

# PRACTICE EXAM 19: ASE A8 ENGINE PERFORMANCE FULL-LENGTH SIMULATION

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50 Questions | 75 Minutes

## DOMAIN A — GENERAL DIAGNOSIS (Questions 1–12)

1. A vacuum gauge at idle shows a reading of 18 in/Hg. The needle drops sharply by 4–5 in/Hg at a regular interval that corresponds exactly to engine firing frequency. RPM is stable. What does this MOST likely indicate?

- A. A sticking EGR valve responding to manifold vacuum pulses
- B. A single cylinder misfiring on every firing event
- C. Worn piston rings on one cylinder reducing pumping efficiency
- D. A vacuum leak that opens and closes with intake manifold pulses

2. A compression test on a V6 shows cylinders 1, 2, 4, and 5 between 158 and 170 psi. Cylinders 3 and 6 both read 105 psi dry and 106 psi wet. What does this MOST likely indicate?

- A. Worn rings on cylinders 3 and 6 simultaneously
- B. Burned valves on both cylinders 3 and 6
- C. A head gasket breach causing cross-cylinder pressure equalization between cylinders 3 and 6
- D. Carbon deposits reducing compression on both cylinders

3. An engine produces a loud single knock that occurs once per crankshaft revolution at idle, increases under load, and is most prominent at operating temperature. Oil pressure is normal. What is the MOST likely cause?

- A. Piston slap occurring on the thrust side once per revolution
- B. A loose flywheel producing one knock event per crankshaft revolution
- C. A worn timing chain tensioner producing one impact per revolution at the front of the engine
- D. A worn crankshaft main bearing producing one knock event per revolution under combustion loading

4. A cylinder leakage test on cylinder 5 shows 19% leakage — within the 20% maximum. The technician notes the reading fluctuates between 14% and 24% on consecutive tests without repositioning the piston. What should the technician check FIRST?

- A. The cylinder 5 valves for a sticking condition causing inconsistent sealing between tests
- B. The cylinder 5 rings for a worn condition that produces variable leakage
- C. The leakage tester calibration for an accuracy fault at this leakage percentage
- D. The cylinder 5 head gasket for intermittent sealing that varies between tests

5. An engine has a misfire under all operating conditions that is worse at idle. Compression is normal. A scope test of the ignition confirms all coils firing correctly. Fuel pressure is correct. LTFT is +22% on all banks. What should the technician check NEXT?

- A. The upstream O<sub>2</sub> sensors for simultaneous contamination causing false lean corrections
- B. The fuel injectors for restriction causing lean misfires under all operating conditions
- C. The MAF sensor for severe underreading causing a lean misfire at all operating conditions
- D. A large vacuum leak introducing unmeasured air and causing the lean misfire condition

6. A cooling system pressure test is performed. The system holds 14 psi for 10 minutes, then drops to 8 psi over the next 5 minutes. The technician finds a small puddle under the water pump. What does this confirm?

- A. The head gasket is leaking — coolant loss from the water pump is a secondary effect

- B. The water pump seal is leaking under sustained pressure — the pump is the source of the pressure loss
- C. The radiator has a pinhole leak — the puddle under the pump is from coolant spray during the test
- D. The thermostat is stuck open causing pressure to drop and coolant to weep past the water pump seal

7. A relative compression test shows cylinders 1 through 5 with consistent crank speed and amperage. Cylinder 6 shows slower crank speed than all others and significantly higher amperage on every compression stroke. What does this indicate?

- A. A CKP signal error at the cylinder 6 position inflating the amperage reading
- B. Carbon deposits on the cylinder 6 piston raising effective compression slightly
- C. Cylinder 6 injector activating during the test adding fuel and affecting the stroke reading
- D. Cylinder 6 has significantly higher compression than all other cylinders

8. An engine has a persistent knock at all operating conditions that does not change with temperature or load. Removing any spark plug wire one at a time has no effect on the knock. Oil pressure is normal. What should the technician check FIRST?

- A. The accessory drive components — belt, tensioner, idler pulleys — for a mechanical noise unrelated to combustion
- B. The connecting rod bearings for load-insensitive wear producing a constant knock
- C. The piston pins for wear that produces a constant double knock independent of combustion loading
- D. The timing chain for a constant rattle from tensioner failure that does not change with load

9. A cylinder contribution test at idle shows all cylinders dropping 185–205 RPM when individually disabled. After completing the test, the engine idles roughly and a P0301 sets. What MOST likely caused the P0301 to set after the test?

- A. The contribution test procedure damaged the cylinder 1 coil from repeated activation and deactivation
- B. The fuel injector on cylinder 1 was damaged during the disable sequence and is now restricted

- C. The cylinder 1 spark plug was fouled by the contribution test procedure and now misfires continuously
- D. The P0301 was a pending code that became confirmed during the contribution test drive cycle

10. An engine has high oil consumption with no external leaks and no smoke visible under any driving condition. The PCV system is confirmed functional. Compression and leakage are normal. What should the technician check NEXT?

- A. The valve stem seals for internal consumption producing smoke only during cold starts
- B. The catalytic converter for oxidizing oil consumption smoke before it exits the tailpipe
- C. The oil cooler for an internal leak allowing oil to enter the coolant circuit
- D. The turbocharger seal for a minor weep that is consumed before reaching the tailpipe

11. A snap-throttle vacuum test produces a normal sharp drop to zero at snap-throttle. The recovery is immediate but the needle settles 3 in/Hg below the pre-test idle baseline and remains there. What does this indicate?

- A. Weak valve springs that cannot fully close after the snap-throttle event
- B. A vacuum hose that dislodged during the snap-throttle event introducing a new vacuum leak
- C. Retarded ignition timing — the post-snap vacuum settling below baseline confirms a timing fault
- D. Normal snap-throttle recovery — a 3 in/Hg post-test variation is within acceptable range

12. A no-start condition exists. Spark is confirmed at all cylinders. Fuel pressure is 56 psi. Compression is 160 psi on all cylinders. Injector pulse is confirmed on all cylinders. A scan tool shows IAT reading -40°F on a vehicle in a 65°F shop. What does the -40°F IAT reading indicate?

