PRACTICE EXAM 19: ASE T2 SIMULATION

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

1. A Class 8 tractor has been in the shop four times for the same progressive power loss complaint. Different parts have been replaced each visit without resolving the issue. The appropriate next step is:

A. Replace all injectors

B. Replace the ECM

C. Rebuild the engine

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

2. A heavy-duty diesel produces black smoke during hard acceleration. The engine is pre-emissions with no DPF. This smoke pattern indicates:

A. Normal engine operation

B. Overfueling relative to available air

C. Excessive coolant consumption

D. Low battery voltage

3. A scan tool snapshot captured at the moment a DTC sets shows engine operating parameters at the time of the fault. This data is called:

A. Freeze frame data

B. Readiness monitors

C. Long-term trim values

D. Adaptive values

4. An oil analysis report shows sodium, potassium, and boron all elevated simultaneously. This pattern indicates:

A. Normal additive depletion

B. Piston ring wear

C. Coolant contamination of the engine oil

D. Air intake contamination

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

A. Worn piston rings

B. Coolant entering the combustion chamber

C. Normal cold-start behavior

D. Low cetane fuel

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

A. Battery voltage

B. Engine oil viscosity

C. Coolant hose condition

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

7. Oil analysis shows silicon rising from 18 to 84 ppm with iron remaining normal. The MOST likely cause is:

A. Dirt ingestion from an air intake leak

B. Normal additive depletion

C. Coolant contamination

D. Fuel contamination

8. 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. Normal variation

C. The cylinder was not contributing before cutout

D. The scan tool is malfunctioning

9. A Class 8 tractor has been derated to 5 mph with inducement countdown active. This condition is triggered by:

A. Low engine oil level

B. Low battery voltage

C. Transmission failure

D. A persistent emissions-related fault in the aftertreatment system

10. Oil analysis shows lead at 30 ppm rising from a baseline of 5 ppm. Lead primarily indicates wear of:

A. Cylinder liner surfaces

B. Rod and main bearing overlay material

C. Piston ring sealing surfaces

D. Turbocharger bearings

11. A heavy-duty diesel has developed a knock loudest at low RPM and synchronized with firing frequency. This description matches:

A. Rod bearing knock intensifying at low speeds

B. Valve train clatter

C. Exhaust manifold leak

D. Normal combustion noise

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

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

A. Installing a thicker gasket

B. Reinstallation as-is

C. Resurfacing within OEM material removal limits

D. Ignoring the measurement

13. Head bolts on modern heavy-duty diesels are almost universally:

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

B. Reusable standard-torque bolts

C. Hand-tightened studs

D. Self-locking bolts that never need replacement

14. 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 stem and impair seal function

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

A. Ignored since valves rotate naturally

B. Replaced to prevent localized valve face burning

C. Repaired in place

D. Reused during current rebuild

DOMAIN C — ENGINE BLOCK (Questions 16–20)

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

A. Investigate what caused the original rod to bend

B. Install oversize bearings

C. Replace the crankshaft

D. Increase oil pressure

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

A. It affects compression ratio

B. It affects coolant flow rate

C. Uneven protrusion produces uneven gasket crush

D. It affects piston ring end gap

18. Block deck flatness inspection requires:

A. A caliper only

B. Hand feel along the surface

C. A standard ruler and paper

D. A precision straightedge and feeler gauges at multiple points

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

A. It is lighter than aluminum

B. It provides superior thermal durability at the crown

C. It costs less to produce

D. It is easier to install

20. Out-of-round on a crankshaft main journal is the difference between:

A. Perpendicular diameter measurements at the same axial position

B. Journal length and diameter

C. Journal diameter and bearing diameter

D. Axial measurements at the same angle

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. A failed oil pump

B. A stuck pressure relief valve

C. Worn main or rod bearings

D. Excessive oil viscosity

22. A coolant pressure test shows 15 psi dropping to 9 psi over 15 minutes with no visible external leak. The MOST likely cause is:

A. A failed pressure cap

B. An internal leak into combustion chamber or crankcase

C. A loose radiator hose

D. Normal coolant expansion

23. Supplemental coolant additive (SCA) replenishes:

A. Nitrite-based cavitation inhibitors

B. Ethylene glycol for freeze protection

C. Water pump lubricant

D. Coolant dye

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

A. Equal to coolant temperature

B. 50°F below coolant

C. 100°F higher than coolant

D. 10 to 20°F higher than coolant

25. Oil-in-coolant without reverse contamination MOST commonly indicates:

A. Head gasket failure

B. Cracked cylinder head

C. Oil cooler internal leak

D. Worn piston rings

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

A. Internal oil cooler leak with oil migrating into coolant

B. Excessive SCA concentration

C. Air in the cooling system

D. Normal coolant condition

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 operation

B. New turbocharger condition

C. Thermal expansion only

D. Bearing wear beyond serviceable limits

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

A. Improved fuel economy

B. Excessive back pressure and potential turbocharger overspeed

C. Reduced boost

D. Normal operation

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

A. Coolant into the compressor

B. Exhaust into the intake

C. Unfiltered dust eroding the compressor wheel

D. Oil into the combustion chamber

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

A. Cleaned or replaced before installing a new turbocharger

B. Painted externally

C. Pressure-tested only

D. Ignored and left in place

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

A. 25 psi

B. 5 psi

C. 40 psi

D. 15 psi

32. Active DPF regeneration is commanded when:

A. The engine reaches idle speed

B. Ambient temperature falls below freezing

C. Vehicle speed exceeds a programmed limit

D. Accumulated DPF soot exceeds the passive regeneration threshold

DOMAIN F — FUEL SYSTEM (Questions 33–48)

33. A heavy-duty diesel HPCR system has rail pressure reaching only 12,000 psi against commanded 26,000 psi. Lift pump output measures 30 psi (spec 45–60). The FIRST diagnostic step is:

A. Replace all injectors

B. Update the ECM calibration

C. Investigate the low-pressure supply system

D. Replace the HP pump

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. Technician A only

B. Technician B only

C. Neither Technician A nor Technician B

D. Both Technician A and 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 additive

C. Safely stop and drain the water from the separator bowl

D. Clear the warning and continue driving

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

A. The ECM compensates for individual injector flow characteristics

B. The codes prevent unauthorized installation

C. The codes confirm warranty coverage

D. The codes activate injector electronics

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

A. 30 percent of total cycle fuel

B. 2 to 5 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 at 50 mL/min against peers at 15 mL/min. This indicates:

A. Normal variation

B. A plugged return line

C. Under-fueling condition

D. Excessive internal injector leakage

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

A. High-pressure engine oil supplied to injectors

B. Fuel rail pressure

C. Coolant pressure

D. Battery voltage

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

A. Increased cetane rating

B. Reduced emissions only

C. Premature fuel filter plugging from dissolved deposits

D. Improved fuel economy

41. The primary fuel filter on a heavy-duty diesel typically filters at:

A. 2 microns

B. 10 to 30 microns nominal

C. 1 micron

D. 100 microns

42. An HPCR pressure control valve stuck closed produces:

A. Reduced rail pressure

B. Improved engine efficiency

C. Normal operation

D. Rail pressure climbing to HP pump maximum output

43. Fuel with a cloud point of 22°F operated at 0°F ambient will:

A. Form wax crystals that plug fuel filters

B. Improve cold-start performance

C. Increase cetane rating

D. Boil in the injection pump

44. Fuel temperature affects injection quantity because:

A. Hot fuel ignites at lower temperatures

B. Cold fuel cannot flow

C. Fuel density changes with temperature

D. Fuel viscosity determines cetane rating

45. An EUI injector requires:

A. Compressed brake air

B. Cam-driven plunger motion with ECM solenoid control

C. High-pressure oil from a rail

D. Coolant flow through the injector

46. A fuel tank vent blocked by debris will:

A. Improve fuel economy

B. Reduce fuel contamination

C. Create tank vacuum, progressively starving the engine

D. Have no operational effect

47. A pilot injection event is typically delivered:

A. At TDC exactly

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

C. 45 to 60 degrees BTDC

D. 30 to 40 degrees ATDC

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

A. The high-pressure pump

B. Each injector internally

C. The common rail acting as a pressure accumulator

D. The pressure control valve

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

49. A heavy-duty diesel cranks slowly. Battery 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. Excessive resistance in the cable or terminals

C. Failed starter motor

D. Failed alternator

50. A parallel-wired battery pack has three batteries at 12.6V and one at 12.0V. The low-reading battery is:

A. Fully charged

B. Over-charged

C. Normal variation

D. Approaching failure with a possible bad cell

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

A. Worn starter drive or pinion

B. Discharged battery

C. Failed voltage regulator

D. Blown starter fuse

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

A. Slipping drive belt

B. Failed voltage regulator

C. Failed rectifier diodes

D. Discharged battery

DOMAIN H — ENGINE BRAKES (Questions 53–55)

