PRACTICE EXAM 13: ASE T2 SIMULATION

DOMAIN A — GENERAL ENGINE DIAGNOSIS (Questions 1–11)

1. A fleet technician is dispatched to a roadside breakdown. The tractor has lost power and is in 5 mph derate. Before any repair attempt, the FIRST action should be:

A. Connect a scan tool and read all DTCs, freeze frame data, and inducement status

B. Replace the fuel filter

C. Refill the DEF tank

D. Jump-start the batteries

2. A scan tool snapshot at the moment a DTC sets shows engine operating parameters — RPM, load, temperatures, pressures. This data is called:

A. Adaptive values

B. Readiness monitors

C. Long-term trim values

D. Freeze frame data

3. A heavy-duty diesel has developed a knock that is loudest at low RPM and synchronized with engine firing frequency. This description is MOST consistent with:

A. Valve train clatter

B. Exhaust manifold leak

C. Rod bearing knock intensifying at low speeds

D. Normal combustion noise

4. An oil analysis shows elevated sodium, potassium, and boron together. These three elements rising simultaneously indicate:

A. Coolant contamination of the engine oil

B. Normal additive depletion

C. Air intake contamination

D. Piston ring wear

5. A customer reports gradual power loss over several weeks on a Class 8 tractor. Boost pressure, rail pressure, and exhaust back pressure all measure within specification. The MOST likely additional area to investigate is:

A. Battery voltage only

B. The aftertreatment system, DPF loading, SCR function, and DEF quality

C. Engine oil viscosity

D. Coolant system hoses

6. A cylinder cutout test shows one cylinder producing no measurable RPM drop when disabled. This result indicates:

A. The cylinder is producing full power

B. The scan tool is malfunctioning

C. Normal variation between cylinders

D. The cylinder is not contributing before cutout

7. Oil analysis shows silicon rising from 14 to 82 ppm with iron remaining normal. The MOST likely cause is:

A. Normal wear

B. Coolant contamination

C. Dirt ingestion from a leaking air intake

D. Fuel contamination

8. A heavy-duty diesel has been experiencing repeated warranty visits for the same intermittent complaint. The appropriate approach is:

A. Review the full diagnostic history and verify current ECM calibration

B. Replace the ECM

C. Replace all injectors

D. Return the truck as unrepairable

9. A technician is diagnosing an intermittent fault that occurs only during hot weather. The MOST useful diagnostic approach is:

A. Cold-weather component inspection

B. Monitor live data during hot-weather conditions when the symptom occurs

C. Replace the ECM

D. Disassemble the engine

10. A heavy-duty diesel produces white smoke that persists after warmup and intensifies under load. The MOST likely cause is:

A. Normal cold-start operation

B. Low cetane fuel

C. Coolant entering the combustion chamber

D. Worn piston rings

11. A cylinder contribution reading shows all six cylinders within 3% of each other, and rail pressure matches commanded pressure during full-throttle operation. The fuel system is:

A. Suffering from injector failure

B. Approaching rail pressure relief limit

C. Experiencing HP pump wear

D. Operating within normal parameters

DOMAIN B — CYLINDER HEAD AND VALVE TRAIN (Questions 12–15)

12. Valve stem-to-guide clearance above specification will:

A. Improve oil distribution

B. Reduce oil consumption

C. Have no effect on operation

D. Allow oil down the valve stem and impair valve seal function

13. A cylinder head warpage reading of 0.008 inches against a 0.004-inch specification requires:

A. Installation with a thicker gasket

B. Resurfacing within OEM material removal limits

C. No action if bolts are TTY

D. Reinstallation with standard torque

14. Head bolts on modern heavy-duty diesels are typically:

A. Torque-to-yield fasteners requiring replacement after removal

B. Standard reusable bolts

C. Hand-tightened studs

D. Self-locking bolts that never need replacement

15. A valve rotator that has stopped working should be:

A. Reused during the current rebuild

B. Ignored since valves typically rotate naturally

C. Replaced to prevent localized valve face burning

D. Repaired in place

DOMAIN C — ENGINE BLOCK (Questions 16–20)