- A. The IAT sensor or its circuit has an open — a -40°F reading is the default for an open IAT circuit on most calibrations
- B. The IAT sensor is reading intake temperature correctly — the intake manifold is cold-soaked from overnight storage

C. The MAF sensor has failed — IAT is integrated into the MAF on this vehicle and the reading confirms MAF failure

D. The PCM has a fault preventing correct IAT processing — the -40°F is a PCM default value

**DOMAIN B — IGNITION SYSTEM DIAGNOSIS AND REPAIR (Questions 13–20)**

13. A spark plug removed from a cylinder shows a black, dry, sooty deposit covering the entire insulator and electrode. The electrode shows minimal erosion. What does this indicate?

A. Carbon fouling from a rich mixture, excessive idling, or repeated short trips preventing full combustion temperature

B. Oil fouling from worn valve stem seals coating the plug with combusted oil deposits

C. Normal deposits on a plug operating at the lower end of its heat range specification

D. Fuel fouling from a flooding condition saturating the plug with raw fuel

14. A P0358 ignition coil H fault is stored. Supply voltage to coil H is 12.3 volts. The PCM command wire reads 12.0 volts at rest and drops to 0.4 volts when commanded. Spark is produced. What is the MOST likely explanation?

A. The 0.4-volt residual confirms high resistance in the PCM driver ground path — the driver is functioning but not fully saturating

B. The command wire resting at 12.0 volts confirms a short to power that set the stored code

C. The code was set during a previous intermittent event — current circuit operation is correct and the code should be cleared and monitored

D. The 0.4-volt drop confirms the coil H primary winding has excessive resistance limiting the driver's ability to pull the circuit low

15. A secondary ignition scope shows a normal firing line followed by a spark line that extinguishes immediately — within the first 10% of normal arc duration — on one cylinder. No misfire code is stored. What does a very brief spark line MOST likely indicate?

- A. A wide plug gap requiring all available secondary energy to initiate the arc with none remaining for sustain
- B. A conductive path parallel to the plug gap — carbon tracking, fouling, or a cracked insulator — allowing the arc to collapse immediately
- C. A weak coil on that cylinder producing insufficient stored energy to sustain the arc beyond initiation
- D. A high-resistance plug wire reducing available secondary current and causing premature arc extinction

16. A Hall effect CKP sensor is tested during cranking. The signal switches cleanly between 0 and 5 volts. On a DVOM set to AC volts, the meter reads 2.4 volts. What is the correct interpretation of the AC voltage reading?

- A. The 2.4-volt AC reading indicates a ground loop in the sensor circuit producing unwanted AC voltage
- B. The DVOM is measuring the RMS value of the square wave — a square wave with equal high and low time produces an RMS of approximately half the peak voltage
- C. The AC reading confirms the sensor is producing a sine wave rather than a square wave, indicating sensor degradation
- D. The 2.4-volt AC reading confirms the sensor supply voltage is dropping below operating threshold during cranking

17. A COP system has a P0302 misfire on cylinder 2. The cylinder 2 coil is swapped with the cylinder 6 coil. After clearing and a test drive, P0302 returns and P0306 does not set. What should the technician check NEXT on cylinder 2?

- A. The spark plug, injector, compression, and leakage on cylinder 2 — the coil swap confirmed the coil is not the cause
- B. The PCM driver circuit for cylinder 2 — the misfire staying at cylinder 2 after the coil swap confirms a driver fault
- C. The plug wire on cylinder 2 — the misfire staying at cylinder 2 after the coil swap isolates the wire
- D. A vacuum leak at the cylinder 2 intake port — the ignition and coil are confirmed good by the swap test

18. A magnetic reluctance CKP sensor waveform is viewed on a lab scope at idle. The waveform shows clean, consistent tooth signals throughout. At 3,500 RPM, the waveform develops a consistent hash or noise pattern superimposed on the tooth signals. The noise disappears when a nearby plug wire is repositioned away from the CKP harness. What does this confirm?

- A. The CKP sensor has a speed-dependent internal fault that manifests at elevated RPM
- B. The reluctor wheel has surface oxidation that produces noise at high tooth-passing frequency
- C. Electromagnetic interference from the adjacent plug wire is inducing noise into the CKP signal at elevated RPM
- D. The PCM input filter is saturating at high signal frequency, producing the apparent noise pattern

19. A distributor ignition system has a confirmed misfire on cylinder 2. A new spark plug on cylinder 2 does not resolve it. A new plug wire on cylinder 2 does not resolve it. Compression and leakage on cylinder 2 are normal. The ignition module and coil are confirmed functional. What should the technician check NEXT?

- A. The fuel injector on cylinder 2 for a restriction causing lean misfire
- B. The distributor cap terminal for cylinder 2 for corrosion, carbon tracking, or physical damage
- C. The distributor advance mechanism for a fault causing over-advance specifically at the cylinder 2 firing position
- D. The PCM for a fuel delivery calculation fault specific to cylinder 2

20. A technician is testing a COP coil. Primary resistance is 0.9 ohms — within specification. Secondary resistance is 11,200 ohms — within specification. The coil produces no spark during a spark test. What should the technician check NEXT?

- A. The coil ground connection for a fault preventing current flow despite correct winding resistance
- B. The coil secondary tower for carbon tracking allowing high voltage to short to ground internally
- C. The coil primary winding for an intermittent open that does not appear on a static resistance test
- D. The PCM driver output for the coil for a fault preventing the firing command from reaching the coil

**DOMAIN C — FUEL, AIR INDUCTION, AND EXHAUST SYSTEMS (Questions 21–30)**

21. A port injection engine has fuel pressure of 60 psi at key-on. After 20 minutes of key-off, pressure drops to 58 psi. After 8 hours, pressure is 57 psi. What does this indicate?

