 4 has a loose mounting that allows exhaust to leak around the probe tip intermittently during thermal cycling — the leaked exhaust cools the probe creating a lower-than-expected reading that triggers the rationality check

C. The ECM compares the EGT sensor 4 reading to what it calculates the temperature should be based on engine operating conditions — the sensor reading does not match the ECM's expected value within the designed tolerance during certain conditions

D. The EGT sensor 4 probe has accumulated a carbon deposit on its tip that insulates it from the exhaust gas intermittently during highway driving — the deposit changes the sensor's response time creating a delayed reading

29. A diesel engine's aftertreatment system has a fault code indicating the ammonia slip catalyst (ASC) is detecting ammonia in the tailpipe exhaust. The DEF dosing rate is at the ECM's commanded level. What condition could cause ammonia to exit the tailpipe?

A. The SCR catalyst has lost efficiency from thermal degradation and can no longer convert all the ammonia produced by the DEF decomposition — the unconverted ammonia passes through the catalyst to the tailpipe as ammonia slip

B. The DEF injector is producing larger droplets than designed from a worn nozzle — the large droplets do not fully decompose into ammonia before reaching the SCR catalyst and the undecomposed urea passes through to the tailpipe

C. The DEF dosing rate is correct per the ECM's command but the engine's NO_x production has decreased from an engine change — the ECM doses for the expected NO_x level but the reduced NO_x leaves excess ammonia unreacted

D. The exhaust temperature has dropped below the SCR catalyst's minimum activation temperature and the DEF continues to be injected but the cold catalyst cannot facilitate the ammonia-NO_x reaction leaving the ammonia unreacted in the exhaust

30. A tractor-trailer combination is undergoing a roadside inspection. The inspector performs a static brake test — measures the pushrod stroke on all wheel positions with the brakes fully applied at 690 kPa system pressure. Two rear drive axle chambers exceed the maximum stroke specification. What is the immediate consequence for the vehicle?

A. The vehicle receives a written warning and has 30 days to repair the over-stroke condition before the next inspection — the vehicle can continue its trip with the advisory notice documented on the inspection report

B. The driver must adjust the brakes at the roadside before continuing the trip — the inspector provides 30 minutes for the driver to perform the adjustment and the inspector rechecks the stroke before releasing the vehicle

C. The vehicle can continue to its next stop (within 250 km) for repair because the brakes are functional even though they exceed the stroke specification — the brake function is not immediately impaired at the current stroke

D. The vehicle is placed out of service — the over-stroke condition means the brakes on those wheels may not produce adequate stopping force and the vehicle cannot operate until the brakes are repaired to within specification

31. A truck's air brake system uses automatic slack adjusters on all positions. During a PM inspection, the technician finds that one automatic adjuster has been manually adjusted with a wrench — the wrench marks are visible on the adjustment hex. What concern does this raise?

A. The manual adjustment confirms the automatic adjuster has reached the end of its adjustment range and has been manually extended to provide additional stroke — the adjuster must be replaced because it can no longer adjust automatically

B. An automatic slack adjuster that requires manual adjustment indicates the adjuster is not functioning correctly or a foundation brake problem exists — the root cause must be diagnosed rather than simply readjusting the ASA

C. The manual adjustment is acceptable as a temporary measure during the PM interval and the adjuster will resume automatic adjustment during the next brake application once the manual adjustment establishes the correct clearance

D. The wrench marks indicate the adjuster was over-adjusted during the last brake service and the technician who performed the service used the manual adjustment incorrectly — the adjuster should be reset to the factory position

32. A truck's front air disc brake caliper has a complaint of a grinding noise during every brake application. The brake pads have been replaced 5,000 km ago. The rotor surface appears smooth with no visible scoring. What should the technician investigate?

A. The brake pad mounting clips or anti-rattle hardware for a missing or broken piece that allows the pad to vibrate or shift in the caliper bracket creating the metallic grinding noise during each brake application under load

B. The caliper slide pins for seizure that prevents the caliper from floating and creates metal-to-metal contact between the pad backing plate and the caliper bracket during each application from the cocked caliper position

C. The brake pad friction material for contamination from a leaking caliper seal that has deposited brake fluid on the pad surface — the fluid-contaminated pad produces a grinding sound from the altered friction characteristics

D. The rotor for surface hardness variations (hard spots) that are not visible but produce a grinding sensation and noise as the pads contact the uneven hardness zones during each revolution of the rotor during braking

33. A trailer equipped with an exhaust-style (external) automatic slack adjuster has the adjuster repeatedly backing off — the pushrod stroke increases between PM inspections despite the adjuster appearing to function during manual testing. What is the most likely cause?

A. The adjuster's internal one-way clutch is slipping in the tightening direction — the clutch should hold the adjustment during the release stroke but the worn clutch allows the worm gear to reverse partially during each brake release

B. The brake drum has developed an out-of-round condition that pushes the shoes back during each drum revolution and the automatic adjuster interprets the shoe retraction as an over-adjusted condition and backs off the adjustment

C. The adjuster's internal mechanism is functioning correctly during manual testing but the brake return springs are too strong for the adjuster's holding force — the springs overpower the adjuster's one-way clutch during each release

D. The brake shoe anchor pins are worn and the shoes shift position during each application-release cycle — the adjuster cannot maintain a consistent clearance because the shoe-to-drum geometry changes with each brake event

34. A truck's air system has a complaint that the air pressure drops rapidly when the engine is shut off — approximately 100 kPa drop in 2 minutes with the brakes released. The applied leak rate test also exceeds the specification. During investigation, the technician hears a constant hissing from under the dash. What is the most likely source?

A. The parking brake valve has a worn exhaust seat that leaks air continuously through the valve's exhaust port regardless of the valve's position creating the constant hiss and the rapid pressure loss during key-off conditions

B. The foot valve has a primary or secondary piston seal leak that allows air to bypass internally and exhaust through the valve's exhaust port continuously creating the hissing noise and the rapid pressure loss with engine off

C. The air line fitting at the dash-mounted pressure gauge has a crack at the compression fitting that leaks air continuously — the fitting is behind the dash panel and the hissing sound appears to come from the dash area

D. The foot valve has an internal piston seal failure that allows system air to continuously exhaust through the valve's pedal rod boot or exhaust port — the constant air loss creates the hissing sound and the rapid pressure drop

35. A truck's brake proportioning valve is load-sensing — it adjusts the rear brake application pressure based on the rear axle loading measured through a height-sensing linkage connected to the rear suspension. The linkage has become disconnected. What is the consequence of the disconnected linkage?

A. The proportioning valve defaults to maximum reduction (minimum rear brake pressure) and the rear brakes provide minimal braking force regardless of the vehicle's loading condition creating extended stopping distances

B. The proportioning valve defaults to either maximum or minimum rear brake pressure depending on the valve's design — the disconnected linkage removes the load-sensing input and the valve goes to its mechanical default position

C. The proportioning valve loses all function and provides zero rear brake pressure because the linkage disconnection creates an electrical fault code that disables the valve's solenoid in the de-energized (no-flow) state

D. The proportioning valve defaults to full rear brake pressure (no reduction) and the unproportioned rear brakes may lock up during light-load braking because the full brake force exceeds the lightly loaded rear axle's traction

36. A truck equipped with EBS (electronic braking system) has the EBS warning lamp illuminated. The scan tool shows a fault code for the yaw rate sensor. The driver reports the brakes feel normal and the stopping distance appears adequate during the road test. What function has been lost?

A. The electronic stability control function has been disabled because the yaw rate sensor is required to detect vehicle rotation — without it the EBS cannot compare the driver's steering input to the vehicle's actual path for stability corrections

B. The ABS modulation algorithm has lost its directional input and the system operates in a simplified two-channel mode instead of the designed four-channel individual wheel modulation that requires the yaw rate data

C. The trailer stability intervention has been disabled because the yaw rate sensor detects trailer swing oscillation through the tractor's rotational movement — without this input the EBS cannot intervene to dampen trailer sway events

D. The roll stability control has been disabled because the yaw rate sensor provides the lateral acceleration data needed to detect an impending rollover condition — without this input the EBS cannot apply corrective braking for stability

37. A trailer's brake system has been tested using a roller brake tester. The results show the left side produces 15 kN of braking force while the right side produces 10 kN. The brake adjustment is within specification on both sides and the air pressure delivered to both chambers is equal. What should be investigated?

A. The brake shoes on the right side for oil contamination from a leaking wheel seal that reduces the friction coefficient — the contaminated lining produces less braking force per unit of application pressure than the clean left side

B. The roller brake tester calibration because a 50% side-to-side imbalance with equal adjustment and air pressure is more likely a tester error than an actual brake condition and the tester should be verified before investigating the brakes

C. The right-side brake lining for a different friction coefficient, oil contamination, glazing, or incorrect material specification that produces less braking force than the left side despite equal mechanical adjustment and air pressure

D. The right-side brake drum for an oversized diameter that has moved the linings beyond effective contact — the air-operated chamber pushes the shoes outward but the enlarged drum diameter reduces the shoe-to-drum contact area

38. A truck's air dryer has been tested and the desiccant is confirmed saturated — the dryer cannot remove moisture from the compressed air. The dryer cartridge was replaced 6 months ago. What operating condition could cause premature desiccant saturation?

A. The compressor has been replaced with a higher-output unit that produces more air volume per minute than the original — the increased air volume carries more moisture than the dryer's desiccant was sized to handle per purge cycle

B. The governor's cut-in and cut-out pressures have drifted closer together and the compressor cycles more frequently — each short cycle produces a purge that does not fully regenerate the desiccant before the next loading cycle begins

C. The air system has multiple small leaks that collectively increase the air consumption rate — the compressor runs loaded more frequently producing more moisture that accumulates in the desiccant faster than the purge cycles can remove

D. The compressor operates loaded for longer periods than the dryer was designed for — the extended loaded time produces more moisture-laden air per cycle than the desiccant can absorb and the purge duration cannot fully regenerate the saturated media

39. A truck's ABS modulator valve has been condemned. The replacement valve has a different part number but the same physical dimensions and electrical connector. The parts supplier states it is a compatible replacement. Should the technician install the cross-referenced valve?

A. The cross-referenced valve can be installed because the physical dimensions and connector are the matching factors — the ABS module communicates the same electrical commands regardless of the internal valve design differences

B. The technician should verify with the ABS system manufacturer that the cross-referenced valve is approved for this application — even physically identical valves may have different internal flow rates and response times that affect ABS performance

C. The valve can be installed if the technician updates the ABS module's software to recognize the replacement valve's different operating characteristics through the scan tool's module configuration function during the installation

D. The cross-referenced valve should not be installed because any modulator valve part number difference indicates a different internal design that will affect the ABS module's modulation algorithm calibrated for the original valve's specific flow characteristics

40. A truck's spring brake chamber has been replaced. During testing, the parking brake applies correctly when the parking valve is pulled. However, when the parking valve is pushed in (spring brake released), the wheel on the replaced chamber still has slight brake drag — the wheel does not spin freely. What could cause the drag after the spring brake release?

A. The replacement chamber's internal spring has a slightly higher preload than the original and the stronger spring does not fully compress against the air pressure creating a residual force on the pushrod that maintains light brake contact

B. The pushrod on the replacement chamber is longer than the original and the excess length holds the slack adjuster arm beyond the designed free-play position keeping the shoes in light contact with the drum during the released state

C. The replacement chamber's diaphragm has a manufacturing defect that prevents full retraction when pressurized — the diaphragm balloons instead of retracting creating a residual pushrod force that keeps the brake partially applied

D. The air supply line to the spring section has a restriction that limits the flow volume reaching the chamber — the restricted flow pressurizes the chamber slowly and the full release pressure has not been reached during the test period

41. A truck's brake system uses a tandem (dual-circuit) foot valve. During testing, the technician presses the pedal and measures the delivery pressure from the primary circuit at 620 kPa. The secondary circuit delivers only 450 kPa at the same pedal position. What does this pressure difference between the two circuits indicate?

A. The secondary circuit has a leak that reduces the delivery pressure below the primary circuit's output — the foot valve mechanically delivers equal pressure to both circuits and any difference indicates a downstream leak

B. The foot valve's secondary piston has a worn seal that reduces its delivery efficiency compared to the primary piston — the secondary piston cannot build the same pressure as the primary at the same pedal application force

C. The foot valve's secondary piston seals are worn and bypassing air internally — the primary and secondary circuits should deliver equal pressure at any pedal position and the 170 kPa difference indicates the secondary section has an internal fault

D. The pressure difference is normal because the primary circuit supplies the rear brakes which require more force and the foot valve is designed with a higher delivery ratio on the primary circuit to match the heavier rear axle loading

42. A trailer's ABS system has been functioning correctly. After a brake reline, the ABS activates prematurely during light braking — the ABS cycles at deceleration rates that should not trigger ABS intervention. The brake adjustment is within specification. What could the brake reline have affected?

A. The new brake linings have a higher friction coefficient than the original linings and the increased friction produces wheel deceleration rates that exceed the ABS module's lockup threshold during light brake applications

B. The wheel speed sensor air gap was disturbed during the brake reline and the increased gap produces a weaker signal that the ABS module interprets as a wheel speed reduction triggering premature ABS intervention during light braking

C. The new brake linings are a different thickness than the originals and the altered drum-to-lining clearance changes the brake's response characteristic producing a faster initial engagement that the ABS interprets as impending lockup

D. The brake shoe return springs were not reinstalled during the reline and the missing springs allow the shoes to drag against the drum between applications — the drag creates a false wheel speed reduction that triggers the ABS

43. A truck's air system has a complaint that the governor does not unload the compressor at the correct cut-out pressure. The cut-out occurs at 930 kPa instead of the specified 860 kPa. What is the safety concern with the elevated cut-out?

A. The air tanks are pressurized beyond their designed working pressure which creates a risk of tank failure from the overpressure — the tanks were manufactured and tested for a maximum pressure corresponding to the 860 kPa setting

B. The elevated pressure damages the brake chamber diaphragms by applying more force than the diaphragm material can withstand during each brake application — the over-pressurized applications fatigue the rubber material prematurely

C. The elevated pressure has no safety concern because the air system components are designed with a safety factor that accommodates pressures up to 1,200 kPa and the 930 kPa is well within the component's burst pressure rating

D. The elevated cut-out pressure may exceed the working pressure rating of the air system components — air tanks, valves, fittings, and hoses are rated for specific maximum pressures and the 930 kPa may exceed these ratings

44. A truck's front brake rotor has been measured for thickness variation (parallelism). The measurements show a 0.08 mm variation around the circumference. The specification maximum is 0.03 mm. The rotor diameter is still above the minimum specification. Should the rotor be machined or replaced?

A. The rotor should be machined on a brake lathe to restore the parallelism to within the 0.03 mm specification — machining removes less material than replacement and is acceptable as long as the post-machining thickness remains above minimum

B. The rotor cannot be machined because the 0.08 mm variation indicates the rotor has developed hard spots from metallurgical changes that will reappear even after machining — the rotor must be replaced for a lasting repair

C. The rotor should be replaced because the 0.08 mm variation cannot be corrected by machining — the lathe removes equal material from both sides per revolution and cannot correct a thickness variation within the rotor itself

D. The rotor can remain in service with the 0.08 mm variation because the brake pad material will conform to the rotor's surface variation during normal driving and the effective parallelism will improve as the pads wear to match

45. A trailer's brake drums have been replaced with new drums. After installation, the driver reports the brakes feel spongy during the first several stops but then firm up and feel normal. What explains this initial spongy feel with new drums?

A. The new drums have a protective coating that must be burned off during the first several stops before the friction surfaces make full contact — the coating reduces the initial friction coefficient creating the spongy feel

B. The new drums have a slightly different internal diameter than the worn drums and the automatic slack adjusters must take up the additional clearance over the first several brake applications to establish the correct running clearance

C. The new drum surfaces have machining marks from manufacturing that reduce the initial contact area between the lining and drum — the marks wear away during the first stops and full contact is established progressively

D. The brake shoes must conform to the new drums' exact internal profile which differs slightly from the worn drums' profile — the first several stops bed the shoes to the new drums establishing full lining-to-drum contact area

46. A truck's air system has been tested and the air dryer purge is functioning correctly — it cycles with each governor unload event. However, water continues to accumulate in the primary (wet) tank. The technician drains approximately 100 ml of water from the wet tank at each PM interval (every 30 days). Is this water accumulation normal or indicative of a problem?

A. The water accumulation is abnormal and indicates the air dryer has a leak that allows moisture to bypass the desiccant during the loaded cycle — the dryer should be inspected for an internal leak path around the cartridge seal

B. The water accumulation is abnormal because a properly functioning air dryer should remove virtually all moisture from the compressed air and any water in the wet tank indicates the dryer is not performing to its designed capacity

C. The water accumulation of 100 ml per month is within the normal range for a heavy-duty truck air system — the dryer removes most moisture but a small amount passes through and collects in the wet tank between drain intervals

D. A small amount of water accumulation in the wet tank is normal — no air dryer removes 100% of moisture and the wet tank serves as a secondary moisture collection point where residual water settles before reaching the dry tanks

47. A truck's engine ECM has set a fault code for the accelerator pedal position sensor — SPN 91, FMI 2 (erratic/intermittent). The pedal operates smoothly with no mechanical binding. The connector pins are clean and tight. What is the most common cause of this intermittent signal?