16. A piston-to-cylinder clearance measurement of 0.009 inches where specification is 0.003–0.005 inches will MOST likely produce:

A. Coolant contamination of oil

B. Excessive crankcase pressure

C. Failed oil cooler

D. Piston slap at cold startup

17. A connecting rod with a bent condition has been identified. Before installing the replacement:

A. Investigate what caused the original rod to bend

B. Install oversize bearings

C. Replace the crankshaft

D. Increase oil pressure

18. Cylinder liner protrusion uniformity around the circumference is critical because:

A. It affects coolant flow

B. Uneven protrusion produces uneven gasket crush and potential gasket failure

C. It changes compression ratio

D. It affects piston ring end gap

19. A forged steel monobloc piston is preferred over cast aluminum for heavy-duty service because:

A. It costs less to produce

B. It is lighter in weight

C. It is easier to install

D. It provides superior thermal durability at the crown

20. Crankshaft runout measurement exceeding specification typically indicates:

A. Bent crankshaft requiring replacement

B. Normal wear

C. Manufacturing defect acceptable in service

D. Thermal expansion only

DOMAIN D — LUBRICATION AND COOLING (Questions 21–26)

21. Low oil pressure at idle that recovers at 1,800 RPM is the classic signature of:

A. Failed oil pump

B. Stuck-closed relief valve

C. Worn main or rod bearings

D. Excessive oil viscosity

22. A coolant sample shows a freeze point of +12°F. The truck operates in a climate reaching -20°F. The correct action is:

A. Add tap water to the system

B. Drain and refill with correct glycol concentration

C. Ignore the reading

D. Install a block heater only

23. Oil-in-coolant without reverse contamination typically indicates:

A. Head gasket failure

B. Oil cooler internal leak

C. Cracked cylinder head

D. Worn piston rings

24. Engine oil typically runs at what temperature relationship to coolant at rated load?

A. 50°F below coolant temperature

B. Equal to coolant temperature

C. 10–20°F higher than coolant temperature

D. 100°F higher than coolant temperature

25. Supplemental coolant additive (SCA) replenishes:

A. Nitrite-based cavitation inhibitors

B. Ethylene glycol for freeze protection

C. Coolant dye

D. Water pump lubricant

26. A brown emulsion visible in the coolant surge tank indicates:

A. Normal coolant condition

B. Excessive SCA concentration

C. Air in the cooling system

D. Internal oil cooler leak with oil migrating into coolant

DOMAIN E — AIR INDUCTION AND EXHAUST (Questions 27–32)

27. A turbocharger with shaft radial play at 0.040 inches where specification is 0.020 max indicates:

A. Normal aging

B. Bearing wear beyond serviceable limits

C. New turbocharger condition

D. Thermal expansion only

28. An air intake leak between the filter and turbocharger admits:

A. Unfiltered dust to erode the compressor wheel

B. Coolant into the compressor

C. Exhaust into the intake

D. Oil into the intake

29. A charge air cooler contaminated with oil from a failed turbocharger compressor-side seal must be:

A. Ignored and left in place

B. Pressure-tested only

C. Cleaned or replaced before installing a new turbocharger

D. Painted externally

30. A VGT stuck in the closed position at high RPM produces:

A. Improved fuel economy

B. Low boost at all speeds

C. Normal operation

D. Excessive back pressure and potential turbocharger overspeed

31. Exhaust back pressure at rated load on a heavy-duty diesel should normally be below:

A. 25 psi

B. 5 psi

C. 15 psi

D. 40 psi

32. Active DPF regeneration is commanded when:

A. Accumulated DPF soot exceeds the passive regeneration threshold

B. The engine reaches idle speed

C. Ambient temperature falls below freezing

D. Vehicle speed exceeds a programmed limit

DOMAIN F — FUEL SYSTEM (Questions 33–48)