- A. A slow injector leak causing gradual post-shutdown drain-back over hours
- B. A failed pump check valve causing slow pressure loss to tank over time
- C. Normal thermal pressure decay — minimal pressure loss over hours confirms system integrity
- D. A partially stuck fuel pressure regulator allowing slow return flow after shutdown

22. A scan tool shows LTFT at +3% and +2% on both banks at idle and +2% and +1% at cruise. MAF reads within specification at all conditions. No vacuum leaks are found. No codes are stored. What is the correct interpretation?

- A. A developing MAF fault — bilateral positive trims always indicate contamination
- B. Normal fuel control operation — trims within  $\pm 10\%$  on both banks at all conditions with no codes confirm no fault
- C. A minor vacuum leak is present — any positive LTFT at idle requires smoke testing to rule out a leak
- D. A borderline injector restriction — bilateral positive trims at cruise confirm a developing flow fault

23. A return-style fuel system has correct idle pressure. Under a 10-second WOT pull on a dyno, pressure drops progressively from 57 psi to 31 psi. After the pull, pressure recovers immediately to 57 psi. What should the technician check FIRST?

- A. The fuel pressure regulator for a fault causing progressive loss under WOT vacuum conditions
- B. The fuel return line for a restriction causing back-pressure under high-flow demand
- C. The fuel filter for a progressive restriction under sustained high-volume WOT demand
- D. The fuel pump inlet screen for a restriction limiting volume under sustained high-demand operation

23. Fuel pressure drops from 57 psi to 31 psi during a 10-second WOT dyno pull and recovers immediately after. What should the technician check FIRST?

- A. The fuel pressure regulator for a fault causing progressive pressure loss under WOT
- B. The fuel return line for a restriction causing back-pressure
- C. The fuel filter for a progressive restriction under sustained high-volume demand
- D. The fuel pump inlet screen for a restriction limiting volume under sustained high demand

24. A scan tool shows MAP reading 98 kPa at idle on a sea-level vehicle with a specification of 25–40 kPa. A P0107 MAP sensor low voltage code is also stored. What is the apparent contradiction between the MAP reading and the stored code?

- A. The high MAP reading and a low voltage code together confirm the MAP sensor signal wire has a short to the 5-volt reference — the code reflects a previous event when the wire shorted to ground
- B. The high MAP reading indicates a disconnected vacuum hose — the P0107 was set during a previous event when the sensor was briefly shorted to ground
- C. There is no contradiction — MAP at 98 kPa at idle is within normal range and the P0107 is unrelated
- D. The P0107 low voltage code and high MAP reading together confirm the sensor has internally failed with a dual-fault condition

25. A GDI engine has normal idle but misfires under hard acceleration. High-pressure rail pressure at idle is 1,750 psi — within specification. Under hard acceleration, rail pressure drops to 600 psi. The low-pressure pump is confirmed delivering 65 psi to the high-pressure pump inlet. What is the MOST likely cause?

- A. Multiple leaking high-pressure injectors bleeding rail pressure under acceleration demand
- B. A high-pressure fuel line with an internal restriction reducing rail pressure under high-flow demand
- C. A high-pressure pump worn internally and unable to sustain rail pressure under increased demand
- D. A high-pressure rail pressure sensor reading low under acceleration — actual pressure is within specification

26. A turbocharged engine develops a whistling sound from the intake side at idle that disappears under boost. No codes are stored and boost is correct. What is the MOST likely cause?

- A. A partially collapsed air filter housing creating a restriction that produces audible noise at idle airflow velocity
- B. A small air leak between the air filter and the turbocharger compressor inlet producing a whistle under intake vacuum at idle
- C. The turbocharger compressor wheel producing blade noise at idle RPM that is masked by boost pressure noise
- D. A partially blocked MAF sensor producing a whistling turbulence at idle airflow rates

27. A naturally aspirated engine has LTFT at +21% on both banks at all speeds. Fuel pressure is correct. MAF reads correctly on a dynamic test at all airflow rates. A thorough smoke test including low-pressure testing reveals no vacuum leaks. What should the technician check NEXT?

- A. The fuel injectors for simultaneous restriction causing lean delivery on all cylinders
- B. The upstream O<sub>2</sub> sensors for simultaneous contamination producing false bilateral lean corrections
- C. The EVAP purge solenoid for a stuck-closed condition preventing normal vapor delivery and driving positive trims
- D. The fuel pump volume output under sustained demand — correct pressure does not confirm adequate volume

27. LTFT is +21% on both banks at all speeds. Fuel pressure is correct. MAF is confirmed correct dynamically. Thorough smoke testing reveals no vacuum leaks. What should the technician check NEXT?

- A. The fuel injectors for simultaneous restriction
- B. The upstream O<sub>2</sub> sensors for simultaneous contamination
- C. The EVAP purge solenoid for stuck-closed operation driving positive trims
- D. The fuel pump volume output — correct pressure does not confirm adequate volume

28. A fuel pressure test shows correct pressure at idle and at cruise. Under a snap-throttle test, pressure drops to 52 psi — above the 50 psi minimum. The system recovers within 1 second. What is the correct interpretation?

- A. The fuel system is functioning correctly — pressure remained above the minimum specification throughout the test
- B. The fuel pump is borderline — a snap-throttle drop to within 2 psi of the minimum indicates marginal pump output
- C. The fuel filter requires replacement — any pressure drop at snap-throttle confirms filter restriction
- D. The fuel pressure regulator is slow to respond — a 1-second recovery time confirms a regulator fault

29. A vehicle with a port injection engine has intermittent stalling at hot idle after coming to a stop from highway speed. Fuel pressure is correct. Ignition is confirmed normal. No codes are stored during stall events. LTFT is +2% on both banks. What should the technician check NEXT?

- A. The throttle body for carbon deposits causing a mechanical restriction at the idle throttle position
- B. The IAC valve for a fault causing insufficient idle airflow recovery after the transition from highway speed
- C. The MAF sensor for an intermittent dropout causing a brief lean condition that stalls the engine at idle
- D. The EGR valve for a stuck-open condition that only affects idle after highway driving from heat

30. A vehicle has elevated exhaust backpressure at 2,500 RPM. The catalytic converter passes visual inspection and backpressure test upstream of the converter shows normal. A backpressure test downstream of the converter shows the elevation. What does this confirm?