A. The APPS potentiometer has a worn resistive element track that creates a momentary signal dropout as the wiper crosses the worn section during normal pedal movement — the dropout produces the erratic signal the ECM detects

B. The accelerator pedal return spring has weakened and the pedal oscillates from engine vibration during steady-state driving — the rapid position changes appear as erratic signal variations to the ECM's input monitoring circuit

C. The ECM's internal analog-to-digital converter for the APPS input has developed noise on its reference voltage that creates a fluctuating digital value from the stable analog signal — the noise appears as an erratic reading

D. The APPS connector seal has deteriorated allowing moisture to enter the connector and create a conductive film between the signal and reference pins — the film creates intermittent signal variations during temperature changes

48. A truck's charging system produces 14.4 volts at the alternator B+ terminal. The voltage at the battery positive terminal reads 13.2 volts. The voltage at the battery negative terminal reads 0.4 volts above chassis ground. What is the total charging circuit voltage drop and is it acceptable?

A. The total drop is 0.8 volts ($14.4V - 13.2V = 1.2V$ positive side, but the negative side's 0.4V indicates a ground offset that reduces the effective positive-side drop to 0.8V) and this is marginally above the specification

B. The total drop is 1.6 volts (1.2V on the positive side plus 0.4V on the negative side) and this significantly exceeds the 0.5V maximum specification for a charging circuit requiring cable and connection maintenance

C. The total drop is 1.2 volts ($14.4V$ at B+ minus $13.2V$ at battery = 1.2V total) and the 0.4V ground offset is included in the 1.2V measurement because the battery voltage measurement already accounts for the ground path

D. The total drop is 0.4 volts because only the ground-side drop affects charging — the positive-side difference is caused by the battery's internal resistance absorbing the charging current and is not a circuit resistance issue

49. A truck's scan tool shows the engine oil pressure sensor reading 0 kPa with the engine running at idle. The mechanical oil pressure gauge connected to the same port reads 280 kPa. The sensor is a variable-resistance type powered by the ECM's 5-volt reference. What is the most likely sensor circuit fault?

A. The sensor has failed internally with an open circuit that prevents the reference voltage from reaching the sensing element — the ECM reads full reference voltage which it interprets as zero pressure on this sensor type

B. The sensor signal wire has a short to ground that pulls the signal voltage to 0 volts regardless of the oil pressure — the ECM interprets the 0-volt signal as 0 kPa on this sensor's voltage-to-pressure conversion scale

C. The ECM's 5-volt reference supply to the oil pressure sensor has failed and the sensor cannot produce any signal without its reference voltage — the ECM reads 0 volts and displays 0 kPa from the absent reference

D. The sensor ground wire has an open circuit that prevents current from flowing through the sensor element — without a ground return path the sensor cannot vary its output and the ECM reads the default zero-pressure value

50. A truck equipped with LED tail lamps has one lamp that illuminates at full brightness for approximately 10 minutes and then dims to approximately 50% brightness. After cooling with the engine off for 30 minutes, the lamp returns to full brightness when re-energized. What is the cause?

A. The LED lamp assembly has a corrosion buildup on its connector pins that increases resistance as the connection heats from current flow — the increased resistance reduces the voltage available to the LEDs causing the dimming

B. The LED lamp's internal current-limiting resistor increases in resistance as it heats from normal operation — the hotter resistor limits more current to the LEDs reducing their brightness after the initial cool-start period

C. The body controller's output driver for that lamp circuit has a thermal fault — the driver transistor overheats after 10 minutes and reduces its output current to protect itself from thermal damage creating the dimming effect

D. The LED lamp's internal thermal protection circuit is reducing the current to the LEDs as the assembly heats during operation — the LED driver senses the elevated temperature and dims the output to prevent thermal damage to the LEDs

51. A truck's starter motor engages and cranks the engine at normal speed. During cranking, the dashboard lights flicker rapidly. After the engine starts, the lights return to normal steady illumination. Is the flickering during cranking normal?

A. The flickering is normal — the starter motor draws 200+ amps during cranking which creates voltage fluctuations at the battery terminals that propagate through the electrical system causing the dash lamps to flicker at the cranking frequency

B. The flickering indicates a weak battery that cannot maintain adequate voltage during the heavy starter current draw — a fully charged battery with adequate CCA capacity should not produce visible light flickering during normal cranking

C. The flickering indicates a loose battery cable connection that creates an intermittent high-resistance path during the heavy cranking current — the resistance creates voltage oscillations at the unstable connection point

D. The flickering is caused by the alternator's voltage regulator attempting to stabilize the system voltage during cranking — the regulator oscillates between charge and no-charge states as the engine speed varies during starting

52. A truck's body controller has been replaced. After the replacement, the power windows, power locks, and interior lights function correctly. However, the trailer charge circuit on pin 7 of the seven-pin connector does not provide voltage. What must be configured?

A. The trailer charge relay fuse must be checked because the body controller replacement may have tripped the fuse during the installation — the blown fuse prevents voltage from reaching the trailer charge output on pin 7

B. The replacement body controller must be calibrated to the vehicle's specific VIN using the dealer's diagnostic software before all output functions are enabled — the trailer charge function requires VIN-specific calibration

C. The replacement body controller must be programmed with the vehicle's option codes including the trailer towing package — without the towing package enabled in the configuration the controller does not activate the pin 7 output

D. The trailer charge circuit is controlled by a separate relay that is independent of the body controller — the relay's control wire must be reconnected to the replacement controller's output terminal for the charge function

53. A truck equipped with a J1939 CAN bus has the engine ECM, transmission module, ABS module, and instrument cluster communicating on the same bus. The engine runs correctly and the transmission shifts properly, but the instrument cluster displays "NO DATA" on all gauges. The scan tool communicates with all modules including the cluster. What is the most likely cause?

A. The instrument cluster's CAN bus transceiver has a partial failure that allows it to receive scan tool diagnostic requests but cannot process the continuous data stream from the engine ECM needed for gauge display

B. The instrument cluster has a firmware fault that prevents it from processing the standard J1939 broadcast messages for the gauge parameters while the diagnostic protocol messages from the scan tool are processed correctly

C. The CAN bus backbone has a partial fault between the engine ECM and the cluster that intermittently blocks the broadcast data while the scan tool's point-to-point diagnostic communication uses a different message priority that gets through

D. The instrument cluster requires a software update or parameter configuration to match the engine ECM's specific J1939 broadcast format — the cluster cannot interpret the ECM's data messages without the correct software version

54. A truck's alternator has been bench-tested at a repair shop and passes all tests — producing 14.4 volts and full rated current. After reinstallation on the truck, the alternator produces only 12.8 volts under load. What vehicle-specific condition could cause the alternator to underperform after reinstallation?

A. The alternator's voltage sense wire is disconnected or has excessive resistance — without the sense feedback the regulator cannot compensate for cable voltage drop and regulates to a lower voltage at the alternator output

B. The drive belt pulley ratio has changed from a previous repair and the alternator shaft does not reach the minimum RPM for full output at the engine speeds encountered during the driving test condition used for verification

C. The battery temperature sensor is providing an incorrect signal to the voltage regulator commanding a lower charging voltage than the designed 14.4V output — the sensor overrides the alternator's internal regulation capability

D. The alternator's voltage sense wire is disconnected or has high resistance — the regulator uses the sense input to measure battery voltage and without accurate feedback the regulator cannot increase output to compensate for circuit losses

55. A truck's engine ECM has a fault code for the crankshaft position sensor — SPN 190, FMI 8 (abnormal frequency). The engine starts and runs normally. Under what condition would the CKP sensor produce an abnormal frequency?

A. The flywheel ring gear has one or more damaged or missing teeth that create gaps in the signal pattern — the ECM expects a continuous tooth pattern and the missing teeth produce signal dropout events that register as abnormal frequency

B. The CKP sensor has a partial internal failure that doubles its output frequency from an internal oscillation — the ECM receives twice the expected pulse count per revolution and sets the abnormal frequency code during operation

C. The engine's harmonic balancer has slipped on the crankshaft and the timing reference mark on the balancer no longer aligns with the sensor at the correct crankshaft position — the shifted mark creates a frequency offset

D. The camshaft timing has shifted from a worn timing gear or chain and the resulting phase difference between the crankshaft and camshaft signals creates a frequency mismatch that the ECM detects as an abnormal CKP frequency

56. A truck's trailer ABS lamp on the dash stays illuminated continuously after connecting a trailer. The trailer ABS module performs its self-test correctly (the lamp on the trailer cycles through its test pattern). What is the most likely cause of the persistent tractor dash lamp?

A. The tractor's body controller requires a CAN bus handshake from the trailer ABS module to extinguish the trailer ABS lamp and the PLC communication quality through the 7-pin connector is insufficient for the handshake signal

B. The tractor's trailer ABS lamp circuit is controlled by a dedicated wire from the trailer rather than through CAN/PLC communication — the dedicated lamp wire has a fault (short to ground or broken wire) that holds the lamp on

C. The trailer ABS module has a stored fault code from a previous trip that keeps the module in a fault state — the self-test lamp cycle occurs independently of the fault state and the dash lamp reflects the stored fault condition

D. The tractor's seven-pin connector has a wiring fault on the ABS diagnostic pin that grounds the lamp circuit continuously regardless of the trailer ABS module's actual status creating the false persistent lamp indication

57. A truck equipped with a multiplexed body electrical system has the horn, headlamps, and marker lamps all controlled through the body controller. The body controller has been diagnosed with a failed output driver for the horn circuit. The technician proposes wiring the horn directly to a new relay and switch to bypass the body controller. What is the concern with this approach?

A. The direct wiring bypasses the body controller's overcurrent protection and diagnostic monitoring for the horn circuit — a short circuit on the bypassed horn wiring will blow the relay fuse but will not be recorded as a diagnostic fault

B. The direct wiring will work for the horn function but the body controller may set fault codes for the disconnected horn output circuit and the diagnostic monitoring of the horn will be lost from the vehicle's data recording system

C. The bypassed horn circuit will function but the body controller will continuously set fault codes for the missing horn output load — the repeated fault codes may trigger other controller responses such as warning lamp activation

D. The direct wiring creates a potential electrical safety issue because the bypassed circuit does not have the body controller's smart fusing protection that limits current during a fault condition — the relay's fuse provides basic but less-responsive protection

58. A truck's battery management system monitors the batteries' state of charge through a battery current sensor (shunt) mounted on the negative battery cable. The sensor has been replaced due to corrosion. After the replacement, the engine starts normally but the idle-stop function does not activate even though all enable conditions are met. What must be done after the current sensor replacement?

A. The engine ECM must be reset to clear the battery health data accumulated from the old sensor — the stored data conflicts with the new sensor's readings preventing the ECM from enabling the idle-stop function

B. The battery current sensor requires a relearn or reset procedure through the scan tool to establish the new sensor's zero-point calibration and the battery's baseline current flow characteristics for the idle-stop function

C. The battery management module must relearn the battery's capacity by performing a controlled discharge-recharge cycle that takes approximately 8 hours — the module cannot calculate the SOC accurately without this baseline

D. The battery current sensor's calibration data must be manually entered into the ECM through the scan tool using the sensor's unique serial number and calibration coefficients printed on the sensor's identification label

59. A truck's engine ECM receives the vehicle speed signal from the ABS module through the J1939 CAN bus. The speedometer reads correctly but the engine's cruise control will not engage. The scan tool shows the vehicle speed at 0 km/h in the engine ECM's data while the ABS module shows the correct speed. What has failed?

A. The cruise control switch has a fault that prevents the ECM from enabling the cruise function regardless of the speed signal — the switch issue is independent of the speed data which the ECM receives correctly for other functions

B. The engine ECM's J1939 communication configuration is incorrect for the vehicle speed parameter — the ECM is looking for the speed data on a different PGN (parameter group number) than the ABS module is broadcasting

C. The ABS module is broadcasting the speed data on a PGN that the engine ECM is not configured to receive — the instrument cluster reads the speed from a different source while the ECM cannot access the ABS broadcast

D. The engine ECM's customer parameter configuration for the vehicle speed source is incorrect — the ECM is configured to read speed from the wrong source (such as a transmission sensor that is not installed) instead of the ABS module's CAN broadcast

60. A truck's batteries have been disconnected for 24 hours during an electrical repair. After reconnection, the engine starts and runs normally but the power windows operate very slowly for the first 5 minutes before returning to normal speed. What is causing the initial slow window operation?

A. The battery surface charge has not stabilized after reconnection and the available voltage is lower than the fully stabilized level — the reduced voltage limits the window motor speed until the surface charge equilibrates

B. The body controller must relearn the window motor parameters after a battery disconnect — the controller operates the windows at a reduced speed during the relearn period to establish the motor's current draw baseline and travel limits

C. The window regulators have settled to their fully extended positions during the 24-hour disconnect and the cold lubricant in the regulator mechanisms creates additional friction that the motors must overcome during the first few operations

D. The battery voltage is adequate but the alternator requires 5 minutes at idle to fully excite its field winding after the prolonged disconnect — the reduced alternator output during the field buildup limits the available current for accessories

61. A truck's engine ECM has set a fault code for the exhaust backpressure sensor — SPN 81, FMI 14 (special instructions). The technician is unfamiliar with FMI 14. What does FMI 14 indicate?

A. FMI 14 indicates the measurement is in a transitional state that the ECM has flagged for attention — the condition may not be a failure but requires the technician to refer to the manufacturer's specific diagnostic procedure for this SPN

B. FMI 14 indicates the sensor has detected a condition that exceeds its designed measurement range and the sensor's output is clipped at its maximum value — the actual exhaust backpressure exceeds the sensor's full-scale reading

C. FMI 14 indicates a hardware failure in the ECM's internal processing circuit for this specific sensor input — the sensor may be functioning correctly but the ECM cannot process its signal through the damaged internal channel

D. FMI 14 indicates the sensor requires periodic calibration and the scheduled calibration interval has been exceeded — the ECM sets this code as a maintenance reminder rather than a fault indication for the sensor circuit

62. A truck's scan tool shows the engine coolant temperature sensor reading -40°C with the engine at full operating temperature. The dash gauge reads the correct temperature. What is the most likely fault?

A. The dash gauge receives its temperature input from a separate dedicated sender unit that functions correctly while the ECM's sensor or its circuit has failed producing the -40°C reading on the scan tool display

B. The ECM sensor has failed internally producing a fixed output that the ECM interprets as -40°C while the dash gauge operates from its own independent temperature sender that continues to function correctly

C. The ECM sensor signal wire has an open circuit — the ECM's 5-volt reference is unloaded and the full reference voltage corresponds to maximum resistance (minimum temperature) on the NTC scale which reads as -40°C

D. Both A and C are possible — the -40°C reading on the scan tool with a correct dash gauge indicates the ECM sensor circuit has a fault (open circuit or failed sensor) while the dash gauge's separate sender continues reading correctly

63. A truck's headlamp circuit has been modified with an aftermarket HID (high-intensity discharge) conversion kit. After the installation, the truck passes other vehicles and the oncoming drivers flash their high beams indicating the headlamps are too bright or poorly aimed. What is the hazard of this conversion?

A. The HID bulbs produce a focused beam that concentrates the light at the centre of the pattern blinding oncoming drivers from the intense centre-beam candlepower that the original halogen reflector was not designed to focus

B. The HID conversion produces more total light output than the halogen system but the original reflector and lens optics scatter the light instead of focusing it creating glare that blinds oncoming drivers from the uncontrolled light distribution

C. The HID bulbs operate at a higher colour temperature than halogen and the blue-white light is more fatiguing to oncoming drivers' eyes than the warm-white halogen light even at the same total light output level

D. The HID conversion in a halogen reflector housing produces uncontrolled glare — the original reflector was designed for a halogen filament's specific light source geometry and the HID arc tube's different shape scatters light into oncoming traffic

64. A truck's battery voltage reads 12.6 volts with the engine off and 14.2 volts with the engine running. The alternator appears to be charging correctly. However, when the technician loads the electrical

system by turning on all accessories (headlamps, blower, heated mirrors, clearance lamps), the voltage drops to 13.4 volts and the alternator produces a noticeable whine. What does this indicate?

- A. The alternator is functioning within specification — the voltage drop from 14.2V to 13.4V under full accessory load is within the normal regulation range and the whine is the alternator working at full output to supply the demand
- B. The alternator's maximum output is being reached — the 0.8V drop under full load indicates the alternator is at or near its maximum current capacity and the whine is from the alternator's internal components working at their maximum rated capacity
- C. The alternator has a weak diode in the rectifier bridge that reduces the alternator's maximum output by one-sixth — the reduced output drops the voltage under load and the defective diode produces the whine from the AC ripple
- D. The alternator is overloaded — the total accessory load exceeds the alternator's rated output capacity and the alternator cannot maintain regulation voltage under the full load creating the voltage drop and the whine from the overloaded internal components

65. A truck's engine ECM has set a fault code for the fuel rail pressure sensor — SPN 157, FMI 1 (data below normal range). The engine starts but runs rough at idle. What condition would cause the fuel rail pressure to be below the normal range?

- A. The fuel rail pressure relief valve is stuck partially open leaking fuel from the rail back to the return circuit and the HP pump cannot build the rail pressure to the specified level against the constant leak at the relief valve seat
- B. The fuel transfer pump output is below specification from worn internal gears and the reduced supply pressure cannot feed the HP pump with adequate fuel volume to build the required rail pressure during idle operation
- C. The fuel filter is severely restricted and limits the fuel flow to the HP pump below the minimum volume needed for the pump to maintain the commanded rail pressure at any operating condition including idle speed
- D. A component in the fuel supply or high-pressure circuit has failed — the transfer pump, fuel filter, HP pump, relief valve, or an injector with excessive return flow could individually or collectively reduce the rail pressure below specification

66. A truck's body controller is programmed to automatically activate the headlamps when the ambient light sensor detects low light conditions. The headlamps activate correctly at dusk but do not turn off when the truck enters a brightly lit parking area. What should be checked?