33. A heavy-duty diesel HPCR system has rail pressure reaching 10,000 psi against a commanded 26,000 psi. Lift pump output measures 30 psi (spec 45–60). The FIRST diagnostic step should be:

A. Replace all injectors

B. Update the ECM calibration

C. Replace the HP pump

D. Investigate the low-pressure supply system

34. Technician A says EUI injectors use cam-driven plungers. Technician B says HEUI injectors use high-pressure engine oil on a hydraulic intensifier. Who is correct?

A. Both Technician A and Technician B

B. Technician A only

C. Technician B only

D. Neither Technician A nor Technician B

35. A water-in-fuel warning has illuminated. The correct immediate response is:

A. Replace the fuel filter element

B. Add an anti-gel fuel additive

C. Clear the warning with a scan tool

D. Drain the water from the separator bowl

36. HPCR injector calibration codes must be programmed into the ECM because:

A. The codes confirm warranty coverage

B. The ECM compensates for individual injector flow characteristics

C. The codes prevent unauthorized installation

D. The codes activate injector electronics

37. A pilot injection event on an HPCR engine delivers approximately:

A. 2 to 5 percent of total cycle fuel

B. 30 percent of total cycle fuel

C. 50 percent of total cycle fuel

D. 85 percent of total cycle fuel

38. An injector return flow test shows one injector returning 50 mL/min while others return 15 mL/min. This indicates:

A. Normal operation

B. Under-fueling condition

C. Excessive internal injector leakage

D. A plugged return line

39. On an HEUI system, the Injection Control Pressure (ICP) sensor monitors:

A. Fuel rail pressure

B. Coolant pressure

C. Battery voltage

D. High-pressure engine oil supplied to injectors

40. Biodiesel B20 introduced to a diesel previously running petroleum diesel may cause:

A. Increased cetane rating

B. Premature fuel filter plugging from dissolved deposits

C. Reduced emissions only

D. Improved fuel economy

41. Primary fuel filters on heavy-duty diesels filter at approximately:

A. 10 to 30 microns nominal

B. 1 micron

C. 100 microns

D. No specified rating

42. An HPCR pressure control valve stuck in the closed position produces:

A. Reduced rail pressure

B. Improved engine efficiency

C. Normal operation

D. Rail pressure climbing to HP pump maximum output

43. A fuel cloud point of 20°F in a truck operating at -5°F will:

A. Improve cold-start performance

B. Cause wax crystals to plug fuel filters

C. Increase the cetane rating

D. Boil the fuel

44. Fuel temperature affects injection quantity because:

A. Hot fuel ignites at lower temperatures

B. Cold fuel is harder to ignite

C. Fuel density changes with temperature

D. Fuel viscosity determines cetane rating

45. An EUI injector requires:

A. Compressed brake air

B. High-pressure oil from a rail

C. Coolant flow through the injector

D. Cam-driven plunger motion with ECM solenoid control

46. A fuel tank vent blocked by debris will:

A. Improve fuel economy

B. Reduce fuel contamination

C. Develop tank vacuum, progressively starving the engine

D. Have no operational effect

47. A pilot injection is typically delivered:

A. At TDC exactly

B. 45 to 60 degrees BTDC

C. 15 to 25 degrees BTDC to initiate combustion before main injection

D. 30 to 40 degrees ATDC

48. On a common rail system, which component physically stores pressurized fuel between injection events?

A. The high-pressure pump

B. The common rail acting as a pressure accumulator

C. Each injector internally

D. The pressure control valve

DOMAIN G — STARTING AND CHARGING (Questions 49–52)

49. A heavy-duty diesel cranks slowly. Battery open-circuit voltage is 12.4V. Voltage drop across the positive cable during cranking reads 1.1V (spec 0.5V max). The MOST likely cause is:

A. Discharged batteries

B. Failed starter motor

C. Failed alternator

D. Excessive resistance in the cable or terminals

50. A parallel-wired battery pack has three batteries at 12.6V and one at 12.1V. The low-reading battery is:

A. Approaching failure with a possible bad cell

B. Fully charged

C. Over-charged

D. Normal variation

51. An AC ripple reading of 820 mV on alternator output (spec below 100 mV) indicates:

A. Slipping drive belt

B. Failed rectifier diodes

C. Discharged battery

D. Failed voltage regulator

52. A starter motor armature spins freely but does not crank the engine. The MOST likely cause is:

A. Discharged battery

B. Failed regulator

C. Worn starter drive or pinion

D. Blown starter fuse

DOMAIN H — ENGINE BRAKES (Questions 53–55)

53. Compression-release engine brakes use engine oil pressure to:

A. Lubricate the brake housing

B. Cool the brake mechanism

C. Hydraulically actuate the master and slave piston circuit

D. Monitor brake electronic status

54. An exhaust brake produces braking effort by:

A. A butterfly valve restricting exhaust flow

B. Opening exhaust valves near TDC

C. Reducing fuel injection

D. Activating the alternator

55. Dashboard brake level switches labeled LOW, MEDIUM, HIGH typically control:

A. Exhaust temperature during braking

B. The number of cylinders activated for braking

C. Transmission gear selection

D. Engine RPM ceiling during braking

PRACTICE EXAM 13: ANSWER KEY AND EXPLANATIONS

1. A — The scan tool is the primary diagnostic starting point at any breakdown. Active DTCs, freeze frame data, and inducement status immediately reveal what the ECM has detected and why the engine is derated. Parts replacement before this diagnostic step wastes time and frequently misses the actual cause.

2. D — Freeze frame data is the scan tool capture that records engine operating parameters at the exact moment a DTC was first detected. RPM, load, temperatures, and pressures at the time of the fault provide the context needed to understand under what conditions the problem occurred.

3. C — A rhythmic knock at low RPM synchronized with engine firing frequency is the classic signature of rod bearing wear. At low RPM, each individual combustion impact is distinguishable, making the knock audible. Higher RPM masks the individual impacts through firing frequency overlap.

4. A — Sodium, potassium, and boron together are the signature chemical elements of heavy-duty coolant additive packages. When all three rise simultaneously in an oil sample, coolant has entered the oil — typically from a head gasket, cracked head/block, or oil cooler failure.

5. B — With boost, rail pressure, and back pressure all within specification, the remaining power-loss factors are in the aftertreatment system. DPF loading progression, SCR function, and DEF quality can all reduce engine power output when the system forces derate or when exhaust backpressure develops downstream of measurement points.

6. D — A cylinder producing no measurable RPM drop when disabled was not contributing before cutout. If it had been firing normally, disabling it would produce a measurable drop. The absence of change is diagnostic evidence that the cylinder was already inactive — fuel delivery, mechanical, or both.

7. C — Silicon is the marker element for dirt contamination. Elevated silicon without other wear metals rising indicates external dirt is reaching the oil — most commonly through a leaking air intake allowing unfiltered dust into the engine. Repair prevents progression to wear metal elevation.

8. A — Repeated warranty visits on the same complaint indicate a diagnostic gap rather than hardware issues. Reviewing full diagnostic history and verifying current ECM calibration often reveals that the root cause was missed or that a calibration update addresses the condition. This systematic approach saves unnecessary parts replacement.

9. B — Intermittent hot-weather faults require observation during the specific conditions that produce them. Live data monitoring with a scan tool during hot weather allows the technician to observe parameter changes as temperature rises, identifying the specific component or sensor that fails thermally.

10. C — White smoke that persists after warmup and intensifies under load indicates coolant entering the combustion chamber. The coolant vaporizes to water vapor (visible as white smoke) during combustion. Common sources are head gasket failure, cracked head, or EGR cooler internal leak.