- A. The flex pipe between the manifold and converter is the restriction source
- B. The exhaust manifold has an internal restriction upstream of the test point
- C. The catalytic converter substrate is the restriction source — normal upstream and elevated downstream pressure isolates the converter
- D. The muffler downstream of the converter is the restriction — elevated post-converter pressure points downstream

**DOMAIN D — EMISSIONS CONTROL SYSTEMS (Questions 31–37)**

31. A PCV valve is removed and shaken — it rattles freely. Manifold vacuum at the PCV port is 17 in/Hg. The fresh air inlet is clear. Oil consumption is 1 quart per 500 miles with no external leaks. Compression and leakage are normal on all cylinders. What should the technician check NEXT?

- A. The valve stem seals for excessive wear — with PCV and rings confirmed normal, valve seals are the primary remaining internal consumption path
- B. The PCV valve for excessive flow — a rattling valve may still flow more than specification
- C. The crankcase fresh air inlet for a partial blockage increasing vacuum draw through the PCV side
- D. The intake manifold oil separator for saturation allowing liquid oil to enter the intake

32. A vehicle has elevated HC and NO<sub>x</sub> simultaneously on a tailpipe test. LTFT is +1% on both banks. EGR is confirmed operational. What is the MOST likely cause?

- A. A rich mixture producing HC from excess fuel and NO<sub>x</sub> from high combustion temperature
- B. A lean mixture at the edge of misfire producing HC from incomplete combustion and elevated NO<sub>x</sub> from lean combustion temperature
- C. Ignition misfires delivering unburned HC while also causing post-misfire combustion that elevates exhaust temperature and NO<sub>x</sub>
- D. A degraded catalytic converter unable to reduce either HC or NO<sub>x</sub> to acceptable levels

33. A P0455 large EVAP leak is stored. The fuel cap seals correctly. A smoke test with the vent solenoid commanded closed reveals smoke escaping from a cracked fuel filler neck just below the fuel cap seating area. What is the correct repair?

- A. Replace the fuel cap — a cracked filler neck at the cap seating area indicates the cap is causing stress cracking
- B. Replace the fuel filler neck and retest with the smoke machine to confirm the repair
- C. Apply fuel-resistant epoxy to the crack and retest — a filler neck crack is a minor repair

D. Replace the charcoal canister — a large EVAP leak from the filler neck indicates canister saturation

34. A vehicle has a P0404 EGR control circuit range/performance code. The EGR valve is commanded open on a bi-directional test and the valve actuates. At 2,500 RPM under light load with the valve commanded open, the scan tool shows no change in MAP sensor reading. What does the absence of MAP change indicate?

A. The MAP sensor has failed — a functioning EGR valve always changes MAP and the sensor should detect it

B. The EGR passages are carbon-restricted — the valve opens but no exhaust gas reaches the intake manifold

C. The DPFE sensor has failed — MAP change is not the correct parameter for EGR flow evaluation

D. The EGR valve is opening electrically but insufficient flow is reaching the manifold to affect MAP — valve or passage fault

34. P0404 EGR range/performance. EGR valve actuates on bi-directional test. At 2,500 RPM with valve commanded open, MAP does not change. What does the absence of MAP change indicate?

A. The MAP sensor has failed

B. The EGR passages are carbon-restricted — the valve opens but no gas reaches the manifold

C. The DPFE sensor has failed — MAP is not the correct EGR flow parameter

D. The EGR valve opens electrically but insufficient flow reaches the manifold — valve or passage fault

35. A vehicle has a P0031 upstream O2 sensor heater circuit low voltage on bank 1. Battery voltage at the heater supply is 12.4 volts. The PCM heater control ground resistance is 0.09 ohms. The heater element resistance measures 6.2 ohms against a specification of 8–12 ohms. What is the MOST likely cause?

A. The heater element is below the 8-ohm minimum specification — a low-resistance element draws excess current, which the PCM detects as a low voltage fault on the control circuit

B. The PCM heater control ground at 0.09 ohms is above the maximum specification and causing the low voltage code

C. The heater supply voltage is marginal — 12.4 volts is below the minimum required for the heater circuit to function correctly

D. The P0031 low voltage code confirms an open heater element — the 6.2-ohm reading is a meter error

36. An AIR system cold start test shows the pump running. The upstream O<sub>2</sub> sensor on bank 1 shows a strong lean response for the full 30-second pump run. The upstream O<sub>2</sub> sensor on bank 2 shows no response at all during the full 30-second pump run. The bank 2 check valve is confirmed open. What should the technician inspect on bank 2?

A. The bank 2 upstream O<sub>2</sub> sensor heater for premature activation masking the lean response

B. The AIR pump output pressure to confirm adequate airflow is reaching the bank 2 delivery circuit

C. The bank 2 AIR distribution tube or delivery hose for a disconnection or blockage preventing air from reaching the bank 2 exhaust ports

D. The bank 2 upstream O<sub>2</sub> sensor for a fault preventing it from detecting the lean response despite correct air delivery

37. A vehicle has a P0420 catalyst efficiency code. The bank 1 downstream O<sub>2</sub> sensor switches at 0.4 cycles per second. The upstream O<sub>2</sub> sensor switches at 1.1 cycles per second. LTFT is +2% on bank 1. Backpressure is 1.8 psi at 2,500 RPM. What is the correct interpretation?

A. The downstream sensor switching faster than expected for a fully functional converter but the switching rate difference is insufficient to confirm efficiency — further testing is needed

B. The downstream sensor switching at 0.4 cycles per second against the upstream rate of 1.1 cycles per second confirms the converter has meaningful oxygen storage capacity remaining — the P0420 may be caused by a downstream sensor fault

C. The backpressure confirms no physical restriction — the P0420 is a false positive from a slow upstream sensor

D. The downstream switching rate of 0.4 against the upstream rate of 1.1 confirms near-normal catalyst efficiency — P0133 should be checked before condemning the converter

**DOMAIN E — COMPUTERIZED ENGINE CONTROLS INCLUDING OBD II (Questions 38–50)**

38. A scan tool shows STFT at +1% and LTFT at +2% on bank 1. STFT is +1% and LTFT is +3% on bank 2 at all speeds. No codes are stored. All monitors are complete. What is the correct interpretation?