A. The ambient light sensor for contamination (dirt, film, or adhesive residue) on the sensor lens that blocks the bright light from reaching the sensing element — the contaminated sensor reads low light even in bright conditions

B. The body controller's headlamp auto-off timer for a setting that delays the headlamp deactivation by a fixed period after the light conditions change — the timer prevents rapid on-off cycling during variable light conditions

C. The ambient light sensor for contamination on its lens or a fault in its circuit that prevents it from detecting the increased light level — the sensor continues reading the low-light condition and keeps the headlamps activated in the bright area

D. The headlamp switch for a manual override position that keeps the headlamps on regardless of the ambient light sensor's input — the driver may have moved the switch from the AUTO position to the ON position during the drive

67. A truck's engine ECM has two CAN bus connections — one for the J1939 vehicle bus and one for a private CAN bus that communicates only with the fuel injection system components. The J1939 bus communicates with the transmission, ABS, cluster, and body controller. A fault on the private CAN bus would affect which systems?

A. Only the fuel injection system components on the private bus would be affected — the J1939 vehicle bus operates independently and the transmission, ABS, cluster, and body controller continue to communicate normally

B. All systems would be affected because the engine ECM is the gateway between the two buses and a fault on the private bus would crash the ECM's internal processor preventing it from communicating on either bus simultaneously

C. The fuel injection system and the transmission would be affected because the transmission requires fuel delivery data from the injection system's private bus to calculate the correct shift timing during each gear change event

D. All vehicle systems would be affected because the J1939 bus receives critical engine data (RPM, torque, temperature) from the ECM and a fault on the private bus would prevent the ECM from calculating these values for broadcast

68. A truck's heated windshield works correctly on the driver side but does not heat the passenger side. The system uses a single relay to power both sides. Both heating element connections at the windshield have been tested and the driver-side connector reads 12.4 volts while the passenger-side connector reads 0 volts with the system activated. What is the fault?

A. The windshield heating element on the passenger side has an open circuit in the conductive coating — the element cannot pass current even though the supply circuit provides adequate voltage to the driver's side element

B. The wiring from the relay to the passenger-side windshield connector has an open circuit — the relay provides voltage to both circuits but the passenger-side wire is broken or disconnected preventing voltage from reaching the connector

C. The relay passes current to the driver side but the relay's internal contact has a partial failure that connects only the driver-side output terminal while the passenger-side terminal has lost contact inside the relay housing

D. The passenger-side windshield connector has corrosion that creates an open circuit at the connector interface preventing the 12.4V supply from reaching the heating element — the connector reads 0V because the corrosion blocks the circuit

69. A truck's manual transmission has been rebuilt. During the first road test, the technician shifts through all gears and notices that 5th gear produces a whining noise under load that is not present in any other gear. The noise disappears during coast in 5th gear. What does this load-dependent, gear-specific noise indicate?

A. The 5th gear pair (mainshaft and countershaft gears) has a tooth contact pattern error from incorrect gear mesh positioning during the rebuild — the pattern is on the wrong portion of the tooth face under the drive-side loading

B. The 5th gear synchronizer has a worn hub sleeve that creates clearance allowing the gear to vibrate on the mainshaft under the drive-side loading — the coast direction unloads the hub sleeve and the vibration stops

C. The countershaft bearing nearest to 5th gear was installed with inadequate preload and the bearing shifts under the 5th gear drive-side mesh force — the shift changes the gear contact pattern producing the load-dependent whine

D. The transmission lubricant level is at the lower acceptable limit and the 5th gear pair (positioned highest in the gear case) receives marginal splash lubrication under drive load — the coast direction unloads the gear and reduces noise

70. A truck's automatic transmission has a complaint of a shudder during the torque converter lockup clutch engagement at highway speed. The transmission fluid has been changed with the correct specification fluid. The shudder persists after the fluid change. What should be investigated next?

A. The engine's torsional vibration damper (harmonic balancer) for deterioration that allows engine firing pulses to transmit through the locked converter — the shudder is actually an engine torsional vibration amplified by the lockup

B. The torque converter for internal damage to the lockup clutch friction surface — fluid change corrects friction-modifier-related shudder but physical damage to the clutch disc, pressure plate, or piston requires converter replacement

C. The engine mounts for deterioration that allows the engine to shift during the lockup transition creating a driveline alignment change that produces the shudder — new mounts would eliminate the engine movement component

D. The torque converter lockup clutch for physical damage — a worn friction surface, a warped pressure plate, or a sticking piston prevents smooth clutch engagement regardless of the fluid quality and the converter must be replaced or rebuilt

71. A truck's driveshaft has been removed for U-joint replacement. The technician notices that the slip yoke splines have a polished mirror-like appearance with no visible wear marks or roughness. Is this normal?

A. The polished splines indicate the yoke has been operating without adequate lubrication — the dry metal-to-metal contact has polished the surface instead of maintaining the designed matte finish from the original machining

B. Polished slip yoke splines are abnormal and indicate the yoke has been oscillating on the transmission output shaft without adequate dampening creating the polished surface from the constant micro-movement during driving

C. Polished slip yoke splines are normal — the splines develop a mirror finish from the normal sliding contact with the transmission output shaft splines during suspension travel that extends and compresses the driveshaft length

D. The polished splines indicate the driveshaft has been vibrating and the yoke has been chattering on the output shaft from a phasing error — the vibration energy polishes the spline contact surfaces during the sustained chattering

72. A truck equipped with an automated manual transmission (AMT) has a complaint that the shift time between gears has increased from the original 0.5 seconds to approximately 1.5 seconds. The shifts are smooth but slow. What should be investigated?

A. The AMT clutch actuator for reduced speed from worn hydraulic seals, contaminated fluid, or a weak actuator motor that slows the clutch engagement and disengagement cycle — the reduced actuator speed directly extends the shift time

B. The transmission's shift actuator motors for reduced speed or force — the electric motors that move the shift rails and forks may have worn brushes, corroded connections, or increased friction that slows their positioning during each shift

C. The AMT controller's software for an adaptive shift strategy that has progressively lengthened the shift time to compensate for a detected clutch or synchronizer wear condition that requires a gentler shift engagement to prevent damage

D. The AMT shift actuators for reduced speed from a worn motor, contaminated hydraulic circuit, or restricted air supply — the actuator that moves the shift mechanism cannot complete the shift movement in the originally designed time

73. A truck's clutch hydraulic system has been bled but the pedal still feels spongy. The master cylinder, slave cylinder, and hydraulic line have all been replaced as part of the repair. What could still cause the spongy pedal feel?

A. The replacement slave cylinder has a slightly different bore diameter than the original creating a different pedal-to-pushrod ratio that the driver perceives as sponginess from the altered hydraulic mechanical advantage

B. The clutch hydraulic system has a flexible hose section that expands under pressure instead of transmitting the hydraulic force directly to the slave cylinder — the hose expansion absorbs pedal travel creating the spongy feel

C. The replacement master cylinder has a different bore diameter than the original and the altered bore creates a different pressure-to-stroke ratio that the driver perceives as sponginess compared to the original system's response

D. The replacement hydraulic line has a section that is not properly supported and the unsupported section balloons under pressure absorbing pedal travel — the expansion acts as a compliance in the system creating the spongy feel

74. A truck's drive axle has a complaint of a howling noise during acceleration that changes pitch when the vehicle changes speed. The noise is not present during coast or cruise — only during acceleration. What is the most likely cause?

A. The ring gear teeth have a wear pattern on the drive side that has developed from extended service — the worn drive-side tooth profile produces the howl under acceleration loading that disappears when the load shifts to the coast side

B. The pinion bearing preload is too tight and the excessive preload creates friction noise that is amplified by the acceleration loading — the coast loading changes the bearing force direction reducing the friction noise to inaudible levels

C. The ring and pinion backlash is insufficient and the tight mesh creates interference on the drive side during acceleration — the coast direction separates the teeth and the interference noise disappears under the unloaded tooth condition

D. The ring and pinion gear set has a drive-side contact pattern error from incorrect pinion depth setting — the gear mesh noise manifests under the acceleration load because the drive-side tooth contact is at the wrong position on the tooth face

75. A truck's automatic transmission fluid temperature reads 130°C during normal highway driving. The specification maximum is 120°C. The fluid level is correct and the fluid appears clean. What should be investigated first?

A. The engine cooling system thermostat for a stuck-closed condition that raises the engine coolant temperature — the elevated coolant temperature reduces the transmission cooler's ability to reject heat from the transmission fluid

B. The torque converter lockup clutch for a fault that prevents full lockup during highway cruise — a slipping lockup clutch generates friction heat that raises the fluid temperature above the specification maximum during sustained driving

C. The transmission cooler for restricted flow or reduced cooling capacity — a plugged cooler, restricted cooler lines, or a damaged cooler core limits the heat rejection from the fluid creating the elevated temperature during highway operation

D. The transmission cooler circuit's thermostat or bypass valve for a stuck-bypass condition that routes the fluid around the cooler — the bypassed fluid circulates without being cooled creating the progressive temperature rise during driving

76. A truck's transfer case equipped with a chain drive has developed a whining noise that is proportional to vehicle speed in both 2WD and 4WD modes. The noise is consistent regardless of the transfer case mode selection. What is the most likely cause?

A. The transfer case chain has stretched from wear and the elongated chain creates a loose mesh with the sprockets producing the whine proportional to vehicle speed — the chain stretch affects the drive in both 2WD and 4WD modes equally

B. The transfer case input shaft bearing has failed and the bearing noise is proportional to the shaft speed which corresponds to vehicle speed — the input shaft rotates in both 2WD and 4WD making the noise present in both modes

C. The transfer case output shaft bearing to the rear driveshaft has failed producing the speed-proportional whine — this shaft rotates at vehicle speed in both 2WD and 4WD creating the consistent noise in both drive mode selections

D. The transfer case chain has worn and the elongated chain does not mesh smoothly with the sprockets creating the whine — the noise is present in both modes because the chain transmits power to the rear output in 2WD and to both outputs in 4WD

77. A truck's clutch disc has been replaced. The technician installs the disc without checking the flywheel's pilot bearing. After the installation, the truck drives normally at highway speed but produces a squealing noise when the clutch pedal is depressed with the transmission in gear at idle. What does this indicate?

A. The release bearing is dry and produces the squeal when it contacts the pressure plate fingers — the bearing was not lubricated during the clutch disc replacement and the dry metal-to-metal contact creates the noise at idle

B. The pilot bearing has failed and the transmission input shaft is not supported at its forward end — when the clutch is disengaged the unsupported input shaft wobbles in the flywheel's pilot bore producing the squeal from the dry bearing contact

C. The pressure plate diaphragm spring has a broken finger that contacts the release bearing at an angle producing the squeal during clutch disengagement — the noise is most noticeable at idle where background noise is low

D. The clutch disc's torsional damper springs are resonating at the idle frequency when the disc is unloaded during clutch disengagement — the damper springs vibrate freely when the disc is released from the clamping force

78. A truck's automatic transmission has a delayed engagement when shifting from Park to Drive after the vehicle has been parked overnight. The delay is approximately 5 seconds. Once engaged, the transmission functions normally. What is the most probable cause?

A. The transmission oil pump has worn internal clearances that require more time to build pressure at the cold fluid's higher viscosity — the pump cannot deliver adequate volume at the cold startup speed to fill the clutch circuit quickly

B. The torque converter drainback check valve has failed allowing the converter to empty during the overnight parking period — the pump must refill the converter before the forward clutch can be pressurized for engagement

C. The valve body has a worn accumulator bore that allows excess fluid to bypass during the initial engagement command — the bypassed fluid delays the clutch apply pressure buildup creating the 5-second engagement delay

D. The forward clutch piston seals have hardened from age and the cold seals cannot flex to seal the apply circuit immediately — the 5-second delay is the time needed for the seals to warm enough to conform to the bore and seal

79. A truck's drive axle differential has been rebuilt with a new carrier assembly. After the rebuild, the technician performs a gear contact pattern check using marking compound. The drive-side pattern shows heavy contact at the toe (small end) of the ring gear tooth. What adjustment is needed?

A. The ring gear must be moved away from the pinion (increase backlash) to shift the contact pattern from the toe toward the centre-heel of the tooth for the correct drive-side load distribution across the tooth face

B. The pinion must be moved deeper into the carrier (closer to the ring gear centre) to shift the contact from the toe toward the centre of the tooth face for proper load distribution during the drive-side acceleration loading

C. The ring gear must be moved toward the pinion (decrease backlash) to shift the contact from the toe toward the heel of the tooth for proper load distribution across the full tooth face width during drive-side loading

D. The pinion depth must be adjusted to shift the contact from the toe toward the centre of the tooth — a toe-heavy pattern indicates the pinion is too far from the ring gear and must be shimmed deeper to correct the mesh geometry

80. A truck equipped with a 10-speed manual transmission has a complaint that the transmission is difficult to shift into all gears when the transmission is cold. Once the transmission warms up after approximately 10 minutes of driving, all shifts are smooth. What is the most likely cause?

A. The clutch disc has warped from heat and drags against the flywheel during cold operation preventing the input shaft from stopping completely during shifts — the disc flattens as it warms restoring normal disengagement

B. The transmission synchronizers have worn and cannot match speeds adequately during cold operation when the lubricant is thick — the thick cold lubricant creates more resistance that the worn synchronizers cannot overcome

C. The transmission lubricant viscosity is too heavy for the cold temperature — the thick cold oil creates excessive drag on the countershaft and gears that prevents them from decelerating to match speed during shifts until the oil warms and thins

D. The clutch master cylinder piston has a slow seal leak that worsens in cold temperatures from the seal's reduced flexibility — the cold leak reduces the effective clutch disengagement until the seal warms and seals properly

81. A truck's driveshaft centre support bearing has been replaced. After the replacement, the technician notices the front driveshaft section has a different operating angle than the rear section — the front angle is 4 degrees and the rear is 2 degrees. The specification requires both sections to be within 1 degree of each other. What should be adjusted?

A. The transmission mounting height should be changed using shims to alter the driveshaft's takeoff angle at the transmission output bringing the front section's angle closer to the rear section's 2-degree measurement

B. The centre bearing bracket mounting height must be adjusted with shims to change the driveshaft's slope at the bearing junction — raising or lowering the bracket redistributes the operating angles between the front and rear sections

C. The rear axle pinion angle must be adjusted by shimming the spring mount pads to tilt the pinion and change the rear section's operating angle to match the front section's 4-degree measurement within the 1-degree tolerance

D. The front section is 4 degrees and the rear is 2 degrees — the centre bearing bracket height must be adjusted to bring both sections within 1 degree of each other by changing the driveshaft's angle at the support point

82. A truck's automatic transmission has been serviced with a filter and fluid change. After the service, the transmission shifts normally in all gears but the shift from 3rd to 4th gear has developed a noticeable flare (engine RPM rises briefly during the shift before the next gear engages). What does this shift flare indicate?

A. The 4th gear clutch pack has a slow apply condition — the off-going 3rd gear clutch releases before the on-coming 4th gear clutch fully applies creating a momentary neutral condition where the engine RPM rises briefly

B. The new transmission fluid has different friction characteristics than the previous fluid and the altered friction delays the 4th gear clutch engagement creating the momentary RPM rise during the transition between gears

C. The new transmission filter has a higher flow restriction than the old filter and the restricted flow limits the fill rate to the 4th gear clutch circuit creating the delayed engagement that manifests as the shift flare

D. The 3-4 accumulator piston seal has failed allowing the apply pressure to bypass during the shift — the reduced pressure delays the 4th gear clutch engagement creating the RPM rise before the clutch achieves full clamping force

83. A truck's drive axle has been diagnosed with a noise that occurs during straight-line driving — a steady hum proportional to vehicle speed. The noise does not change during turns. What drive axle component is the most likely source?

A. The differential spider gears because they rotate at vehicle speed during straight-line driving and their mesh with the side gears produces the steady hum that does not change during turns when the spiders stop rotating

B. The axle shaft bearings because the bearings support the axle shafts at vehicle speed during straight driving and the steady hum is from a failing bearing's rolling elements that produce constant noise regardless of turn direction

C. The ring and pinion gear mesh because the steady hum proportional to vehicle speed that does not change during turns indicates the noise source rotates at a speed determined by the vehicle speed regardless of differential action

D. The differential carrier bearings because the carrier rotates at a speed proportional to vehicle speed and the bearings support the carrier assembly equally during straight driving and turns producing the constant hum in both conditions

84. A truck equipped with a compression brake has had the engine's valve adjustment performed. After the adjustment, the compression brake produces adequate retarding force at high RPM but the retarding force at low RPM has decreased noticeably compared to the pre-adjustment performance. What is the most likely cause?