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

A. Lubricate the brake housing

B. Hydraulically actuate the master and slave piston circuit

C. Cool the brake mechanism

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 quantity

D. Activating the alternator

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

A. Exhaust temperature during braking

B. Engine RPM ceiling during braking

C. Transmission gear selection

D. The number of cylinders activated for braking

PRACTICE EXAM 19: ANSWER KEY AND EXPLANATIONS

1. D — Repeated failed repairs 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 never correctly identified or that a calibration update addresses the condition. This systematic approach saves unnecessary parts replacement.

2. B — Dense black smoke under hard acceleration on a pre-emissions diesel indicates overfueling relative to available air. Either too much fuel is being delivered or insufficient air is reaching the cylinders. Intake restrictions, worn turbochargers, or injector problems all produce this air-fuel imbalance.

3. A — Freeze frame data is the scan tool capture that records engine parameters — RPM, load, temperatures, pressures — at the exact moment a DTC was first detected. This contextual information is often more diagnostically valuable than the DTC itself, identifying the conditions under which the fault occurred.

4. C — Sodium, potassium, and boron 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 — 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.

6. D — 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.

7. A — Silicon is the marker element for dirt contamination. Elevated silicon without other wear metals rising indicates external dirt is entering the engine without yet causing significant internal wear. A leaking air intake is the most common cause; repair prevents progression to wear metal elevation.

8. C — 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.

9. D — Inducement countdown on a derated Class 8 tractor is specifically an emissions-related enforcement action. The ECM has detected a persistent fault in the aftertreatment system (typically SCR or DEF-related) and is progressively limiting engine operation per EPA requirements. Other listed conditions do not trigger inducement.

10. B — Lead is the primary marker element for rod and main bearing overlay wear. The overlay is typically a thin lead-tin alloy that provides the bearing's running surface. Rising lead levels in oil analysis indicate this overlay is wearing, providing early warning of bearing deterioration before catastrophic failure.

11. A — 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.

12. C — 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 or ignoring warp produces combustion leaks and gasket failures.

13. 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.

14. 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.

15. B — 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 prevents this failure mode.

16. 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.

17. C — 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.

18. D — Block deck flatness requires a precision straightedge placed across the deck surface, with feeler gauges measuring any gap. This technique identifies warp in multiple orientations — longitudinal, transverse, and diagonal. Calipers, hand feel, and rulers cannot accurately measure flatness.

19. B — 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 — Out-of-round is specifically the difference between diameter measurements at perpendicular angles (typically 90°) at the same axial position. This measures cross-sectional shape distortion. Taper — the separate measurement — is the difference between axial positions at the same angle.

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 — Pressure loss with no external leak indicates internal leakage into the combustion chamber or crankcase. Head gasket failure and cracked head/block are the two primary paths. Combustion leak testing can confirm which internal path is losing coolant, guiding the specific repair needed.

23. A — SCA is a nitrite-based additive that replenishes 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.

24. D — Engine oil typically runs 10 to 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. C — Oil-in-coolant without reverse contamination is the classic signature of an oil cooler internal leak. Oil pressure normally exceeds coolant pressure, so internal leaks flow from high-pressure oil to lower-pressure coolant. Head gasket and block cracks would typically produce bidirectional contamination.

26. A — 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. D — Shaft radial play double the maximum 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. B — 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.

29. C — 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.

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

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. D — 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. C — 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. D — 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. C — A water-in-fuel warning indicates water has accumulated in the separator bowl to the sensor level. Safely stopping and draining the water prevents it from reaching the fuel filter and injection system, which would cause serious damage. Continuing operation risks expensive fuel system contamination.

36. A — 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. B — 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. D — 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. A — 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. C — 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. B — 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. A — Fuel with a cloud point of 22°F will form wax crystals at any temperature below that value. In a 0°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. B — 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. B — 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. C — 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. B — 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. D — A battery at 12.0V in a pack with three others at 12.6V shows lower open-circuit voltage indicating a possible cell failure or significant capacity degradation. The 0.6V difference is substantial and will degrade overall pack performance. Load testing confirms weakness; replacement is recommended.

51. A — 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.

52. C — 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.

53. B — 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. D — 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.