- A. A bilateral vacuum leak is present — any positive LTFT requires smoke testing
- B. Bank 2 LTFT at +3% is above normal — further diagnosis of the bank 2 injection system is indicated
- C. Fuel trims are within the normal operating range on both banks — no fault is indicated
- D. The MAF sensor is reading low — bilateral positive trims at all speeds confirm contamination

39. A vehicle has a P0172 rich code on bank 1. LTFT bank 1 is -17%. LTFT bank 2 is +2%. A scope of the bank 1 upstream O<sub>2</sub> sensor shows it switching normally between 0.1 and 0.9 volts. MAF is confirmed correct. Fuel pressure is correct. All bank 1 injectors pass a balance test within 2%. What should the technician check NEXT?

- A. An exhaust manifold leak downstream of the bank 1 O<sub>2</sub> sensor — the sensor is switching normally confirming the rich condition is real, and the source is unidentified
- B. The bank 1 upstream O<sub>2</sub> sensor for a rich-biased contamination fault — a switching sensor can still be biased toward rich output
- C. The EVAP purge solenoid for preferential vapor delivery to bank 1
- D. The bank 1 fuel pressure regulator for a vacuum reference fault causing local pressure elevation

39. P0172 bank 1 rich. LTFT bank 1 is -17%. Bank 2 LTFT is +2%. Bank 1 O<sub>2</sub> sensor switches normally. MAF, fuel pressure, and injectors are all confirmed normal. What should the technician check NEXT?

- A. An exhaust manifold leak downstream of the bank 1 O<sub>2</sub> sensor
- B. The bank 1 upstream O<sub>2</sub> sensor for rich-biased contamination — a switching sensor can still be biased
- C. The EVAP purge solenoid for preferential vapor delivery to bank 1
- D. The bank 1 fuel pressure regulator for a vacuum reference fault

40. A scan tool during cold start shows STFT at -14% for the first 90 seconds before closed-loop entry. After closed-loop entry, STFT normalizes to +1% on both banks. LTFT is +1% after the drive. What does the negative cold-start STFT indicate?

- A. A leaking injector delivering excess fuel during cold open-loop operation that seals when hot
- B. A vacuum leak that is sealed when cold and opens with thermal expansion during warm-up
- C. Normal closed-loop correction from a slightly rich open-loop base map
- D. The cold-start enrichment strategy is over-delivering fuel — the ECT sensor may be reading colder than actual

40. Cold-start STFT is -14% for 90 seconds then normalizes to +1% at closed-loop entry. LTFT is +1% after the drive. What does the negative cold-start STFT indicate?

- A. A leaking injector delivering excess fuel during cold open-loop operation
- B. A vacuum leak sealed when cold and opening with thermal expansion
- C. Normal correction from a slightly rich open-loop base map
- D. The cold-start enrichment strategy is over-delivering fuel — the ECT may be reading colder than actual

41. A vehicle has LTFT at +2% and +3% at idle on both banks. During a highway cruise segment, LTFT on both banks drops to -5% for 3 minutes then returns to baseline. A scan tool confirms the EVAP purge solenoid was commanded open during the LTFT drop. What does this pattern confirm?

- A. A MAF sensor over-reading at highway cruise airflow causing the bilateral negative trim excursion
- B. A fuel pressure increase at highway speed causing momentary over-delivery during the cruise segment
- C. A vacuum leak sealing at highway speed from aerodynamic intake pressure changes
- D. Normal EVAP canister purge delivering fuel vapor at cruise conditions causing the temporary negative trim correction

42. A vehicle has P0507 idle speed high. Idle is 1,200 RPM against a 700 RPM specification. The IAC valve is confirmed functional. The throttle plate closes fully. A smoke test reveals no vacuum leaks. What should the technician check NEXT?

- A. The TPS for a fault causing the PCM to misread closed-throttle position and over-command idle air
- B. The throttle body bore for a carbon deposit bypassing the closed throttle plate and providing excess idle air
- C. The PCM for a fault incorrectly commanding elevated idle speed through a functional IAC
- D. The PCV system for a hose routing fault directing excessive airflow into the intake at idle

43. A vehicle has an intermittent P0300 random misfire that sets only during cold ambient temperatures below 35°F. No codes set when warm. A standard smoke test performed cold reveals no vacuum leaks. LTFT is +22% when the code sets. What is the MOST likely cause?

- A. A rubber intake component that shrinks below 35°F creating a vacuum leak not detectable by standard smoke testing at that temperature
- B. A cold-sensitive ignition coil with degraded insulation that arcs internally when cold
- C. A MAF sensor underreading at cold intake air temperatures causing lean delivery in cold conditions
- D. An IAC valve that sticks when cold causing insufficient idle airflow and a rich stumble

44. A vehicle has a U0100 lost communication with PCM code stored in a secondary module. The PCM communicates normally with the scan tool. All other systems function correctly. What is the MOST likely cause?

- A. The PCM has an internal fault preventing it from broadcasting on the CAN bus to other modules
- B. The secondary module has failed and is misreporting the communication fault
- C. An intermittent CAN bus connection or ground fault caused a temporary loss of PCM communication that has since resolved
- D. The scan tool is connected to a different communication bus than the secondary module uses for its PCM communication

45. A vehicle has STFT at +2% and LTFT at +3% on both banks throughout all driving. No codes are stored. Mode 6 data shows all parameters within normal thresholds. At highway cruise, LTFT drops to -4% for 2 minutes then returns. What does the cruise LTFT drop confirm?