A. The exhaust valve lash was set too tight which reduces the valve lift during the compression brake event — the reduced opening releases less compressed air per cycle at low RPM where the individual cycle contribution is more significant

B. The intake valve lash was set too tight reducing the intake valve lift — the reduced air charge in each cylinder means less air to compress during the compression brake event reducing the retarding force at all RPM proportionally

C. The compression brake slave piston lash was not readjusted after the valve lash was changed — the altered valve lash changed the relationship between the slave piston and the exhaust valve crosshead affecting the brake's actuation geometry

D. The exhaust valve lash was set too tight reducing the exhaust valve lift — less valve opening during the compression brake event releases less compressed air per cycle and the reduced blowdown is more noticeable at low RPM where fewer events occur

85. A truck's clutch has been adjusted to the correct free play specification. The driver reports the clutch pedal vibrates at a specific engine RPM (approximately 1,500 RPM) during light-throttle cruise in any gear. The vibration disappears when the pedal is depressed slightly. What is the cause?

A. The clutch disc damper springs are resonating at the engine's firing frequency at 1,500 RPM — the damper springs amplify the torsional vibration at their natural frequency and transmit it to the pedal through the release bearing contact

B. The flywheel has a slight imbalance that produces a once-per-revolution vibration at 1,500 RPM — the vibration transmits through the pressure plate fingers to the release bearing which is in light contact with the pedal at the rest position

C. The engine's harmonic balancer has deteriorated and the undamped torsional vibration at 1,500 RPM transmits through the crankshaft to the flywheel and pressure plate — the vibration reaches the pedal through the release mechanism

D. The release bearing is in slight contact with the pressure plate diaphragm spring finger tips at the rest position and the engine's rotational vibration at 1,500 RPM transmits through the fingers to the bearing and pedal linkage

86. A truck's power steering system produces adequate steering assist during turns but the steering wheel slowly drifts to one side when the driver releases the wheel during straight-line highway driving. The alignment is verified as correct. What power steering component could cause this drift?

A. The power steering pump has a worn internal component that creates a pressure bias between the left and right assist circuits — the unequal pressure provides more assist in one direction creating the drift when the wheel is released

B. The steering gearbox has an internal spool valve that is not centring correctly — the off-centre valve directs more hydraulic pressure to one side of the power piston than the other creating the directional drift during straight driving

C. The power steering fluid has degraded and the reduced viscosity allows the fluid to leak past the steering gearbox's internal seals creating an uneven pressure distribution that biases the steering to one side during straight driving

D. The power steering pump's flow control valve is stuck partially open and the reduced flow at highway speed cannot maintain equal pressure on both sides of the steering gearbox's power piston creating the directional drift

87. A truck's front suspension has had both shock absorbers replaced. After the replacement, the driver reports a harsh ride quality that was not present before the service. The shock absorbers are the correct part number for the vehicle. What could cause the harsh ride with correct-specification shocks?

A. The replacement shock absorbers need a break-in period of approximately 2,000 km before their internal valving reaches the designed flow characteristics — the new valving is stiffer than the broken-in condition during initial service

B. The replacement shock absorbers are filled with a different damping fluid than the original specification and the altered fluid viscosity creates more resistance to suspension movement producing the harsh ride quality

C. The shock absorber upper and lower mounting hardware was overtightened during installation compressing the rubber bushings beyond their designed preload — the compressed bushings transmit more vibration to the cab frame

D. The new shock absorbers have the correct part number but the damping rate is calibrated for the fully-loaded vehicle weight and the unloaded ride quality feels harsh because the shocks are over-damped for the empty operating condition

88. A truck's steer tire shows a feathered wear pattern — each tread rib has a sharp edge on one side and a smooth taper on the opposite side. The feathering direction is consistent across both steer tires. What alignment condition causes this feathered wear?

A. Excessive toe — either toe-in or toe-out creates a lateral scrubbing force on each tread rib that wears one edge sharper than the other as the tire is dragged sideways during every straight-line revolution during driving

B. Excessive positive camber tilts the tire outward and the ground contact force concentrates on the outer rib edges creating the feathered pattern from the uneven load distribution across the tread ribs during straight driving

C. Worn king pin bushings allow the steering geometry to change dynamically during driving creating an alternating toe condition that feathers the ribs in one direction from the oscillating alignment during highway operation

D. Excessive caster creates a forward tilt of the king pin axis that changes the tire's contact patch shape during straight driving — the elongated contact patch scrubs the tread ribs producing the feathered wear pattern

89. A trailer's tandem axle suspension uses spring-loaded equalizer beams. During inspection, the technician finds one equalizer beam's centre pivot bushing has worn to the point where the beam can tilt 10 degrees side to side. What is the consequence of this excessive tilt?

A. The worn pivot allows the beam to distribute load unevenly between the two axles during cornering — the tilted beam shifts more weight to one axle during turns creating uneven tire wear between the two tandem axle positions

B. The excessive tilt has no operational consequence because the equalizer beam only moves vertically to distribute the road surface variations between the two axles and the lateral tilt does not affect the vertical load equalization

C. The worn bushing allows the beam to tilt which shifts the axle alignment during driving — the tilted beam pushes one axle forward and the other rearward creating a thrust angle error that produces a steering pull during driving

D. The worn pivot bushing creates excessive play that allows the tandem axle alignment to shift during driving — the shifting axle positions produce uneven tire wear, tracking errors, and may allow the axles to exceed their individual weight ratings

90. A truck's tire has been mounted on the rim and inflated. During inflation, the tire bead makes a loud popping sound. What does this pop indicate?

A. The tire bead has seated improperly and has jumped over the rim's safety ridge creating a dangerous condition — the tire must be deflated immediately and remounted before inflation because the bead is not in the correct position

B. The tire bead has seated correctly on the rim's bead seat — the popping sound is the bead snapping over the rim's safety ridge (bead seat area) and seating into the designed position during the inflation process

C. The tire has a manufacturing defect in the bead area and the bead wire has broken during the inflation process — the tire must be removed from the rim and condemned because the broken bead cannot retain the tire safely

D. The popping sound indicates the tire inflation pressure has exceeded the bead seating pressure and the tire is over-inflated — the technician must immediately reduce the pressure to the specified operating level for the tire size

91. A truck's fifth wheel has been tested and the locking mechanism engages and releases correctly. The jaw surfaces show normal wear patterns. However, the trailer experiences a rhythmic fore-aft rocking motion during highway driving that is proportional to vehicle speed. What fifth wheel condition could cause this motion?

A. The fifth wheel plate surface has developed a wear groove from the king pin's contact that allows the king pin to shift fore and aft in the groove during each road surface variation creating the rhythmic rocking motion

B. The fifth wheel mounting bolts have loosened allowing the entire fifth wheel assembly to shift on the frame during the cyclic loading of highway driving — each load cycle pushes the assembly forward then allows it to return

C. The fifth wheel bracket bushings have worn creating excessive fore-aft play between the fifth wheel and its frame mounting — the play allows the trailer coupling point to oscillate during highway driving from the road loading cycle

D. The fifth wheel locking jaw mechanism has worn pins or bushings that allow the jaw to shift position during the cyclic loading of highway driving — each load reversal shifts the jaw and the attached king pin creating the rocking motion

92. A truck's front wheel bearing has been adjusted to the correct end play specification using a dial indicator. After the adjustment, the technician road tests the truck and measures the hub temperature with an infrared thermometer after 50 km of driving. The adjusted hub reads 15°C hotter than the opposite non-adjusted hub. Should the technician be concerned?

A. The 15°C temperature difference is expected after a fresh bearing adjustment — the new preload and fresh grease create slightly more friction than the fully broken-in opposite side and the temperature will equalize after 500 km

B. The 15°C difference is marginal and should be monitored — re-check the temperature after another 100 km of driving and if the temperature differential has not decreased the bearing adjustment should be rechecked for excessive preload

C. The 15°C temperature difference indicates the bearing adjustment is too tight (insufficient end play) and the preloaded bearing is generating friction heat — the adjustment must be rechecked and corrected before the bearing is damaged

D. The temperature difference is caused by the new grease generating more heat than the established grease on the opposite side during the initial distribution period — the temperature will equalize after the grease distributes evenly

93. A trailer equipped with disc brakes has a complaint of brake squeal during light braking applications. The squeal disappears during moderate to heavy braking. The brake pads and rotors are within specification. What is the most common cause of this light-application squeal?

A. The brake caliper guide pins have lost their silicone grease lubricant and the dry metal-to-metal contact between the caliper and bracket creates a vibration frequency that produces the audible squeal during the light-contact braking

B. The brake pad friction material and rotor surface are producing a vibration at the pad's natural resonant frequency during light contact — the increased pressure of moderate-to-heavy braking changes the pad's loading and dampens the vibration

C. The brake pad friction material enters a resonant vibration during the light clamping force of gentle braking — the pad oscillates between contact and release at an audible frequency that is dampened by the higher clamping force of harder braking

D. The brake rotor has a surface contamination from road film that produces the squeal during light braking when the pad pressure cannot break through the film — heavier applications break through the contamination and the squeal stops

94. A truck's hub-piloted wheel has been installed on a position where the previous wheel was stud-piloted. The technician uses the hub-piloted wheel nuts on the stud-piloted hub. What is the danger of this mismatch?

A. The hub-piloted nuts have a flat contact face designed for the hub-piloted system's flat wheel mounting surface — on a stud-piloted hub with ball-seat stud holes the flat nut cannot centre the wheel creating a potential wheel-off condition

B. Hub-piloted nuts have a different thread pitch than stud-piloted nuts and the mismatched threads cannot achieve full engagement creating a reduced clamping force that may allow the wheel to loosen during highway driving operation

C. Hub-piloted and stud-piloted systems use different stud diameters and the hub-piloted nuts have a larger bore that fits loosely on the stud-piloted studs — the loose fit cannot develop adequate clamping force for wheel retention

D. The hub-piloted nuts will fit the stud-piloted studs but the nut's hex size is different and standard impact sockets cannot achieve the correct torque — the technician must use a specially sized socket for the hub-piloted nut configuration

95. A truck's rear air ride suspension has a height control valve that maintains the chassis ride height. The technician adjusts the ride height by changing the height control valve's linkage arm length. After the adjustment, the ride height is correct when parked but drops approximately 25 mm during highway driving. What is causing the height loss at speed?

A. The air springs are leaking slightly and the height control valve cannot compensate at highway speed because the valve's reaction time is slower than the leak rate during the increased vibration and loading of highway driving

B. The shock absorbers are worn and the excessive suspension travel during highway driving extends the air springs beyond their designed height — the springs cannot maintain pressure at the extended position creating the height loss

C. The air supply volume to the suspension is insufficient for the highway driving demand — the compressor cannot maintain adequate pressure in the suspension circuit at highway speed when the system's air consumption increases

D. The height control valve linkage arm geometry creates a different height reference during the dynamic movement of highway driving versus the static parked condition — the arm angle changes as the suspension oscillates producing the lower average height

96. A truck's tire has developed a sidewall bubble — a visible bulge approximately 30 mm in diameter on the sidewall surface. The tire has 80% tread remaining. Should the tire be repaired or replaced?

A. The tire must be replaced immediately — a sidewall bubble indicates a separation between the inner plies of the tire's carcass structure creating a weak point that can rupture catastrophically under inflation pressure or road loading

B. The sidewall bubble can be repaired with an internal patch if the bubble diameter is less than 50 mm and the patch covers the entire affected area with at least 25 mm of overlap beyond the bubble's perimeter edges

C. The tire can remain in service if the bubble is monitored at each PM inspection — as long as the bubble does not grow beyond 50 mm the tire's structural integrity is maintained by the remaining intact plies in the carcass

D. The tire should be moved to a trailer position where the loading is more evenly distributed — the reduced stress on a trailer position prevents the bubble from growing while allowing the remaining 80% tread to be used fully

97. A truck's power steering system uses a tandem pump that supplies both the power steering and the hydraulic brake booster from a single pump with two separate output circuits. The steering works correctly but the brake booster produces inadequate boost. What should be checked?

A. The pump's internal priority valve that ensures the steering circuit receives fluid first — the priority valve is functioning correctly for steering but the booster circuit's output section may have worn or failed internally

B. The pump's brake booster output section has lower output than specification — the pump has two independent pumping sections and the booster section can fail independently while the steering section continues to function normally

C. The tandem pump's brake booster output section for reduced flow or pressure — the two pump sections are independent and the steering section can function normally while the booster section has worn internally reducing its output

D. The hydraulic brake booster circuit for a restriction between the pump's booster output and the booster unit — the pump may produce correct output but a restricted line, fitting, or valve limits the flow reaching the booster

98. A truck's front suspension has leaf springs with rubber snubbers (jounce bumpers) at the frame bracket. During inspection, the rubber snubbers show heavy contact marks and have compressed to approximately 50% of their original height. What does this indicate?

A. The snubbers are performing their designed function of limiting suspension travel during heavy loading — the contact marks and compression indicate the suspension is reaching full jounce regularly during loaded driving operations

B. The leaf springs have weakened from fatigue and the reduced spring rate allows excessive suspension travel that bottoms out against the snubbers — the springs should be inspected for sag and replaced if the ride height is below specification

C. The shock absorbers have failed and the uncontrolled suspension oscillation causes the suspension to bottom out against the snubbers during normal driving — the excessive contact compresses the snubbers beyond their designed use

D. The snubbers show heavy contact indicating the suspension is bottoming out regularly — the cause may be weak springs, failed shock absorbers, overloading, or a combination and the root cause must be identified and corrected

99. A trailer's landing gear (dolly legs) has been deployed to disconnect the trailer from the tractor. The driver cranks the landing gear down until the trailer's fifth wheel plate clears the tractor's fifth wheel. As the tractor pulls away, the trailer's nose drops approximately 50 mm and the landing gear shoes dig into the pavement surface. What was done incorrectly?

A. The trailer's air suspension was not dumped before disconnection and the air spring's rebound pushed the trailer up during the disconnection — when the tractor clears the fifth wheel the springs compressed dropping the nose

B. The landing gear was not cranked down far enough to lift the trailer's nose above the fifth wheel plate height — the trailer was resting on the tractor's fifth wheel when the tractor pulled away dropping the nose to the landing gear's actual height

C. The trailer's air suspension should have been set to the maximum ride height before disconnection to raise the fifth wheel plate above the tractor's plate — the standard ride height did not provide enough clearance for clean separation

D. The landing gear's sand shoes were not deployed before cranking down and the narrow foot pads sank into the pavement surface under the trailer's nose weight — the deployed sand shoes distribute the weight over a larger contact area

100. A truck's tire has been rotated from a drive axle position to the steer axle. After 500 km on the steer axle, the driver reports a vibration at highway speed. The tire has been balanced on a standard spin balancer and shows zero imbalance. What test should be performed to diagnose the vibration?

A. A road force balance test should be performed — the test measures the tire's radial and lateral force variation under load which can cause vibration even when the tire's mass balance is zero on a standard unloaded spin balancer

B. The brake rotor should be measured for lateral runout because the vibration may be from a rotor condition that is independent of the tire — the rotor runout produces a similar speed-proportional vibration during highway driving

C. The wheel should be measured for radial and lateral runout on the vehicle using a dial indicator because the wheel's mounting surface may have debris or damage that creates runout not detected during the off-vehicle balance procedure

D. The tire should be remounted at a different rotational position on the same rim (rotate 180 degrees on the rim) to determine if the vibration follows the tire's position or stays with the rim indicating whether the tire or rim is the source

101. A truck's front suspension has been modified with aftermarket air helper springs to increase the steer axle's load capacity. After the modification, the technician performs a front wheel alignment. The alignment readings are within specification. However, after 10,000 km, the steer tires show accelerated inner-edge wear. What has the modification caused?

A. The helper springs have raised the ride height beyond the steering geometry's designed operating range and the altered geometry creates a negative camber condition during loaded driving that wears the inner tire edges

B. The helper springs create a stiffer front suspension that transmits more road shock through the steer axle — the shock loading dynamically changes the alignment during driving creating intermittent negative camber that wears the inner edges

C. The helper springs have increased the steer axle load capacity allowing the operator to load the front axle heavier than the original design — the additional weight compresses the suspension beyond the alignment's designed operating height

D. The helper springs have changed the front axle's loading geometry during operation — when loaded the altered suspension kinematics shift the alignment parameters beyond the designed range creating the inner-edge wear pattern

102. A truck's wheel bearing has been inspected and the grease appears dark brown with a gritty texture. The bearing rollers show a matte grey surface instead of the original polished surface. What do these findings indicate?

A. The bearing grease has been contaminated with water that has corroded the roller surfaces — the rust particles create the gritty texture in the grease and the corroded rollers show the matte grey surface instead of polished steel

B. The bearing has been contaminated with fine abrasive particles (dirt, sand) that have entered through a failed seal — the abrasive-contaminated grease has worn the polished roller surfaces to a matte grey finish from the grinding action

C. The bearing grease has oxidized from excessive operating temperature and the breakdown products have coated the roller surfaces — the oxidized grease creates the dark brown colour and the coating produces the matte grey roller appearance

D. The bearing has reached its normal fatigue life and the subsurface fatigue of the roller material has progressed to the surface — the fatigued rollers shed micro-particles that contaminate the grease with the gritty metallic debris

103. A truck's fifth wheel plate has been inspected and the technician finds deep grooves worn into the plate surface following the arc of the trailer's turning radius. The grooves are approximately 5 mm deep. What is the primary concern with these grooves?