11. D — Rail pressure matching command, normal cylinder contribution balance within 3%, and proper fueling indicate the fuel system is operating within normal parameters under full-throttle conditions. These are the diagnostic indicators of healthy HPCR operation.

12. D — Excessive valve stem-to-guide clearance allows oil to flow down the valve stem past the worn guide and also prevents the valve stem seal from functioning effectively. The result is oil consumption through the guide, visible as blue smoke, and reduced oil life.

13. B — Warpage of 0.008 inches against a 0.004-inch specification requires resurfacing within OEM material removal limits. If total cumulative removal stays within the manufacturer's maximum, the head can be restored. Installing with thicker gaskets produces combustion leaks; ignoring warp produces gasket failures.

14. A — Modern heavy-duty diesel head bolts are almost universally torque-to-yield (TTY) fasteners. They are stretched past their yield point during installation to provide consistent clamping force. Once stretched, they cannot reliably produce correct clamp load on reuse, so OEMs require replacement after removal.

15. C — Valve rotators distribute wear evenly by rotating the valve slightly with each opening. Without rotation, the same portion of the valve contacts the same portion of the seat repeatedly, producing localized burning and uneven wear. Replacement during rebuild prevents this failure mode.

16. D — Piston-to-cylinder clearance nearly double the specification produces the classic cold-startup rattle described as piston slap. As the engine warms, thermal expansion closes the excessive clearance and the noise subsides, but wear has already accelerated and will continue until the piston is replaced.

17. A — Bent rods are typically symptoms of upstream events such as hydrolock, detonation, or severe cylinder pressure spikes. Installing a replacement rod without identifying the cause of the original bending guarantees repeat failure. Root cause investigation must precede reassembly.

18. B — Cylinder liner protrusion uniformity ensures the head gasket fire ring is crushed uniformly around the cylinder. Uneven protrusion produces uneven crush, which creates weak sealing zones that fail in service. Uniform protrusion is critical for gasket sealing integrity over engine life.

19. D — Monobloc forged steel pistons provide superior thermal durability because steel retains strength and dimensional stability at the high temperatures (often above 900°F at crown) that heavy-duty diesel pistons experience. Cast aluminum pistons cannot sustain these temperatures reliably in rated-load service.

20. A — Crankshaft runout exceeding specification indicates a bent crankshaft. Heavy-duty diesel crankshafts are not reliably straightened in commercial service; replacement is the correct action. Running a bent crank produces bearing failure and eventual crankshaft fracture.

21. C — Low oil pressure at idle that recovers at higher RPM is the classic signature of worn main or rod bearings. As clearance increases from wear, more oil leaks out of the bearings at low pump output (idle); at higher RPM, increased pump output overcomes the leakage to restore pressure.

22. B — A +12°F freeze point in a climate reaching -20°F means the coolant mixture will freeze during winter operation. Simply adding antifreeze to a degraded mixture cannot reliably restore protection; drain and refill with correct ratio guarantees freeze protection for the operating climate.

23. B — Oil-in-coolant without reverse contamination (no coolant-in-oil) is the classic signature of an oil cooler internal leak. Oil pressure exceeds coolant pressure, so internal leaks flow from high-pressure oil to lower-pressure coolant. Head gasket failures typically produce bidirectional contamination.

24. C — Engine oil typically runs 10–20°F higher than coolant temperature at rated load. The oil absorbs heat directly from bearings, piston cooling jets, and friction surfaces that operate hotter than the coolant. This thermal relationship is normal and indicates both systems are functioning correctly.

25. A — SCA is a nitrite-based additive that replenishes the cavitation inhibitor chemistry protecting cylinder liner outer surfaces. Cavitation damage occurs from coolant bubble collapse during cylinder flex; nitrite forms protective films that prevent this pitting attack.