- A. A MAF sensor beginning to over-read at highway airflow rates
- B. Normal EVAP canister purge operation adding fuel vapor during the cruise segment
- C. A fuel pressure increase at sustained highway speed causing momentary over-delivery
- D. A vacuum leak that seals at highway speed temporarily correcting the lean baseline condition

46. A vehicle fails an OBD II readiness check — the oxygen sensor monitor and the catalyst monitor both show incomplete. All other monitors are complete. No codes are stored. The battery was replaced 4 days ago. The vehicle has been driven 180 miles of mixed city and highway. What is the MOST likely reason both monitors are incomplete?

- A. A pending O2 sensor fault is blocking both the O2 sensor and catalyst monitors from completing
- B. The vehicle has not been driven sufficiently for the monitors to complete — more drive cycles with specific enable conditions are needed
- C. An EVAP system seep below the code threshold is blocking the O2 sensor monitor as a prerequisite
- D. The catalyst monitor requires the O2 sensor monitor to complete first — only the O2 sensor monitor needs to be addressed

47. A vehicle has LTFT at +24% on bank 1 and +3% on bank 2 at idle. At 2,500 RPM, bank 1 LTFT drops to +5% and bank 2 LTFT remains at +3%. A smoke test of the bank 1 intake reveals no vacuum leaks. Fuel pressure is correct and all bank 1 injectors pass a balance test. What should the technician check NEXT?

- A. An exhaust manifold leak on bank 1 upstream of the O2 sensor — equal delivery confirmed by injector balance test rules out fuel faults and the idle-specific lean pattern suggests oxygen introduction rather than a vacuum leak
- B. The bank 1 upstream O2 sensor for contamination producing a false lean correction at all conditions

C. The bank 1 MAF sensing element for a contamination fault selectively affecting bank 1 airflow calculation

D. A low-pressure smoke test on bank 1 — a small leak missed by the standard test may explain the idle-specific lean

48. A vehicle has a P0300 random misfire. Fuel trims are +2% on both banks. Compression and leakage are normal on all cylinders. All ignition waveforms are confirmed normal. A cylinder contribution test shows all cylinders within 10 RPM of each other. Mode 6 data shows the cylinder 3 misfire monitor at 88% of the maximum allowed threshold. What is the MOST appropriate next step?

A. Inspect cylinder 3 ignition components, injector delivery, and compression with more sensitive testing before a P0303 code sets

B. No action required — the P0300 is random and no specific cylinder has been identified

C. Replace the catalytic converter — elevated misfire counts on Mode 6 indicate HC damage is occurring

D. Perform a cylinder contribution test at 2,500 RPM — the idle contribution test may not reveal a load-sensitive fault on cylinder 3

48. P0300 random misfire. Fuel trims, compression, leakage, contribution test, and ignition waveforms are all confirmed normal. Mode 6 shows cylinder 3 misfire monitor at 88% of maximum threshold. What is the MOST appropriate next step?

A. Inspect cylinder 3 ignition, injector delivery, and compression with more sensitive testing before P0303 sets

B. No action — the P0300 is random and no specific cylinder has been confirmed

C. Replace the catalytic converter — elevated misfire counts indicate HC damage

D. Perform a contribution test at 2,500 RPM — the idle test may miss a load-sensitive fault on cylinder 3

49. A vehicle has LTFT at -20% on bank 1 and +2% on bank 2. All bank 1 injectors pass a balance test within 3%. MAF is confirmed correct. Fuel pressure is correct. A bi-directional test commanding all bank 1 injectors off causes LTFT to move from -20% toward zero within 15 seconds. What does this confirm?

- A. The bank 1 upstream O<sub>2</sub> sensor is contaminated — the injector disable eliminates fuel as the variable and confirms a sensor fault
- B. One or more bank 1 injectors are leaking fuel when commanded off — the LTFT recovery with injectors disabled confirms injectors as the fuel source
- C. The EVAP purge solenoid is delivering vapor preferentially to bank 1 — the injector disable reveals the purge contribution
- D. The bank 1 MAF sensing element is over-reading — disabling injectors reduces airflow and reveals the MAF fault

50. A vehicle has all OBD II monitors complete with no stored codes. The customer reports a subtle loss of power under hard acceleration that has worsened over 3 months. STFT and LTFT are within  $\pm 3\%$  on both banks. No misfire codes have been stored. What is the MOST appropriate first diagnostic step?

- A. Perform a compression test — a gradual power loss over months suggests a developing mechanical fault
- B. Perform a fuel pressure test under load — a pressure drop during WOT that does not trigger codes would explain gradual power loss
- C. Check for pending codes — a fault developing toward the code-setting threshold may appear as a pending code before becoming confirmed
- D. Perform an exhaust backpressure test — a gradual catalytic converter restriction would explain the progressive power loss under hard acceleration without affecting fuel trims or triggering misfire codes

# PRACTICE EXAM 19: ANSWER KEY AND EXPLANATIONS

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## DOMAIN A — GENERAL DIAGNOSIS

1. **B. A single cylinder misfiring on every firing event** — A vacuum needle that drops sharply at regular intervals matching engine firing frequency with stable RPM is the classic pattern of a single cylinder failing on every combustion event. Each miss allows unburned mixture to pass into the intake on the overlap event, briefly reducing manifold vacuum. The regularity of the drop — exactly matching firing frequency — confirms a single cylinder failing consistently rather than an intermittent or random fault.
2. **C. A head gasket breach causing cross-cylinder pressure equalization between cylinders 3 and 6** — Cylinders 3 and 6 both read 105 psi dry with near-zero wet test improvement. Two cylinders on the same bank reading identically low — well below all others — with no wet response is the signature of a head gasket breach between those two cylinders. Pressure equalizes through the breach during cranking, limiting both cylinders to a shared maximum. Rings or burned valves rarely fail identically on two non-adjacent cylinders simultaneously.
3. **D. A worn crankshaft main bearing producing one knock per revolution under combustion loading** — A single loud knock occurring once per crankshaft revolution that increases under load and is most prominent at operating temperature with normal oil pressure is the presentation of a worn main bearing. Main bearing knock occurs once per revolution as the crankshaft journal impacts the worn bearing surface on the power stroke. The load sensitivity confirms combustion pressure is required to produce the impact — distinguishing it from accessory or timing noise.
4. **A. The cylinder 5 valves for a sticking condition causing inconsistent sealing between tests** — Leakage fluctuating between 14% and 24% on consecutive tests without repositioning the piston confirms inconsistent sealing that varies independently of test setup. A sticking valve that intermittently seats and unseats between tests produces exactly this variable leakage pattern. A consistent mechanical fault such as worn rings or a failed gasket would produce repeatable readings rather than fluctuating results on consecutive tests.
5. **C. The MAF sensor for severe underreading causing a lean misfire at all operating conditions** — LTFT at +22% on all banks simultaneously at all engine speeds is a global bilateral lean condition. Normal ignition and correct fuel pressure eliminate spark and delivery pressure as causes. Severe MAF underreporting at all airflow rates causes the PCM to calculate and deliver insufficient fuel across all operating conditions, producing the global lean misfire. A vacuum leak