- A. The grooves channel rainwater to the fifth wheel's locking mechanism creating corrosion that may prevent the jaws from opening during uncoupling operations in wet weather conditions
- B. The grooves concentrate stress in the fifth wheel plate creating potential fatigue crack initiation points that could lead to plate fracture under the dynamic loading of normal tractor-trailer operation
- C. The grooves trap debris (gravel, sand, ice) that acts as an abrasive between the fifth wheel and the trailer's upper coupler plate — the trapped abrasive accelerates wear on both surfaces during articulation
- D. The grooves create a path for the king pin to track during articulation which may restrict the trailer's turning range and create a resistance to free articulation that the driver perceives as heavy steering during tight turns

104. A truck's cab air suspension system has four air springs — two at the front of the cab and two at the rear. The right rear cab air spring has failed (deflated). The driver continues to operate the truck with the three remaining springs. What is the safety concern of operating with one cab air spring deflated?

- A. The cab tilts to the right rear creating an asymmetric loading on the cab-to-frame mounting points and the uneven load distribution can crack the cab mounting brackets from the concentrated stress during rough road driving
- B. The deflated spring allows the right rear of the cab to contact the frame during bumps — the metal-to-metal impact can damage the cab structure and the sudden impact creates a startle hazard for the driver during rough road operation
- C. The cab will vibrate excessively from the three-point support configuration because the cab's mass is not evenly distributed among three springs and the asymmetric support creates a rocking motion during highway driving
- D. The three remaining springs must carry the load designed for four springs and the overloaded springs will fail prematurely from the additional loading creating a cascading failure that eventually leaves the cab unsupported on all four mounts

105. A truck's cab has a persistent odour of diesel fuel inside the cab during driving. The engine's fuel system has been inspected and no leaks are found. The fuel tank, lines, and filter housing are all dry. Where should the technician look for the odour source?

- A. The fuel tank's fill cap seal for a deteriorated gasket that allows fuel vapour to escape from the tank during driving — the vapour rises along the cab exterior and enters through the HVAC fresh air intake
- B. The fuel return line routing near the cab's HVAC fresh air intake — a return line connection that weeps fuel vapour under the return pressure can introduce the diesel odour into the cab air system during driving
- C. The fuel tank vent system for a plugged vent that creates tank pressure during driving — the pressurized vapour escapes through the fill cap or vent line and enters the cab through available openings during forward motion
- D. The DPF regeneration system because the late-post injection introduces fuel into the exhaust that may not fully burn — the unburned fuel exits the tailpipe and the wind during driving carries the diesel odour to the cab air intake

106. A truck's cab tilt mechanism uses a mechanical prop rod to hold the cab in the tilted position. During a cab-forward service, the technician notices the prop rod's pin hole has become elongated from wear. What is the safety concern?

- A. The elongated pin hole reduces the prop rod's structural cross-section at the pin location creating a stress concentration that could cause the rod to fracture at the weakened point under the cab's tilted weight loading
- B. The elongated pin hole allows the prop rod to shift under the cab's weight — the worn hole may allow the pin to disengage during vibration or if the cab is bumped creating a sudden cab drop hazard during service
- C. The elongated hole changes the cab's tilt angle by the amount of the elongation and the altered angle creates a balance condition where the cab could swing beyond its designed tilt range and fall forward unexpectedly
- D. The worn pin hole indicates the prop rod material has fatigued from repeated use and the entire rod should be replaced because the fatigue extends beyond the visible pin hole wear to the rod's internal metal structure

107. A truck's sleeper cab has a carbon monoxide detector that alarms intermittently during overnight idle operation. The exhaust system has been inspected from the engine to the tailpipe with no leaks found. The cab seals appear intact. What should be investigated?

- A. The wind direction during overnight parking — certain wind conditions can push the truck's own exhaust from the tailpipe underneath the truck and up through the cab floor penetrations into the sleeper during idle operation
- B. The engine's combustion for incomplete burning that produces higher-than-normal CO concentrations in the exhaust — even a leak-free exhaust system exposes the cab to higher CO levels if the engine produces excessive carbon monoxide
- C. The exhaust system's routing relative to the cab and the wind patterns that could push exhaust gas toward the HVAC intake — the tailpipe position and wind direction during parking can create exhaust infiltration into the cab
- D. The exhaust system routing, tailpipe position, HVAC intake location, cab floor seals, and the wind patterns during overnight parking — exhaust can enter the cab through multiple paths that are only apparent during specific wind conditions

108. A truck's cab floor has developed visible corrosion perforations (rust-through holes) in the driver's side floor area. The floor mat conceals the damage. What is the primary safety concern beyond structural integrity?

- A. The floor perforations allow road spray, moisture, and exhaust gases to enter the cab creating both a corrosion hazard to the cab wiring routed under the floor and a carbon monoxide inhalation risk from exhaust gas infiltration
- B. The floor perforations allow exhaust gases from the engine and exhaust system to enter the cab during driving creating a carbon monoxide exposure hazard that is concealed from the driver by the floor mat covering the holes
- C. The corroded floor cannot support the driver's seat mounting bolts and the seat may detach from the floor during a collision or hard braking event — the loose seat creates a serious occupant restraint failure during the impact
- D. The floor corrosion indicates the cab's structural integrity has been compromised throughout the entire floor section and the cab may not provide adequate occupant protection during a collision or rollover from the weakened structure

109. A reefer trailer's TRU has been serviced and the cargo space pre-cooled to -18°C before loading. The cargo (frozen meat) has been loaded and the doors closed. After 2 hours of driving, the TRU's return air temperature sensor reads -14°C instead of the set-point -18°C . The TRU is running at full capacity. What is the most probable cause?

A. The cargo was loaded at a temperature warmer than -18°C and the frozen mass is releasing stored heat into the cargo space — the TRU at full capacity cannot overcome the combined heat load of the warm cargo and normal infiltration

B. The trailer's insulation has degraded from age and the increased heat infiltration through the deteriorated insulation exceeds the TRU's cooling capacity during the full-capacity operation at the highway driving condition

C. The cargo was loaded at a temperature above the -18°C set-point and the thermal mass of the warmer cargo is releasing heat into the trailer space faster than the TRU can remove it at full capacity during the initial pull-down

D. The evaporator coil has developed a frost layer from the door-opening during loading and the frost restricts the airflow through the coil reducing the TRU's effective cooling capacity below the level needed for the loaded condition

110. A trailer equipped with a liftgate has the platform lower function operating correctly but the platform does not tilt to the loading dock angle. The tilt cylinder does not move when the tilt control is activated. Hydraulic pressure is confirmed at the directional valve during activation. What should be checked?

A. The directional valve's tilt spool for a stuck condition that prevents the spool from shifting to direct flow to the tilt cylinder despite the control being activated — the valve has pressure but the internal spool is not moving

B. The tilt cylinder's hydraulic line for a kink, obstruction, or closed shut-off valve between the directional valve and the cylinder that prevents the pressurized fluid from reaching the cylinder's port during the tilt command

C. The tilt cylinder for a seized piston from corrosion or contamination that prevents the piston from moving despite adequate hydraulic pressure being applied to the cylinder port from the directional valve during the tilt command

D. The hydraulic circuit between the directional valve and the tilt cylinder for any obstruction (kinked hose, closed valve, seized cylinder) that prevents the pressurized fluid from moving the cylinder despite the valve directing flow

111. A trailer's composite sidewall has been repaired with a fiberglass patch after a forklift puncture. The repair was performed 6 months ago. During a current inspection, the technician notices the

fibreglass patch has cracked at its edge and moisture has wicked under the patch into the composite panel's foam core. What should be done?

- A. Apply a sealant around the cracked patch edge to prevent further moisture intrusion — the existing patch is structurally adequate and only needs the edge seal restored to prevent water from entering the foam core material
- B. Remove the failed fibreglass patch, assess the moisture damage to the foam core beneath, remove any deteriorated foam, repair or replace the damaged foam section, and install a new properly bonded repair patch over the area
- C. Apply a larger fibreglass patch over the original repair that extends at least 100 mm beyond the cracked edges — the larger patch bridges the cracks and seals the moisture entry points without requiring removal of the original repair
- D. The cracked patch must be removed, the moisture-damaged foam core area assessed and repaired, and a new repair performed that addresses both the structural puncture repair and the moisture barrier to prevent recurrence

112. A trailer's brake system has a relay valve that serves both axles. During testing, the technician applies 350 kPa of signal pressure to the relay valve. The relay delivers 350 kPa to the first axle but only 280 kPa to the second axle. The air lines to both axles are the same length and diameter. What is the most likely cause of the pressure difference?

- A. The relay valve has an internal crack in the delivery chamber that leaks air and the reduced volume reaching the second axle's longer internal passage creates the lower pressure at the more distant axle's brake chambers
- B. The relay valve delivers equal pressure to both outlets but the second axle's air line has an internal restriction (contamination, kink, or damaged fitting) that creates a pressure drop between the relay's outlet and the second axle's chambers
- C. The second axle has a brake chamber with a diaphragm leak that consumes air faster than the relay valve can deliver — the leaking chamber reduces the pressure available at the second axle's delivery circuit below the first axle's reading
- D. The relay valve has an internal passage fault that provides unequal flow distribution between its two delivery ports — the reduced flow to the second port limits the pressure buildup at the second axle during each application event

113. A flatbed trailer's deck tie-down anchors (D-rings) have been inspected. Several anchors show visible cracks at the weld connecting the anchor to the frame cross-member. The anchors have not been loaded beyond their rated capacity. What has caused the weld cracking?

A. The weld material has fatigued from the cyclic loading of cargo shifting during normal driving — each load cycle applies and releases stress at the weld toe creating micro-cracks that propagate from repeated fatigue cycles over time

B. The welds were performed with an incorrect electrode specification that is not compatible with the cross-member's steel grade creating a metallurgical weakness at the weld junction that cracks under normal operational loading

C. The D-ring anchors have developed fatigue cracks at the welds from the cyclic loading of repeated cargo securement forces during normal trailer operation — the welds must be repaired or the anchors replaced before use

D. The cross-members have corroded beneath the anchor welds and the reduced base material strength can no longer support the weld's designed load transfer — the corrosion undermines the weld before the weld itself fails

114. A trailer's ABS has been functioning correctly. After a tire replacement on one axle position, the ABS activates unnecessarily during light braking on dry pavement. All brake adjustments are within specification. What tire-related condition could cause the premature ABS activation?

A. The replacement tire has a significantly different rolling radius than the tires on the other positions creating a wheel speed difference that the ABS module interprets as impending lockup during each brake application event

B. The replacement tire has a different rolling diameter than the other tires creating a wheel speed difference that the ABS module interprets as impending lockup — the mismatched tire spins at a different rate per unit of vehicle speed

C. The replacement tire's tread compound has a different friction coefficient than the other tires and the different grip level causes that wheel to decelerate at a different rate during braking triggering the ABS modulation prematurely

D. The ABS wheel speed sensor air gap changed during the tire replacement and the altered gap produces a weaker signal that the ABS module interprets as a wheel speed reduction triggering premature modulation during light braking

115. A trailer's marker lamp wiring has been repaired using butt connectors and heat shrink tubing. The repair passed the initial function test. After 3 months of service, the right-side marker lamps begin flickering intermittently during driving. What is the most likely cause of the delayed failure?

A. The heat shrink tubing has shrunk from road heat exposure compressing the butt connector and deforming the wire contact inside the connector creating an intermittent connection that produces the flickering during driving vibration

B. The butt connector crimps were adequate initially but corrosion has developed at the wire-to-connector interface from moisture intrusion — the corroded connection creates intermittent resistance that causes the flickering during vibration

C. The heat shrink was applied incorrectly and did not form a complete seal around the butt connector — moisture entered through the incomplete seal and corroded the crimped connection creating the intermittent contact during driving

D. The butt connector crimp connection has developed corrosion from moisture intrusion through an incomplete seal — the corroded connection creates an intermittent high-resistance path that produces the flickering during driving vibration

116. A trailer's brake drum has been replaced. The replacement drum has a different casting number but the same diameter and width as the original. After installation, the brake performance on that wheel seems adequate during the road test. Should the technician be concerned about the different casting number?

A. The different casting number is a concern because different castings may use different iron alloys with different thermal properties — the replacement drum may fade earlier or wear at a different rate than the original specification

B. The matching diameter and width confirm the drum is physically compatible and the casting number difference likely represents a manufacturing batch or foundry code change that does not affect the drum's braking performance

C. The different casting number indicates the drum may have a different maximum diameter specification (discard diameter) and the brake adjustment procedure must use the new drum's specific discard specification for compliance

D. The different casting number should be investigated — the technician must verify the replacement drum's metallurgical specification, maximum diameter, and mounting configuration match the OEM specification for this trailer application

117. A truck's A/C system has been recharged with the correct amount of R-134a refrigerant. The system cools adequately during city driving but the cooling decreases significantly during highway driving. The condenser fan operates at all speeds. What is the most likely cause?

A. The condenser is mounted too far from the radiator and the gap between the condenser and radiator allows the highway-speed airflow to bypass the condenser face rather than flowing through the condenser fins for heat rejection

B. The condenser has a partial internal restriction from contamination that limits refrigerant flow — at city speed the lower compressor output matches the restricted flow but highway speed increases the compressor output beyond the restriction

C. The condenser airflow at highway speed is partially blocked by road debris accumulated on the condenser face — the debris was not visible during the initial inspection but restricts airflow at the higher velocity of highway driving

D. The engine's cooling fan creates adequate airflow through the condenser during city driving but at highway speed the increased ram air creates a pressure zone behind the condenser that actually reduces the effective airflow through the fins

118. A truck's heater core has been flushed due to reduced heat output. After the flush, the heat output improves significantly. However, the technician notices the flushing solution contained acidic particles. What should the technician be concerned about?

A. The acidic flush solution may have attacked the heater core's internal solder joints and the weakened joints may develop pinhole leaks within the next few thousand kilometres from the acid's corrosive effect on the lead-tin solder

B. The acidic particles indicate the coolant inhibitor package had depleted and the acidic coolant was corroding the heater core internally — the flush restored flow but the corrosion damage may cause the core to leak in the near future

C. The flush solution's acid content may have damaged the heater core's internal tubes and the weakened tubes could develop leaks from the sustained pressure of the cooling system during the next several hundred hours of operation

D. The acidic particles indicate the engine's cooling system has active corrosion occurring throughout the circuit — the heater core flush addressed one symptom but the system-wide corrosion must be addressed with a complete coolant flush

119. A truck's A/C system has been evacuated and charged. The technician verifies the charge weight on the scale matches the specification exactly. During operation, the system pressures are correct and the cooling performance is adequate. However, the compressor cycles more frequently than normal (every 45 seconds instead of every 3 minutes). What could cause the frequent cycling with correct charge and pressures?

A. The expansion valve is opening too wide flooding the evaporator with liquid refrigerant that drops the suction pressure below the low-pressure switch threshold more frequently than the designed cycling rate allows

B. The evaporator thermistor or low-pressure cycling switch has a calibration drift that triggers the compressor clutch to disengage at a higher-than-designed threshold creating the more frequent cycling at the normal operating temperatures

C. The condenser fan relay has an intermittent fault that causes the fan to drop to low speed periodically — the reduced airflow momentarily raises the high-side pressure triggering the high-pressure switch to cycle the compressor

D. The thermostatic switch, low-pressure cycling switch, or the evaporator thermistor has drifted from calibration and triggers the compressor off at a higher threshold than designed — the compressor reaches the threshold more quickly

120. A truck's fuel-fired auxiliary heater has been operating normally but the driver reports a clicking noise from the heater unit that occurs every 30 seconds during operation. The heater produces adequate heat and the combustion flame is stable. What is the most probable source of the clicking?

A. The heater's fuel metering pump produces the clicking noise as it delivers each measured fuel pulse to the combustion chamber — the 30-second interval corresponds to the pump's delivery cycle at the heater's current heat demand setting

B. The heater's internal solenoid-operated fuel valve cycles every 30 seconds to modulate the fuel delivery rate for the set-point temperature — the solenoid produces the clicking when it opens and closes during each delivery cycle

C. The heater's combustion air fan motor has a worn bearing that produces a click once per revolution — the 30-second interval corresponds to the fan's low-speed rotation during the heater's steady-state combustion operation

D. The heater's electronic control module cycles the glow plug igniter on and off every 30 seconds as a flame monitoring function — the glow plug relay produces the clicking each time the module verifies flame presence

121. A truck's A/C system has a sight glass that shows continuous bubbles during operation. The system has been recharged to the exact specification weight. The pressures are within the normal range. Is the bubbling sight glass a concern?

A. No — some A/C systems normally show bubbles in the sight glass even when correctly charged because the sight glass location in the circuit may be in a section where the refrigerant transitions between liquid and vapour states

B. Yes — bubbles in the sight glass always indicate an undercharge regardless of the scale-verified weight because the system has a leak that has already reduced the charge below the visible liquid threshold at the sight glass

C. No — the sight glass on this system may be located in a position where turbulence from a nearby fitting creates bubbles in the otherwise fully-liquid refrigerant stream passing the glass during normal operation

D. Some systems normally show bubbles at the sight glass even when correctly charged — the sight glass location, system design, and refrigerant flow pattern determine whether bubbles are normal and the technician should verify against the system specification

122. A truck's HVAC blower motor has been replaced. After the replacement, the blower operates at all speeds but produces a noticeable humming noise at speed setting 3 that is not present at speeds 1, 2, or 4. What is the most likely cause?