26. D — Brown emulsion visible in the coolant surge tank is the classic signature of an internal oil cooler leak. Oil pressure exceeds coolant pressure, forcing oil into the coolant side where it floats to the top and forms a visible emulsion layer. The finding directs diagnosis specifically to the oil cooler.

27. B — Shaft radial play double the specification indicates bearing wear beyond serviceable limits. Heavy-duty turbocharger bearings wear from oil supply issues, contamination, or extended operation beyond service intervals. Turbocharger rebuild or replacement is required.

28. A — An air intake leak between the filter and turbocharger admits unfiltered dust directly to the compressor wheel. Abrasive particles erode the compressor blade leading edges and damage bearings, eventually destroying the turbocharger. This location has no secondary filtration.

29. C — An oil-contaminated CAC will immediately contaminate any new turbocharger installed on the same engine. Residue coats internal surfaces and provides a continuous contamination source. Cleaning or replacing the CAC before turbo installation is essential to prevent immediate re-failure.

30. D — A VGT stuck closed at high RPM restricts exhaust flow precisely when volume is highest. The result is excessive back pressure, potential turbocharger overspeed, and elevated cylinder pressures that can damage pistons and valves. The condition cannot be tolerated; immediate intervention is required.

31. B — Normal exhaust back pressure at rated load on a heavy-duty diesel is 3 to 5 psi maximum. Values above 5 psi indicate restriction in the exhaust system or aftertreatment. The specification provides the threshold for diagnosis of aftertreatment or exhaust path issues.

32. A — Active regeneration is commanded when accumulated DPF soot exceeds the threshold that passive regeneration can clear. The ECM then initiates fuel dosing to raise DPF temperature high enough to burn off accumulated soot. Engine speed, ambient temperature, and vehicle speed are not primary triggers.

33. D — Lift pump output at 30 psi (well below 45–60 spec) indicates inadequate low-pressure supply, which prevents the HP pump from building rated rail pressure. The low-pressure supply must be verified and repaired first before investigating HP components. Parts replacement without addressing supply wastes time.

34. A — Both technicians are correct. EUI injectors use cam-driven plungers inside each injector to generate injection pressure locally. HEUI injectors use high-pressure engine oil acting on a hydraulic intensifier inside each injector. These defining characteristics distinguish the two injection technologies.

35. D — A water-in-fuel warning indicates water has accumulated in the separator bowl to the sensor level. Draining via the manual drain valve releases the water and should clear the warning. This is standard maintenance; replacing filters, adding additives, or clearing the warning without draining does not address the actual condition.

36. B — HPCR injectors carry unique factory calibration codes encoding individual flow characteristics. The ECM uses this code to compensate for injector-to-injector variation during operation. Without proper coding, cylinder balance faults and emissions issues develop because the ECM cannot match actual injector flow to command.

37. A — Pilot injection delivers a small quantity of fuel, typically 2 to 5 percent of total cycle fuel. The small volume is enough to initiate combustion early and raise chamber conditions, reducing ignition delay on the main injection and significantly reducing diesel combustion noise. Main injection delivers 65–85% of total fuel.

38. C — Return flow of 50 mL/min against peers at 15 mL/min represents more than triple the normal leakage rate. This indicates excessive internal leakage past worn plungers or control valves — rail pressure escapes through the return path rather than being delivered as injection. Injector service or replacement is required.

39. D — On HEUI systems, the ICP (Injection Control Pressure) sensor monitors the high-pressure engine oil supplied to the injectors. HEUI injection pressure is generated from this oil acting on each injector's hydraulic intensifier. ICP feedback allows the ECM's pressure control loop to maintain commanded injection pressure.

40. B — Biodiesel acts as a solvent and dissolves accumulated deposits in fuel tanks, lines, and filters. When switching from petroleum diesel to B20, these deposits flush through the system and collect in the fuel filter, causing premature plugging. Filter service intervals should be reduced during transition.