or injector restriction typically produces more idle-specific or speed-specific patterns rather than a uniform bilateral correction at all conditions.

6. **B. The water pump seal is leaking under sustained pressure** — The cooling system held 14 psi for 10 minutes before dropping — confirming the system is sealed at low duration before pressure opens the leak path. The puddle found directly under the water pump confirms the pump seal as the pressure loss source. A head gasket leak would produce no external puddle; a thermostat fault would not cause a pressure test drop with an external puddle.
7. **D. Cylinder 6 has significantly higher compression than all other cylinders** — Slower crank speed on one cylinder during a relative compression test means the starter motor must work harder — drawing more amperage — to compress that cylinder. Higher-than-normal compression in cylinder 6 from carbon buildup, a thinner head gasket, or a domed deposit on the piston creates greater resistance per compression stroke, slowing crank speed and elevating amperage consistently on that cylinder's compression event.
8. **A. The accessory drive components — belt, tensioner, idler pulleys** — A knock that does not change with temperature, load, or spark plug removal is not combustion-related. Removing plug wires one at a time changes combustion loading on each cylinder — a combustion knock always changes character when the affected cylinder is disabled. A knock completely unaffected by all plug wire removals confirms the source is mechanical and outside the combustion system, directing the technician to external rotating components.
9. **D. The P0301 was a pending code that became confirmed during the contribution test drive cycle** — All cylinders contributed equally at 185–205 RPM, confirming no cylinder fault existed before or during the test. The contribution test procedure itself creates the additional drive cycle conditions — specific RPM, load, and operating duration — required for a pending misfire code already stored in the PCM to accumulate sufficient misfire events and cross the confirmation threshold, converting from pending to confirmed and illuminating the MIL.
10. **B. The catalytic converter for oxidizing oil consumption smoke before it exits the tailpipe** — No external leaks, no visible smoke under any driving condition, and confirmed normal PCV, compression, and leakage confirms oil is being consumed internally but not producing visible tailpipe smoke. A functioning catalytic converter operating at full efficiency oxidizes oil combustion byproducts — partially burned hydrocarbons — before they exit the tailpipe, eliminating visible blue smoke despite active oil consumption. The converter's oxidation efficiency can mask consumption until it becomes severe.
11. **B. A vacuum hose that dislodged during the snap-throttle event** — A snap-throttle test that produces a normal sharp drop and immediate recovery confirms engine mechanical integrity. A post-test idle vacuum that settles permanently 3 in/Hg below the pre-test baseline — and remains there — confirms a new steady-state vacuum leak was introduced during the test. The snap-throttle

event generates significant intake and engine vibration that can dislodge a partially seated vacuum hose, creating a new unmetered air path that lowers idle vacuum to its new lower baseline.

12. **A. The IAT sensor or circuit has an open** — All fundamental systems — spark, fuel pressure, compression, and injector pulse — are confirmed correct, eliminating each as the no-start cause individually. An IAT reading of -40°F is the default substitution value the PCM applies when the IAT signal wire is open-circuited. At -40°F, the PCM applies an extreme cold-start enrichment strategy — injecting a fuel volume far exceeding what a 65°F engine requires — flooding the cylinders and preventing combustion despite correct ignition and compression.

## **DOMAIN B — IGNITION SYSTEM DIAGNOSIS AND REPAIR**

13. **A. Carbon fouling from a rich mixture, excessive idling, or repeated short trips** — A black, dry, sooty deposit covering the entire insulator and electrode with minimal erosion is the defining appearance of carbon fouling. Carbon deposits accumulate when combustion temperature is insufficient to burn away normal combustion byproducts — from a rich mixture, excessive idling, or short trips that prevent the plug from reaching self-cleaning temperature. The dry texture distinguishes carbon fouling from oil fouling, which produces a wet, black oily deposit.
14. **C. The code was set during a previous intermittent event — current circuit operation is correct** — Supply voltage, resting command wire voltage, switching voltage, and confirmed spark production are all normal. A P0358 stored as an inactive code with all circuit parameters currently correct confirms the fault occurred during a previous event that has since resolved. Clearing the code and monitoring for recurrence is appropriate — no current fault data supports component replacement.
15. **B. A conductive path parallel to the plug gap — carbon tracking, fouling, or a cracked insulator** — A spark line that extinguishes within the first 10% of normal arc duration confirms available secondary energy was not sustained into the arc phase. When a conductive parallel path exists — carbon tracking across the ceramic, a fouled insulator, or a hairline crack — the high-voltage discharge follows the lower-resistance path instead of bridging the electrode gap. The arc collapses immediately because the conductive path dissipates the available energy without producing a sustained electrode arc.
16. **B. The DVOM is measuring the RMS value of the square wave** — A Hall effect sensor producing clean 0–5 volt square wave transitions is functioning correctly. A DVOM set to AC volts measures the root mean square of the waveform. A square wave with equal high and low time — 50% duty cycle — produces an RMS value of approximately half its peak-to-peak amplitude. A 5-volt square wave produces approximately 2.5 volts RMS on an AC meter. The 2.4-volt reading is consistent with a slightly asymmetric duty cycle square wave and confirms normal sensor output.
17. **A. The spark plug, injector, compression, and leakage on cylinder 2** — The coil moved from cylinder 2 to cylinder 6. P0302 returns on cylinder 2 and P0306 does not set — the misfire stayed at cylinder 2 regardless of which coil served it. With the coil confirmed not responsible, the fault

is in the fixed components specific to cylinder 2. Systematically testing the remaining cylinder 2-specific elements — spark plug, injector delivery, compression, and leakage — identifies the actual fault source.