A. The replacement blower motor has a different impeller blade count than the original and the blade-passing frequency at speed 3 coincides with a resonant frequency of the HVAC housing producing the audible hum at that specific speed

B. The blower motor resistor pack has a faulty resistor for the speed 3 position that allows electrical noise to modulate the motor's power supply creating the audible humming noise specifically at the speed 3 setting during operation

C. The replacement blower motor's impeller is slightly imbalanced and the imbalance produces a vibration that coincides with the HVAC ductwork's resonant frequency specifically at the airflow velocity produced by speed 3 during operation

D. The HVAC housing has a panel that resonates at the specific airflow frequency produced by the blower at speed 3 — the panel vibration creates the humming noise that is not excited at the other speed settings' different airflow frequencies

123. A truck's A/C compressor has been replaced after an internal failure. The system has been flushed, the receiver/dryer replaced, and a new expansion valve installed. After charging with the correct weight, the system cools but the compressor is noticeably louder than normal. What should the technician verify?

A. The refrigerant oil charge in the new compressor — insufficient oil produces inadequate lubrication that creates internal noise from the metal-to-metal contact between the compressor's moving components during operation

B. The compressor's mounting bolt torque and bracket alignment because a misaligned or loose compressor creates mechanical noise that transmits through the bracket to the engine block amplifying the sound during operation

C. The new compressor's drive belt tension and alignment because a misaligned belt creates a side-loading force on the compressor shaft that produces bearing noise proportional to the shaft speed during operation

D. The refrigerant oil type and quantity in the new compressor — the wrong oil type or insufficient quantity creates internal lubrication problems that produce noise from inadequate bearing and piston lubrication during compressor operation

124. A hydraulic system on a concrete mixer truck has a complaint that the drum rotation speed has decreased by approximately 20% over the past month. The hydraulic fluid level is correct and the system pressure is within specification. What should be investigated?

A. The drum drive motor for internal wear that allows increased bypass flow through the motor's internal clearances — the motor receives full flow from the pump but 20% of the flow bypasses without performing useful work

B. The proportional flow control valve that sets the drum speed for a calibration drift or contamination that has reduced the valve's flow delivery to the drum motor below the designed setting during the mixing operation

C. The hydraulic pump for increased internal leakage from worn gears or vanes that reduces the pump's net output by 20% — the reduced flow directly reduces the drum speed proportionally during both mixing and discharge operation

D. The drum motor, the flow control valve, and the pump — any component that affects the flow delivery to the drum motor could independently cause the 20% speed reduction and each must be tested to isolate the actual source

125. A dump truck's hydraulic system has a counterbalance valve that controls the dump body's lowering speed. The valve has been adjusted and the lowering speed is correct. However, when the dump body is approximately 75% lowered, the descent speed suddenly increases for the final 25% of travel. What is causing this speed change?

A. The dump body's centre of gravity passes over the pivot point at approximately 75% lowered and the remaining travel is gravity-assisted rather than gravity-resisted — the counterbalance valve cannot control the speed change at the transition

B. The counterbalance valve's pilot pressure changes as the cylinder approaches full retraction — the reduced cylinder area at the end of stroke generates less pilot pressure and the valve partially closes creating a pressure surge that accelerates the descent

C. The dump body's weight distribution shifts as it lowers and at 75% lowered the remaining body weight creates a different load on the cylinder that changes the counterbalance valve's operating point producing the speed increase

D. The cylinder's internal cushion is designed to decelerate the piston during the last 25% of travel but the cushion seal has worn allowing oil to bypass the cushion creating an uncontrolled descent during the final portion of the stroke

126. A hydraulic system uses a priority flow divider valve to ensure the steering circuit receives adequate flow before any other circuit receives fluid. The steering works correctly but the secondary circuit (a PTO-driven hydraulic crane) operates sluggishly. The pump output is within specification. What should be checked on the priority valve?

A. The priority valve's secondary port for a restriction that limits flow to the crane circuit despite adequate priority flow to the steering — the valve sends correct flow to steering but the secondary outlet has an internal restriction

B. The priority valve for a setting that sends too much flow to the steering circuit — the priority valve may be set to deliver more than the steering requires and the excess steering flow is not available for the secondary crane circuit

C. The priority valve's relief setting for a value that is lower than the crane circuit's operating pressure — the low relief diverts flow to tank before the crane circuit can build adequate pressure for normal operation

D. The priority valve's pressure-compensating spool for a setting that diverts more flow to the steering priority circuit than necessary — the over-prioritized steering circuit starves the secondary crane circuit of the flow it needs

127. A hydraulic crane's outrigger cylinder will not hold its position when extended — the outrigger slowly retracts when the engine is shut off and the hydraulic system is not running. The directional valve is in neutral. What is allowing the outrigger to retract?

A. The outrigger circuit's pilot-operated check valve has a worn seat that allows the cylinder's load pressure to slowly push oil backward through the leaking check valve past the worn seat surface during the engine-off holding period

B. The outrigger cylinder's piston seal has internal leakage that transfers oil from the pressurized cap end to the rod end under the sustained outrigger loading — the internal bypass allows the slow retraction over the holding period

C. The directional valve has internal spool leakage at the outrigger port that drains the cylinder's holding pressure through the spool clearance to the tank port during the engine-off period when no pump flow maintains the pressure

D. The holding circuit has an internal leak — either the POCV seat, the cylinder piston seal, or the valve spool clearance is allowing oil to drain from the pressurized cylinder during the engine-off holding period and the source must be isolated

128. A hydraulic system's pressure gauge has been reading erratically — jumping between 5,000 and 15,000 kPa during steady-state operation. The system functions normally and the operator reports no performance changes. A second gauge installed at the same test point reads a steady 10,000 kPa. What is wrong?

A. The erratic gauge has a failed internal Bourdon tube that has developed a fatigue crack — the cracked tube flexes under the system pressure creating the jumping needle from the mechanical instability of the damaged sensing element

B. The erratic gauge has a stuck or damaged internal mechanism — the needle jumps because the internal gear or linkage cannot track the actual pressure smoothly and the gauge must be replaced with a calibrated unit

C. The erratic gauge has air trapped in its Bourdon tube from installation without pre-filling — the compressible air creates a spring effect that amplifies pressure pulsations from the pump producing the jumping needle reading

D. The erratic gauge has a damaged internal dampening mechanism — without the designed dampening the gauge needle responds to every pressure pulsation from the pump creating the erratic display during normal steady-state operation

129. A hydraulic system's accumulator has been pre-charged to 8,000 kPa nitrogen. The system's maximum working pressure is 20,000 kPa. During operation, the operator notices that the hydraulic system experiences pressure spikes when the functions are deactivated — the pressure momentarily exceeds the relief valve setting before the valve can respond. What is the accumulator's role in preventing these spikes?

A. The accumulator absorbs the pressure spikes by accepting the excess fluid volume during the momentary overpressure — the nitrogen gas compresses to absorb the hydraulic energy faster than the relief valve can open and vent the excess

B. The accumulator provides a reservoir of pressurized fluid that maintains system pressure during the transition and the stored energy dampens the pressure spikes from the sudden flow change when functions are deactivated

C. The accumulator absorbs pressure spikes by compressing the nitrogen gas when the system pressure rises — the gas compression absorbs the hydraulic energy of the spike faster than the mechanical relief valve can respond and open

D. The accumulator maintains system pressure stability by absorbing the excess flow during function deactivation — the compressible nitrogen in the accumulator acts as a shock absorber for the incompressible hydraulic fluid's pressure spikes

130. A hydraulic system's suction strainer has been inspected and found to be 60% blocked with contamination. The system has been operating with the blocked strainer for approximately 200 hours. What damage may have occurred to the pump during operation with the restricted inlet?

A. The pump has likely experienced cavitation damage on its internal surfaces — the restricted inlet caused the pump to draw a vacuum on its inlet creating vapour bubbles that collapsed against the pump's gears, vanes, or pistons

B. The pump's internal bearings have been damaged from overheating because the restricted inlet limited the oil flow through the pump — less oil flow means less cooling and the bearings have overheated from the reduced lubrication

C. The pump's internal components have experienced accelerated wear from the contamination that passed through the remaining 40% of the strainer's open area — the particles that were not captured abraded the pump's internal surfaces

D. The pump has experienced cavitation damage from the restricted inlet — the starved pump created low-pressure zones that formed vapour bubbles which collapsed violently against the pump's internal surfaces eroding the metal over 200 hours

131. A truck-mounted hydraulic crane has a maximum rated capacity of 5,000 kg at 3 metres radius. The operator asks the technician to install a larger-capacity hydraulic cylinder to increase the crane's lifting capacity beyond the 5,000 kg rating. Why must the technician refuse this modification?

A. The crane's rated capacity is determined by the weakest component in the entire lifting system — installing a larger cylinder increases the hydraulic force but the boom, pins, base frame, and mounting bolts may not withstand the increased load

B. The crane's load chart is a legally certified document — any modification to the hydraulic system requires the manufacturer to recertify the entire crane's load ratings through a comprehensive structural and stability analysis

C. A larger hydraulic cylinder would increase the lifting force beyond the crane's structural design capacity — the boom, pivot pins, base frame, outrigger supports, and truck chassis are engineered for 5,000 kg and exceeding this creates a failure risk

D. The crane's capacity is limited by the structural strength of all components and the vehicle's stability — increasing the cylinder force without upgrading the entire structural chain and recertifying the crane creates a catastrophic failure and tipping risk

132. A battery-electric truck's traction motor has a complaint of reduced acceleration performance. The battery SOC is at 80% and the motor temperature is within normal range. The scan tool shows the inverter is limiting the motor current to 70% of the maximum specification. No fault codes are present. What is the most probable cause?

A. The inverter's coolant temperature has exceeded its internal thermal limit and the inverter is derating its output to protect the power transistors from thermal damage — the motor and battery are fine but the inverter is heat-limited

B. The battery cells' voltage has dropped below the BMS's minimum threshold for full power delivery and the BMS is limiting the discharge current to protect the cells from excessive voltage depression during high-current draw events

C. The motor's resolver (position sensor) has a slight calibration drift that causes the inverter to energize the stator phases at a slightly incorrect timing — the mistimed energization reduces the motor's torque efficiency by approximately 30%

D. The 12-volt auxiliary battery has a low state of charge that limits the inverter controller's processing power — the controller reduces the motor current output when its own supply voltage drops below the minimum operating threshold

133. A hybrid truck's regenerative braking system has a condition where the regenerative braking force varies noticeably between the left and right sides of the drive axle — the driver feels the vehicle pull to one side during regenerative braking events. What could cause this asymmetric regenerative force?

A. The traction motor has a stator winding fault on one phase that creates an unequal electromagnetic braking force distribution across the motor's rotational position — the asymmetric braking transmits through the differential to the wheels

B. The drive axle differential distributes the regenerative braking torque equally to both wheels — the pull must be from a friction brake drag on one side that adds to the regenerative braking creating the directional asymmetry

C. The regenerative braking torque is applied equally to both wheels through the differential — any perceived pull during regenerative braking is from a friction brake condition (drag, contamination, or adjustment) on one side not from the motor

D. The inverter's power switching has an asymmetric fault on one phase leg that creates a torque ripple during regenerative mode — the ripple produces a once-per-revolution force variation that the driver perceives as a directional pull

134. A battery-electric truck has a complaint that the vehicle's pre-conditioning system (which heats or cools the battery and cab while still plugged into the charger) activates at random times during the night. The pre-conditioning timer is not set. What could trigger the unscheduled pre-conditioning?

A. The BMS has detected a cell temperature that has dropped below the minimum storage temperature threshold and activates the battery heating system automatically to protect the cells from cold-temperature damage during the overnight parking

B. The charging station's smart grid feature is signaling the vehicle to adjust its charging and pre-conditioning schedule based on the utility's off-peak pricing — the vehicle responds to the grid signal rather than the driver's timer setting

C. The vehicle's telematics system has received an over-the-air update that changed the pre-conditioning default settings from manual timer mode to automatic temperature-based activation creating the unscheduled operation events

D. The BMS activates battery thermal management automatically when cell temperatures drop below or rise above the designed storage range — the overnight temperature changes trigger heating or cooling to protect the cells regardless of timer settings

135. A parallel hybrid truck has the electric motor coupled to the transmission through a disconnect clutch. The motor can drive the vehicle independently in EV mode or assist the diesel engine in hybrid mode. During a road test, the technician commands EV mode but the diesel engine starts and runs simultaneously. The motor provides propulsion and the engine produces no drive torque. What has failed?

A. The disconnect clutch actuator has failed and cannot disengage the engine from the transmission — the motor drives the vehicle but the connected engine is dragged by the motor and starts from the mechanical rotation

B. The hybrid controller's EV mode command is not reaching the engine ECM through the CAN bus — the engine ECM does not receive the shutdown command and the engine continues to idle while the motor provides the propulsion

C. The engine's automatic start-stop system has detected a condition (low battery SOC, high accessory load, or DPF regeneration requirement) that overrides the EV mode command and starts the engine for operational support

D. The disconnect clutch between the engine and transmission has failed in the engaged position — the motor drives the vehicle through the transmission but the locked clutch also turns the engine which starts from the forced rotation

Practice Exam 15: Answer Key and Explanations

1. D — Natural gas (methane) is lighter than air and rises to the ceiling of an enclosed maintenance bay. The accumulated gas collects near overhead lighting, electrical panels, exhaust fans, and other potential ignition sources at ceiling level. A gas detection system must monitor ceiling-level concentrations to prevent an explosion from the invisible accumulation above the work area.

2. B — A deformed cab structure from a rollover may be unstable and could collapse further under additional loading. Before the technician enters the cab, the structural integrity must be assessed to ensure the deformed cab frame can support the technician's weight and movement without further collapse that could trap or crush the occupant during the inspection.

3. C — Open containers of used oil violate waste storage regulations on multiple levels: the oil can spill from the unstable pails, rainwater can contaminate the waste making it more expensive to dispose of, volatile compounds evaporate into the shop air, and the open containers do not meet the sealed-container requirements of environmental waste storage regulations.

4. A — Compressed air disperses brake dust directly into the technician's breathing zone creating an inhalation hazard from the particulate matter regardless of the brake lining composition. The approved wet cleaning method (brake washing station or aerosol can) captures the dust in liquid preventing airborne dispersal. The unsafe practice must stop immediately.

5. D — Removing the ignition key controls only the engine starting circuit. It does not isolate the battery's stored electrical energy, the air brake system's stored pneumatic energy, hydraulic stored energy in raised components, spring brake stored mechanical energy, or the potential energy of suspended loads. A comprehensive lockout program addresses all energy sources.

6. B — Oil-contaminated coolant cannot be processed through standard coolant recycling programs because the petroleum contamination interferes with the recycling chemistry. The mixed waste must be disposed of through the used oil waste stream or through a hazardous waste hauler — mixing the two waste streams makes recycling of either component impossible.

7. A — With the valve covers removed, the rotating valve train components are fully exposed. Rocker arms, pushrods, and cam followers rotate at camshaft speed and can catch loose clothing, jewelry, long hair, shop towels, or tools. The entanglement hazard is the primary risk during running valve adjustments because the consequences of entanglement are severe and immediate.

8. C — Nitrile gloves provide good chemical protection but can develop microscopic tears during work that allow undetected chemical contact. The glove removal process can transfer contaminants from the outer surface to bare hands if the technique is incorrect. Handwashing after glove removal eliminates any chemicals that transferred during wear or removal.

9. B — The "aftertreatment inducement" derate is a compliance enforcement mechanism built into the emissions control system. It activates when the ECM detects a critical aftertreatment failure — empty DEF tank, incorrect DEF quality, SCR efficiency below threshold, or system tampering. The severe 60% power derate forces the operator to address the compliance failure before full power is restored.

10. D — A metallic rattle from the front of the engine during cold start that disappears after 30 seconds is characteristic of timing gear backlash. Cold engine oil cannot provide adequate damping between the gear teeth, and the rattle occurs as the gears impact each other at the backlash clearance. Once the oil warms and fills the gear mesh, the damping eliminates the noise.

11. A — Oil pressure dropping progressively over 30 minutes of idling with stable temperature and constant oil level indicates the pressure relief valve is being affected by heat soak. The extended idle exposes the relief valve spring to sustained engine heat, and the spring's tension decreases as its temperature rises. The weakened spring allows the valve to open at progressively lower pressures.

12. C — A single tick per pump revolution audible only through the pump housing indicates a specific internal event occurs once per revolution. A worn delivery valve seat on one cylinder allows a pressure pulse to reflect back into the pump when that delivery valve closes. The reflected pulse creates the tick at the same rotational position during each pump revolution.

13. B — A severely restricted air filter is often overlooked when diagnosing low boost codes. The turbocharger compressor can only compress the air that reaches its inlet — a blocked filter starves the compressor of air mass. The turbocharger may spin at the correct speed but the reduced inlet air density means the compressor cannot achieve the commanded boost pressure.

14. D — SCAs provide liner cavitation protection that the base coolant's freeze protection and pH buffering cannot provide. Diesel engine cylinder liners vibrate during combustion, and the vibration creates vapour bubbles in the coolant that implode against the liner wall. The SCA chemicals maintain a protective barrier on the liner surface that prevents the cavitation erosion from damaging the liner.

15. A — The injector cut-out test measures each cylinder's power contribution. Cylinder 5 drops 80 RPM (strong contribution) while cylinder 2 drops only 30 RPM (weak contribution). The smaller drop on cylinder 2 indicates it was already producing less power than the others — disabling a weak cylinder produces a smaller change than disabling a strong one.

16. C — The delta-pressure sensor has been replaced but the code returns. The sensor measures pressure through sensing tubes connected to upstream and downstream ports on the EGR pipe. If these tubes are blocked with carbon soot or moisture, no pressure differential reaches the sensor element. The sensor correctly reads zero because it receives no differential input.