41. A — Primary fuel filters on heavy-duty diesels filter at 10 to 30 microns nominal. This coarser filtration captures significant contamination at high flow rates. The finer secondary filter (2–4 microns) provides final protection for high-pressure injection components; primary filters handle initial capture.

42. D — A pressure control valve stuck closed cannot bleed excess rail pressure. The HP pump continues pumping until reaching its maximum output capacity, far exceeding commanded pressure. Modern ECMs detect this overpressure condition and trigger protective derate to prevent catastrophic damage to fuel system components.

43. B — Fuel with a cloud point of 20°F will form wax crystals at any temperature below that value. In a -5°F climate, the wax progressively plugs fuel filters during cold operation. Anti-gel additives or winter blending are required to prevent wax-related operational problems in cold conditions.

44. C — Fuel density varies with temperature — hotter fuel is less dense than cooler fuel. Because injection is commanded as a volume (duration of valve open time at rail pressure), temperature-driven density changes affect the mass of fuel delivered per injection pulse. Modern ECMs compensate injection timing based on fuel temperature.

45. D — EUI injectors require cam-driven plunger motion to generate injection pressure internally. ECM solenoid control determines timing and duration of the injection event. This combination distinguishes EUI from HEUI (oil pressure) and HPCR (stored rail pressure) injection systems.

46. C — A blocked tank vent prevents atmospheric air from entering as fuel is consumed. Vacuum progressively develops in the tank, opposing fuel flow through the pickup. Initially the engine may run at low demand, but the vacuum eventually starves the engine, producing power loss and stalling.

47. C — Pilot injection occurs approximately 15 to 25 degrees before TDC to initiate combustion before the main injection arrives. This early combustion raises chamber pressure and temperature,

reducing ignition delay on the main event and significantly reducing diesel combustion noise and NOx formation.

48. B — The common rail is the pressurized accumulator that stores fuel between injection events. The HP pump maintains rail pressure; each injector releases stored pressure when commanded. Individual injectors do not store fuel internally, and the pressure control valve regulates rather than stores pressure.

49. D — Cable voltage drop of 1.1V (against 0.5V max) indicates excessive resistance in the positive cable or its terminal connections. Battery voltage is adequate at 12.4V, so the fault is not battery-related. The resistance restricts current flow to the starter, producing slow cranking despite sufficient battery charge.

50. A — A battery at 12.1V in a pack with three others at 12.6V shows lower open-circuit voltage indicating a possible cell failure or significant capacity degradation. The 0.5V difference is substantial and will degrade overall pack performance. Load testing confirms weakness; replacement is recommended.

51. B — AC ripple reading more than 8 times above specification is the classic signature of failed rectifier diodes. Each failed diode allows AC to pass through to the DC output. Elevated ripple damages sensitive electronic components throughout the vehicle, especially ECM circuits.

52. C — When the starter armature spins freely without cranking the engine, the drive mechanism has failed to transfer rotation to the flywheel ring gear. The pinion, Bendix drive, or shift fork is worn or damaged. Battery, regulator, and fuse issues would prevent armature rotation entirely.

53. C — Compression-release engine brakes use engine oil pressure to hydraulically actuate the master and slave piston circuit. The master piston (driven by a dedicated cam lobe) displaces oil through the circuit to the slave piston, which pushes the exhaust valve open near TDC. Adequate oil pressure is essential for the mechanism.

54. A — Exhaust brakes use a butterfly valve in the exhaust piping to restrict flow, creating back pressure that the piston must pump against during the exhaust stroke. The pumping work absorbs drivetrain energy. The mechanism is simpler than compression-release brakes but generally produces less braking power per cylinder.

55. B — Dashboard brake levels (LOW, MEDIUM, HIGH) control the number of cylinders activated for compression-release braking. LOW typically engages 2 cylinders, MEDIUM 4, and HIGH all 6 on a six-cylinder engine. Each level adds cylinders to progressively increase braking effort for different driving conditions.