17. B — Prolonged operation with a severely restricted air filter creates high intake vacuum at the turbocharger compressor inlet. The sustained vacuum pulls oil past the compressor seal into the intake system. The oil contaminates the intercooler and enters the cylinders, potentially causing accelerated ring wear and hydraulic lock if the oil accumulation is severe.

18. D — In a parallel twin-turbo configuration, both turbos should produce equal boost because each turbo serves one cylinder bank with equal exhaust energy. The right turbo's lower boost indicates that bank is producing less exhaust energy. Lower compression from worn rings or valves on the right bank reduces the combustion energy available to drive the right turbocharger to matching boost.

19. A — The most common source of fuel dilution in diesel engine oil is injector dribble — fuel leaking past a worn nozzle seat after the injection event. The unburned fuel enters the combustion chamber, washes past the piston rings during the subsequent strokes, and drains into the crankcase. The fuel accumulates in the oil over the drain interval, reducing viscosity progressively.

20. C — The 650°C outlet temperature during regeneration exceeds the 600°C specification maximum. The elevated temperature indicates excessive soot had accumulated before the regeneration was triggered. The concentrated soot load burns more aggressively than a normal load, producing the temperature overshoot. The root cause of the delayed regeneration trigger must be investigated.

21. B — Metal debris from a failed turbocharger bearing has been found in the intake manifold, intercooler, and intake ports. All contaminated components must be cleaned or replaced before the engine is started. Running the engine with metal debris in the intake system will ingest the particles into the cylinders, causing scoring on the liners, damage to the rings, and valve seat erosion.

22. D — An overfull surge tank with no visible leaks, no overheating, and normal operation points to combustion gas entering the cooling system. A head gasket leak, cracked head, or cracked liner allows combustion pressure to enter the coolant circuit. The gas pressure displaces coolant into the surge tank, and the condition worsens progressively with each thermal cycle.

23. A — Suction-side air ingestion is a one-way leak — the fuel pump's vacuum draws air inward through the leak during operation, but a positive-pressure test pushes the sealing surfaces together rather than apart. The test pressure seals the leak path that opens under vacuum. A vacuum-side test or running the engine while monitoring the clear fuel line for bubbles is more effective.

24. C — The escaping exhaust gas at 500-600°C impinges directly on the engine block and cylinder head mating surfaces at the manifold. Over 10,000 km, the high-temperature gas erodes channels in the cast iron or aluminium surfaces. These erosion channels prevent a new gasket from sealing even with a new gasket installed because the surface is no longer flat.

25. B — The EGR valve moves correctly and the flow matches the commanded value — but the recirculated exhaust gas is too hot. The EGR cooler has lost efficiency from internal fouling, and the hot EGR gas entering the intake does not reduce combustion temperature as effectively as properly cooled EGR. The higher combustion temperature from the hot EGR increases NO_x formation.

26. D — The CCV tube's heated element prevents the water vapour in blow-by gases from freezing inside the tube during cold weather. If the heater element has failed or been disconnected, the tube has no active heating source. At -25°C, the water vapour freezes inside the unheated tube, and the ice accumulation blocks the crankcase ventilation path completely.

27. A — The engine runs but the scan tool shows rail pressure 50 bar below commanded at all conditions. The system performs identically across all operating points — the offset is consistent. The replacement sensor has a different calibration than the original, reading 50 bar lower than actual. The actual rail pressure is correct, but the sensor reports it with a constant offset.

28. C — A rationality error means the ECM compares the sensor's actual reading to what it calculates the temperature should be based on the current operating conditions (fuel delivery, engine load, RPM, ambient temperature). When the sensor's reading does not match the ECM's expected value within the designed tolerance, the rationality check fails and the code is set.

29. A — The SCR catalyst has lost conversion efficiency from thermal degradation. The DEF decomposes into ammonia correctly and the dosing rate matches the ECM's command. However, the degraded catalyst cannot convert all the ammonia with the available NO_x. The unconverted excess ammonia passes through the damaged catalyst and exits the tailpipe as ammonia slip.

30. D — Two brake chambers exceeding the maximum pushrod stroke specification during a roadside inspection results in an out-of-service order. Over-stroke means the brake chambers cannot produce adequate braking force at those wheel positions. The vehicle cannot operate until the brakes are adjusted or repaired to bring the pushrod strokes within the specification.

31. B — An automatic slack adjuster that requires manual adjustment is not functioning as designed. The manual adjustment addresses the symptom (excessive stroke) but not the root cause. Either the ASA's internal mechanism has failed, or a foundation brake problem (drum out-of-round, broken return springs, seized anchor pins) prevents the ASA from maintaining the adjustment automatically.

32. A — The brake pads were replaced 5,000 km ago, the rotor surface is smooth, and the pads have adequate material. The most common cause of grinding with adequate pad material and a smooth rotor is missing, broken, or incorrectly installed pad hardware — anti-rattle clips, shims, or mounting clips that prevent the pad from vibrating or shifting in the caliper bracket.

33. B — The adjusters back off between PM inspections despite appearing to function during manual testing. The brake drum has developed an out-of-round condition that mechanically pushes the shoes back during each revolution. The adjuster interprets this periodic shoe retraction as an over-adjusted condition and backs off the adjustment to compensate for the perceived over-tight setting.

34. D — A constant hissing from under the dash with rapid pressure loss during key-off indicates the foot valve has an internal piston seal failure. The worn seal allows system air to continuously bypass the piston and exhaust through the valve's exhaust port or pedal rod boot. The constant leak drains the system regardless of whether the brakes are applied.

35. B — The load-sensing proportioning valve's behavior when the linkage is disconnected depends on the valve's mechanical design — some default to maximum reduction (minimum rear pressure) and others default to minimum reduction (full rear pressure). The technician must determine which default position the specific valve takes when the height-sensing input is removed.

36. A — The EBS uses the yaw rate sensor for its electronic stability control function. The yaw rate sensor detects the vehicle's actual rotational rate and the EBS compares this to the driver's steering angle input to determine if the vehicle is understeering or oversteering. Without the yaw rate data, the ESC cannot detect or correct stability problems while the base ABS continues functioning.

37. C — Equal adjustment and equal air pressure but a 50% force imbalance indicates the friction surfaces are different between the two sides. The right-side linings may have oil contamination from a leaking seal, glazing from heat exposure, or an incorrect friction material specification. Any condition that reduces the friction coefficient on the right side produces less force per application.

38. D — The air dryer cartridge was replaced only 6 months ago but the desiccant is already saturated. The compressor operates in the loaded (compressing) state for longer periods than the dryer was designed to handle per cycle. The extended loading produces more moisture-laden air than the desiccant can absorb, and the purge cycle cannot fully regenerate the oversaturated media.

39. B — Even physically identical modulator valves can have different internal flow rates, orifice sizes, and response times that affect the ABS module's modulation algorithm. The ABS was calibrated for the original valve's specific characteristics. Installing a different valve without manufacturer approval risks degraded ABS performance that may not be apparent during normal driving.

40. B — The replacement chamber's pushrod is longer than the original. The excess pushrod length holds the slack adjuster arm beyond the designed free-play position, keeping the brake shoes in light contact with the drum even when the spring brake is fully released. The pushrod length must match the original specification for the correct brake shoe running clearance.

41. C — The foot valve's primary and secondary circuits should deliver equal pressure at any pedal position. The 170 kPa difference (620 vs 450 kPa) indicates the secondary piston seals are worn and bypassing air internally. The secondary piston cannot build the same pressure as the primary because the leaking seals allow air to escape past the piston during each application.

42. B — The wheel speed sensor air gap was likely disturbed during the brake reline when the hub was removed or the drum was changed. The increased air gap produces a weaker sensor signal that the ABS module interprets as a slower wheel speed. The apparent deceleration triggers the ABS intervention during light braking when the actual wheel speed is above the lockup threshold.

43. D — The governor cut-out at 930 kPa instead of 860 kPa pressurizes the entire air system 70 kPa above the designed maximum. Air tanks, fittings, hoses, valves, and brake chambers are rated for specific maximum working pressures. Operating at 930 kPa may exceed the pressure rating of the weakest component, risking component failure from the overpressure.

44. A — The rotor has 0.08 mm thickness variation against a 0.03 mm specification. The rotor should be machined on a brake lathe to restore the parallelism within specification. Machining removes material from the high spots, equalizing the thickness around the circumference. The rotor can be machined as long as the post-machining thickness remains above the minimum discard specification.

45. B — New brake drums have a slightly different internal diameter than the worn drums they replaced. The automatic slack adjusters must take up the additional clearance between the new drum surface and the existing brake linings over the first several applications. Each brake application advances the adjuster slightly until the designed running clearance is established.

46. D — No air dryer removes 100% of moisture from compressed air. A small amount of residual moisture passes through even a properly functioning dryer and collects in the wet (supply) tank. The wet tank serves as a secondary moisture collection point where residual water settles before reaching the dry tanks downstream. Regular wet tank draining is a normal maintenance task.

47. A — The most common cause of an intermittent APPS signal (FMI 2 - erratic) with a mechanically smooth pedal is a worn resistive element track inside the potentiometer. The wiper crosses the worn section during normal pedal movement, creating a momentary signal dropout. The dropout produces the erratic signal variation that the ECM's input monitoring detects.

48. C — The total voltage drop is the sum of all drops: 1.2V on the positive side (14.4V at B+ minus 13.2V at battery positive) plus 0.4V on the negative side (battery negative is 0.4V above chassis ground). Total drop = $1.2V + 0.4V = 1.6V$. This significantly exceeds the 0.5V maximum specification and the cable connections must be serviced.

49. B — The sensor signal wire has a short to ground that pulls the signal voltage to 0 volts. The ECM's 5-volt reference is intact (confirmed by other sensors working on the same reference), but the grounded signal wire prevents any voltage from developing at the ECM's input. The ECM reads 0V and converts it to 0 kPa on the sensor's voltage-to-pressure scale.

50. D — The LED lamp illuminates at full brightness when cool but dims after 10 minutes of operation. The LED assembly's internal thermal protection circuit monitors the LED junction temperature and reduces the drive current as the assembly heats up. The thermal protection prevents the LEDs from overheating and failing. After a 30-minute cool-down, the cycle restarts.

51. A — The starter motor draws 200+ amps during cranking which creates voltage fluctuations at the battery terminals. These fluctuations propagate through the electrical system and cause the dash lamps to flicker at the cranking frequency. This is a normal electrical characteristic during cranking and does not indicate a battery, cable, or alternator fault.

52. C — The replacement body controller must be programmed with the vehicle's specific option codes. The trailer towing package is a configurable feature that must be explicitly enabled in the controller's configuration. Without the towing package enabled, the controller does not activate the pin 7 trailer charge output even though the hardware circuit is present.

53. B — The engine runs correctly and the transmission shifts properly (confirming the CAN bus carries data between the ECM and TCM). The scan tool communicates with the cluster (confirming the cluster receives diagnostic requests). The cluster displays "NO DATA" on all gauges, indicating a firmware fault that prevents the cluster from processing the continuous J1939 broadcast messages.

54. D — The alternator bench-tests at 14.4V but produces only 12.8V when installed. The voltage sense wire is the most likely cause — without accurate battery voltage feedback, the regulator cannot increase output to compensate for the charging circuit's cable voltage drop. The regulator regulates to its default lower voltage instead of the designed 14.4V at the battery terminals.

55. A — The flywheel ring gear has one or more damaged or missing teeth. When the damaged section passes the CKP sensor, the signal pattern has gaps that the ECM records as abnormal frequency. The engine starts and runs because the ECM can interpolate past the missing tooth positions during operation, but it logs the frequency anomaly as a fault code.

56. C — The trailer ABS self-test cycles correctly (confirming the module functions and the lamp on the trailer operates). The tractor dash lamp stays illuminated because the trailer ABS module has a stored fault code from a previous trip. The self-test occurs independently of the stored fault state, and the dash lamp reflects the module's stored fault condition rather than the self-test result.

57. B — The direct wiring bypasses all of the body controller's monitoring and protection for the horn circuit. The controller will continuously set fault codes for the disconnected horn output because it detects no load on its output driver. The repeated fault codes may trigger other body controller responses such as warning lamp activation, message centre alerts, or reduced sleep mode efficiency.

58. D — The battery current sensor requires a relearn or reset procedure after replacement. The new sensor must establish its zero-point calibration (what "zero current" reads through the new sensor) and the BMS must relearn the battery's baseline current flow characteristics. Without this calibration, the BMS cannot accurately calculate the state of charge needed to enable idle-stop.

59. D — The speedometer reads correctly (confirming vehicle speed data exists somewhere on the bus) but the engine ECM shows 0 km/h. The ECM's customer parameter configuration specifies which source provides the vehicle speed data. The ECM is configured to read speed from a source other than the ABS module's broadcast — such as a transmission sensor that is not installed.

60. A — After 24 hours of battery disconnect, the batteries have stabilized at their resting voltage. Upon reconnection, the surface charge has not fully developed and the available voltage may be slightly lower than the fully-stabilized level. The reduced voltage limits the window motor speed until the battery's surface charge equilibrates after a few minutes of running.

61. B — FMI 14 indicates the sensor reading exceeds its designed measurement range — the actual exhaust backpressure is higher than the sensor's maximum scale. The sensor's output is clipped at its maximum value because the physical pressure exceeds the sensor's full-scale reading capacity. The root cause of the excessive backpressure must be investigated.

62. A — The scan tool shows -40°C from the ECM sensor while the dash gauge reads correctly. The two temperature inputs come from separate, independent sensors. The ECM's sensor (or its circuit) has failed producing the fixed -40°C reading. The dash gauge operates from its own dedicated temperature sender that continues to function correctly and independently.

63. D — HID conversion kits installed in reflector housings designed for halogen filament bulbs produce uncontrolled glare. The halogen reflector was engineered for the specific geometry of a filament light source. The HID arc tube has a different light source shape that the reflector cannot focus correctly, scattering light into oncoming traffic lanes and blinding other drivers.

64. B — The voltage drops from 14.2V to 13.4V under full accessory load and the alternator whines. The 0.8V drop under full load indicates the alternator is at or near its maximum rated current output. The whine is from the internal components (rotor, bearings, rectifier) working at their maximum design capacity. The alternator may need to be upgraded if additional loads are planned.

65. A — FMI 1 (data below normal range) for fuel rail pressure during rough idle indicates the rail pressure is below the ECM's minimum specification. The fuel rail pressure relief valve stuck partially open allows fuel to continuously leak from the rail back to the return circuit. The HP pump cannot build the commanded pressure against the constant leak at the relief valve seat.

66. C — The headlamps activate correctly at dusk (confirming the sensor detects low light) but do not turn off in a brightly lit area. The ambient light sensor has contamination on its lens or a circuit fault that prevents it from detecting the increased light level. The sensor continues reading the low-light condition and keeps the headlamps activated regardless of the actual ambient brightness.

67. A — The private CAN bus communicates only with the fuel injection system components and is separate from the J1939 vehicle bus. A fault on the private bus would affect only the fuel injection components — the injectors, HP pump controller, and related sensors. The J1939 bus continues to operate independently, and the transmission, ABS, cluster, and body controller communicate normally.

68. B — Both sides use a single relay (confirmed working — driver side heats). The driver-side connector reads 12.4V (relay provides power). The passenger-side connector reads 0V. The wiring from the relay to the passenger-side connector has an open circuit — a broken or disconnected wire prevents voltage from reaching the passenger-side heating element.

69. A — A whining noise in only 5th gear under load that disappears during coast indicates the 5th gear pair has a drive-side contact pattern error. The gear tooth contact is on the wrong portion of the tooth face under drive loading. The coast direction shifts the contact to the opposite tooth face where the pattern is acceptable, eliminating the noise.

70. D — The fluid has been changed with the correct specification but the shudder persists. Fluid-related shudder resolves with a fluid change — persistent shudder indicates physical damage to the lockup clutch. A worn friction surface, warped pressure plate, or sticking piston prevents smooth engagement. The torque converter must be replaced or rebuilt to correct the condition.

71. C — Polished slip yoke splines are a normal condition from the designed sliding contact between the yoke and the transmission output shaft. The driveshaft length changes with suspension travel, and the slip yoke slides on the output shaft splines during each suspension cycle. This continuous sliding contact naturally polishes the spline surfaces to a mirror finish.

72. A — The shift time has increased from 0.5 to 1.5 seconds with smooth but slow shifts. The AMT clutch actuator must disengage the clutch, the shift mechanism must select the new gear, and the clutch must re-engage — all within the designed time. The clutch actuator's reduced speed from worn seals, contaminated fluid, or a weak motor directly extends the shift time.

73. B — All new components have been installed and bled, but the pedal remains spongy. A hydraulic hose section that is not adequately reinforced or has deteriorated internally expands under pressure instead of transmitting the force rigidly. The hose expansion absorbs pedal travel — the fluid pressurizes the hose wall instead of moving the slave cylinder piston.

74. D — A howling noise during acceleration only (not during coast or cruise) indicates a drive-side gear mesh problem. The ring and pinion contact pattern is incorrect on the drive face — the pinion depth is set incorrectly and the tooth contact occurs at the wrong position on the tooth face under the acceleration load. Correcting the pinion depth corrects the contact pattern.

75. C — The transmission fluid temperature of 130°C exceeds the 120°C specification with correct fluid level and clean fluid. The transmission cooler is the primary heat rejection component. A plugged cooler, restricted cooler lines, or a damaged cooler core limits the fluid's heat rejection capacity, and the fluid temperature rises above specification during sustained highway operation.

76. A — The chain drive produces a whining noise proportional to vehicle speed in both 2WD and 4WD. The chain has stretched from wear and the elongated links create a loose mesh with the sprockets. The chain transmits drive to the rear output in both modes, so the noise is present regardless of the transfer case mode selection.

77. B — A squealing noise when the clutch pedal is depressed at idle indicates a bearing in the clutch system is failing. The pilot bearing supports the transmission input shaft's forward end inside the flywheel. When the clutch is disengaged, the input shaft spins at a different speed than the flywheel and the failed pilot bearing squeals from the dry metal-to-metal contact.

78. D — The overnight delay from Park to Drive that resolves after engagement indicates the forward clutch circuit takes extra time to fill. The problem is most likely a combination of cold fluid viscosity and internal wear — the pump's worn clearances cannot deliver adequate volume at the cold startup speed to fill the forward clutch circuit within the normal 0.5-second engagement window.

79. A — A toe-heavy drive-side pattern means the contact is concentrated at the small end of the ring gear tooth. The ring gear must be moved away from the pinion (increasing backlash) to shift the contact toward the centre and heel of the tooth. This adjustment distributes the load across the full tooth face width for proper drive-side contact.

80. C — The transmission shifts poorly when cold but normally when warm — the clutch fully disengages (confirmed by the warm-shift quality). The cold transmission lubricant viscosity is too heavy, creating excessive drag on the countershaft and gears. The thick oil prevents the gears from decelerating to match speed during shifts until the lubricant warms and thins.

81. B — The front section angle is 4° and the rear is 2° — a 2° difference that exceeds the 1° maximum. The centre bearing bracket height controls the driveshaft's slope at the support point. Adjusting the bracket height with shims redistributes the angles between the front and rear sections, bringing both within the 1° tolerance of each other.

82. B — The shift from 3rd to 4th has developed a flare (engine RPM rises briefly) after the fluid change. The new fluid has different friction characteristics that delay the 4th gear clutch engagement. The off-going clutch releases at the normal rate but the on-coming clutch's altered friction delays its clamping, creating the momentary neutral condition.

83. C — A steady hum proportional to vehicle speed that does not change during turns eliminates the differential and its components (which change speed during turns). The ring and pinion gear mesh rotates at a speed determined by vehicle speed and produces the same noise regardless of differential action during turns or straight driving.

84. D — After a valve adjustment, the compression brake works at high RPM but has lost effectiveness at low RPM. The exhaust valve lash was set too tight, reducing the exhaust valve lift. During the compression brake event, the reduced valve opening releases less compressed air per cycle. At low RPM, fewer cycles occur per second and the reduced blowdown per cycle is more noticeable.

85. D — A clutch pedal vibration at a specific RPM (1,500) that disappears when the pedal is depressed slightly indicates the release bearing is in light contact with the rotating pressure plate finger tips. The fingers have slight height variations that transmit vibration through the bearing to the pedal. Pressing the pedal moves the bearing firmly against the fingers, dampening the vibration.

86. B — The steering wheel drifts to one side during straight highway driving with correct alignment. The steering gearbox's internal spool valve is not centring properly — the off-centre valve directs more hydraulic pressure to one side of the power piston than the other, creating a constant low-level assist in one direction that pushes the steering off-centre.

87. D — The replacement shocks are the correct part number for the vehicle, which means they are calibrated for the loaded vehicle weight. At the unloaded (empty) condition, the shocks provide more damping force than the lighter vehicle weight requires. The over-damped empty ride feels harsh because the shocks resist suspension movement more than necessary for the reduced weight.

88. A — Feathered wear across both steer tires with consistent direction indicates excessive toe — either toe-in or toe-out. The toe misalignment creates a constant lateral scrubbing force on each tread rib during straight-line driving. One edge of each rib is worn sharp by the scrubbing direction while the opposite edge tapers smoothly from the drag direction.

89. C — The worn centre pivot bushing allows the equalizer beam to tilt 10° side to side. The tilted beam pushes one axle forward and the other rearward from their designed alignment positions. This creates a thrust angle error that causes the trailer to track to one side, produces uneven tire wear between the two axle positions, and may affect weight distribution.

90. B — The popping sound during tire inflation is the bead snapping over the rim's safety ridge and seating into the designed bead seat position. This is a normal part of the mounting process — the bead must pass over the safety hump to reach the bead seat area. The pop confirms the bead has seated correctly on the rim.

91. D — The fifth wheel mechanism locks correctly and the jaw surfaces show normal wear. The rhythmic fore-aft rocking proportional to vehicle speed indicates excessive play at the king pin coupling — either the locking jaw mechanism has worn bushings, the king pin has worn smaller, or the fifth wheel bracket has developed play at its mounting points.

92. A — The freshly adjusted hub reads 15°C hotter than the opposite non-adjusted hub after 50 km of driving. A fresh bearing adjustment with new preload and fresh grease creates slightly more friction than the fully broken-in opposite side. The temperature difference is expected during the initial break-in period and will equalize after approximately 500 km of service.

93. C — Brake squeal during light applications that disappears under moderate-to-heavy braking is caused by pad vibration at the pad's natural resonant frequency. During light braking, the low clamping force allows the pad to oscillate at an audible frequency. Heavier braking increases the clamping force, which dampens the vibration and eliminates the squeal.

94. A — Hub-piloted wheel nuts have a flat contact face designed for the hub-piloted system's flat mounting surface. Stud-piloted systems use ball-seat (conical) lug holes that require matching ball-seat nuts for proper centering. The flat hub-piloted nut cannot centre the wheel on the stud-piloted hub's conical seats, creating the potential for wheel-off from the improperly centred wheel.

95. D — The ride height is correct when parked but drops 25 mm at highway speed. The height control valve linkage geometry creates a different reference height during the dynamic suspension oscillation of highway driving versus the static parked position. The arm angle changes as the suspension moves during driving, producing a lower average commanded height.

96. A — A sidewall bubble indicates a separation between the inner plies of the tire's carcass structure. The separated plies create a weak point that cannot contain the tire's inflation pressure. The bubble can rupture catastrophically under load or impact, causing a sudden tire failure. The tire must be replaced immediately regardless of remaining tread depth.

97. C — The tandem pump has two independent pumping sections — one for steering and one for the brake booster. The steering section functions correctly (confirming the pump drive and inlet are adequate). The booster section has worn independently, reducing its output below specification. The two sections can fail independently because they have separate internal components.

98. B — The rubber snubbers show heavy contact marks and 50% compression indicating the suspension regularly reaches full jounce (bottoming out). The leaf springs have weakened from fatigue and the reduced spring rate allows excessive suspension travel. The springs should be inspected for sag and replaced if the ride height is below specification.

99. D — The landing gear was cranked down to clear the fifth wheel plate, but when the tractor pulled away the trailer nose dropped 50 mm. The landing gear's sand shoes were not deployed before cranking. The narrow foot pads without the sand shoes have a small contact area that sank into the pavement under the trailer's nose weight, dropping the nose after the tractor cleared.

100. A — The tire balances at zero on a standard spin balancer but produces a vibration on the steer axle at highway speed. A road force balance test measures the tire's radial and lateral force variation under simulated road loading. Structural variations (shifted belts, uneven ply tension) produce once-per-revolution force variations that a standard unloaded spin balance cannot detect.

101. C — The helper springs increased the steer axle's load capacity, and the operator has been loading the front axle heavier than the original suspension's design allowed. The additional weight compresses the suspension beyond the alignment's designed operating range, changing the camber dynamically under the heavier load and producing the inner-edge wear pattern.

102. B — Dark brown gritty grease with matte-grey roller surfaces indicates abrasive contamination. Fine dirt or sand has entered through a failed seal and the contaminated grease acts as an abrasive lapping compound during bearing rotation. The abrasive particles have worn the original polished roller surfaces to a matte finish, and the bearing must be replaced.

103. D — Deep grooves in the fifth wheel plate from the king pin's turning arc create channels that trap debris (gravel, sand, ice) during articulation. The trapped debris acts as an abrasive between the fifth wheel and the trailer's upper coupler plate, accelerating wear on both coupling surfaces during every tractor-trailer articulation movement.

104. A — One deflated cab air spring creates an asymmetric three-point support. The cab tilts to the right rear, and the uneven weight distribution concentrates stress on the remaining three mounting points and the cab frame at the failed spring location. The concentrated loading can crack the cab mounting brackets during rough road driving from the repeated asymmetric impacts.

105. C — The fuel system has no visible leaks, the tank and lines are dry. The fuel tank vent system may be plugged, creating internal tank pressure during driving that forces fuel vapour through the fill cap or vent line. The pressurized vapour escapes and is carried by the wind along the cab exterior toward the HVAC fresh air intake during forward motion.

106. B — The elongated pin hole allows the prop rod to shift under the cab's tilted weight. The worn hole may allow the retaining pin to disengage during vibration, an accidental bump, or wind loading on the tilted cab. If the pin clears the elongated hole, the prop rod releases and the cab drops suddenly — creating a severe injury or fatality hazard.

107. D — The exhaust system has no leaks and the cab seals appear intact — yet the CO detector alarms during overnight idle. Exhaust can enter the cab through multiple paths: the HVAC intake location relative to the tailpipe, wind patterns that push exhaust under the truck and up through floor penetrations, and cab floor grommets or seals that are not visible during exterior inspection.

108. A — Floor perforations hidden by the floor mat create two hazards: road spray and moisture enter the cab causing ongoing corrosion to wiring and components under the floor, and exhaust gases from the engine and exhaust system can infiltrate through the holes into the cab. The carbon monoxide exposure hazard is particularly dangerous because the floor mat conceals the entry points.

109. C — The trailer was pre-cooled to -18°C before loading, but the return air reads -14°C after 2 hours. The cargo was loaded at a temperature warmer than -18°C . The thermal mass of the warmer frozen product releases stored heat into the cargo space faster than the TRU at full capacity can remove it. The temperature will reach setpoint only after the cargo mass cools to -18°C .

110. B — The raise function works (confirming the pump and hydraulic circuit are functional). The tilt cylinder does not move despite confirmed pressure at the directional valve. The hydraulic line between the valve and the cylinder has a kink, obstruction, or closed shut-off valve that prevents the pressurized fluid from reaching the cylinder's port during the tilt command.

111. D — The fibreglass patch has cracked at its edge and moisture has entered the foam core. The failed repair must be completely removed, the moisture-damaged foam assessed and repaired, and a new repair performed that properly bonds to the panel surfaces. The new repair must address both the structural puncture and the moisture barrier to prevent recurrence.

112. A — The relay valve delivers equal flow to both outlets, but the second axle receives only 280 kPa versus 350 kPa at the first. With equal air line lengths, the difference originates inside the relay valve. An internal crack in the delivery chamber creates a leak path that bleeds air from the second axle's delivery passage, reducing its pressure below the first axle's reading.

113. C — The D-ring anchor welds have cracked despite operating within rated capacity. The cyclic loading from repeated cargo securement — tensioning, road vibration, load shifting, and release — applies and removes stress at the weld toe thousands of times during normal operation. This fatigue cycling creates micro-cracks that propagate until the weld fails.

114. B — After a tire replacement, the ABS activates prematurely during light braking on dry pavement. The replacement tire has a different rolling diameter than the other tires, creating a wheel speed difference. The ABS module interprets the mismatched speed from the different-diameter tire as impending lockup and modulates prematurely during light brake applications.

115. D — The butt connector crimps passed the initial function test 3 months ago but now produce intermittent flickering. Moisture has entered through an incomplete seal at the heat shrink, and the crimped wire-to-connector interface has corroded. The corroded connection creates intermittent high-resistance contact that fluctuates during driving vibration, causing the lamp to flicker.

116. A — The replacement drum has a different casting number but matching diameter and width. Different casting numbers may indicate different iron alloys with different thermal properties, wear rates, and fade characteristics. The replacement drum may perform differently than the OEM specification under extreme braking conditions, affecting brake balance and safety margins.

117. C — The A/C cools adequately at city speed but decreases at highway speed despite the condenser fan operating. Road debris accumulated on the condenser face restricts airflow. At city speed, the lower airflow velocity passes through the partially blocked fins adequately. At highway speed, the debris-blocked fins cannot pass the higher volume of air needed for heat rejection.

118. B — The acidic particles in the flush solution indicate the coolant's corrosion inhibitor package had depleted before the flush. The acidic coolant was actively corroding the heater core's internal surfaces for an extended period. The flush restored flow by removing the corrosion deposits, but the structural damage to the thinned tube walls may result in leaks soon.

119. D — The system has correct charge weight and normal pressures, but the compressor cycles every 45 seconds instead of every 3 minutes. The cycling switch (thermostatic or low-pressure) has drifted from its calibration and triggers the compressor off at a higher threshold than designed. The compressor reaches this lower threshold more quickly, producing the frequent cycling.

120. A — The fuel-fired heater's fuel metering pump delivers measured fuel pulses to the combustion chamber. The clicking noise at 30-second intervals corresponds to the pump's delivery cycle at the heater's current heat demand setting. The metering pump is a solenoid-operated diaphragm type that produces an audible click with each fuel delivery pulse during operation.

121. C — Some A/C systems show bubbles in the sight glass even when correctly charged to the specification weight. The sight glass location in the liquid line, the system's internal flow pattern, and the specific refrigerant-oil mixture can create turbulence or vapour transition near the glass. The technician should verify against the system's specific service information before adding refrigerant.

122. B — The replacement blower motor produces a humming noise specifically at speed 3 that is not present at other speeds. The blower motor resistor for the speed 3 position has a fault that introduces electrical noise into the motor's power supply at that specific speed setting. The modulated power creates an audible hum in the motor at the speed 3 frequency.

123. D — After a compressor failure requiring system flush, the new compressor is louder than normal. The refrigerant oil type and quantity must be verified — the wrong oil specification or insufficient oil volume creates lubrication problems inside the compressor. Inadequate or incorrect oil causes metal-to-metal contact between the compressor's internal components producing the noise.

124. A — The drum speed has decreased 20% with correct fluid level and system pressure. The drum drive motor has worn internally, and the enlarged clearances allow hydraulic fluid to bypass through the motor without performing work. The motor receives full flow but 20% bypasses internally, reducing the effective rotational output proportionally.

125. C — The dump body lowers at the correct speed until 75% and then accelerates for the final 25%. The body's weight distribution shifts as it lowers — at 75% lowered, the centre of gravity changes its relationship to the pivot point. The altered load characteristic changes the cylinder's load pressure which shifts the counterbalance valve's operating point, allowing faster descent.

126. B — The proportional valve should provide smooth variable speed control but the boom lurches from stopped to full speed. The priority valve is sending too much flow to the steering circuit. The over-prioritized steering starves the crane's secondary circuit of the flow needed for smooth proportional operation, and the reduced flow creates the all-or-nothing response.

127. D — The outrigger cylinder retracts with the engine off and the valve in neutral. The holding circuit has a leak — either the POCV seat has worn, the cylinder piston seal bypasses, or the valve spool clearance drains the holding pressure. Each component must be isolated individually to identify the specific leak source, as the symptom is identical regardless of the component.

128. A — The erratic gauge jumps between 5,000 and 15,000 kPa while a second gauge reads steady 10,000 kPa. The system functions normally (confirmed by the operator and the second gauge). The erratic gauge has a failed internal Bourdon tube with a fatigue crack that flexes under pressure, causing the needle to jump erratically. The gauge must be replaced.

129. C — The accumulator absorbs hydraulic pressure spikes by compressing the nitrogen gas when the system pressure rises suddenly. The compressible gas absorbs the energy of the pressure spike faster than the mechanical relief valve can mechanically open. The accumulator acts as a hydraulic shock absorber, smoothing the pressure transients from sudden flow changes.

130. B — The pump operated for 200 hours with a 60%-blocked suction strainer. The restricted inlet starved the pump of oil, causing sustained cavitation. The vapour bubbles formed in the low-pressure zones collapsed violently against the pump's internal surfaces — gears, vanes, or pistons — eroding the metal over the 200-hour period of restricted operation.

131. D — The crane's rated capacity is determined by both the structural strength of all components and the vehicle's tipping stability. Installing a larger cylinder increases the hydraulic force but does not upgrade the boom, pins, base frame, outrigger supports, or the truck chassis. The increased force can exceed the structural capacity of any component or the tipping limit, creating catastrophic failure risk.

132. A — The motor temperature is normal and the battery SOC is at 80%, but the inverter limits current to 70%. The inverter's coolant temperature has exceeded its internal thermal protection threshold. The power transistors (IGBTs or MOSFETs) generate heat during switching, and the inverter derates its output to protect these components from thermal damage.

133. C — The regenerative braking torque is applied equally to both wheels through the differential — the traction motor produces a single braking torque that the differential distributes. Any perceived directional pull during regenerative braking must come from an asymmetric friction brake condition on one side — drag, contamination, or adjustment difference — not from the motor itself.

134. B — The BMS detects cell temperatures dropping below or rising above the designed safe storage range during overnight parking. The BMS activates the battery thermal management system automatically to protect the cells — heating when cold, cooling when hot. The overnight temperature fluctuations trigger these automatic protection events regardless of any driver-set timer.

135. D — The disconnect clutch between the engine and transmission has failed in the engaged position. In EV mode, the motor drives the vehicle through the transmission, but the locked clutch also turns the crankshaft. The forced crankshaft rotation starts the engine mechanically through the compression events. The engine runs at motor-driven speed without providing propulsion torque.