18. **C. Electromagnetic interference from the adjacent plug wire inducing noise into the CKP signal** — The CKP waveform is clean at idle and develops noise only at elevated RPM — correlating with increased plug wire firing frequency and higher secondary voltage demand from the adjacent wire. The noise disappearing when the plug wire is physically repositioned away from the CKP harness provides direct confirmation that the plug wire is the EMI source. Inductive coupling between a high-voltage secondary wire and an adjacent low-voltage sensor harness increases proportionally with firing frequency.
19. **B. The distributor cap terminal for cylinder 2 for corrosion, carbon tracking, or physical damage** — A new spark plug and new plug wire on cylinder 2 have both failed to resolve the misfire, eliminating both as the fault source. The ignition module and coil are confirmed functional. With all external components replaced or confirmed correct, the remaining distributor-specific component in the cylinder 2 secondary circuit is the cap terminal itself — corrosion, carbon tracking across the cap interior, or a cracked terminal prevents the secondary voltage from reaching the cylinder 2 plug wire insert reliably.
20. **D. The PCM driver output for the coil for a fault preventing the firing command from reaching the coil** — Primary and secondary winding resistance are both confirmed within specification, confirming the coil internally is mechanically intact. A coil with correct resistance measurements that produces no spark when the driver is commanded confirms the firing command is not reaching the coil. With the coil confirmed internally correct, the fault must be in the circuit delivering the firing command — the PCM driver output, the command wire, or the coil connector.

## DOMAIN C — FUEL, AIR INDUCTION, AND EXHAUST SYSTEMS

21. **C. Normal thermal pressure decay — minimal pressure loss over hours confirms system integrity** — Pressure dropping only 3 psi over 8 hours from an initial 60 psi at key-on represents minimal thermal decay consistent with a fully sealed system cooling to ambient temperature. A faulty pump check valve would allow pressure to decay toward zero over hours. Leaking injectors would produce measurable ongoing bleed-down beyond normal thermal contraction. Near-static pressure retention over an 8-hour period confirms both the check valve and all injectors are sealing correctly.
22. **B. Normal fuel control operation — trims within  $\pm 10\%$  on both banks at all conditions with no codes** — LTFT at +3% and +2% on both banks at idle and +2% and +1% at cruise are well within the accepted  $\pm 10\%$  normal operating range. Bilateral symmetry and consistency at all speeds with a confirmed correct MAF, no vacuum leaks, and no stored codes confirm normal closed-loop fuel control. Minor positive corrections within normal range are expected and require no diagnostic action.

23. **D. The fuel pump inlet screen for a restriction limiting volume under sustained high demand** — Idle pressure confirms adequate low-demand delivery. Progressive pressure collapse during a sustained 10-second WOT pull — dropping 26 psi — with immediate full recovery after the pull is the pattern of a volume delivery restriction that accumulates under sustained high demand. The immediate recovery confirms pump mechanical function is intact — the pump can restore pressure when demand drops. A pump inlet screen restriction limits sustained volume throughput while allowing adequate low-demand delivery and full pressure recovery when high demand ends.
24. **A. The high MAP reading and a low voltage code confirm the MAP signal wire has a short to the 5-volt reference** — A MAP reading of 98 kPa at idle on a sea-level engine should read 25–40 kPa under normal idle vacuum. A high MAP reading indicates the PCM is interpreting the signal as indicating low vacuum or high manifold pressure. A signal wire shorted to the 5-volt reference holds the signal at maximum voltage — the PCM interprets maximum voltage as maximum pressure (98 kPa). The stored P0107 low voltage code reflects a previous event when the wire briefly contacted ground before shorting to the reference circuit.
25. **C. A high-pressure pump worn internally and unable to sustain rail pressure under increased demand** — Low-pressure pump delivery at 65 psi is confirmed adequate. Rail pressure at idle is 1,750 psi — within specification — confirming the high-pressure pump builds correct pressure under low demand. Under hard acceleration, increased injector pulse width creates high-volume demand that the worn high-pressure pump cannot sustain — pressure collapses to 600 psi. A pump that builds correct pressure at idle but collapses under demand is the signature of internal pump wear reducing maximum flow capacity without affecting low-demand output.
26. **B. A small air leak between the air filter and the turbocharger compressor inlet** — At idle, the turbocharger creates suction on the inlet side — intake vacuum rather than boost pressure. A small leak between the air filter housing and the compressor inlet allows air to be drawn in through the leak point under inlet vacuum, producing a whistle. Under boost, the compressor pressurizes the inlet side — the leak point now faces positive pressure from the boost side and the whistle disappears as the pressure differential reverses.
27. **D. The fuel pump volume output — correct pressure does not confirm adequate volume** — Correct fuel pressure, confirmed correct MAF, and confirmed no vacuum leaks eliminate the most common bilateral lean causes. LTFT at +21% bilaterally at all speeds confirms a severe, global lean condition. Fuel pressure confirms the pump can build and hold pressure against a closed or low-flow system — it does not confirm the pump can deliver adequate fuel volume at the sustained high-flow rates required at cruise and higher RPM. A pump with a worn impeller may hold static pressure but deliver insufficient volume under sustained demand.
28. **A. The fuel system is functioning correctly — pressure remained above the minimum specification throughout** — Snap-throttle pressure dropped to 52 psi — 2 psi above the 50 psi minimum — and recovered within 1 second. The specification establishes a minimum pressure floor, not a target range. Pressure remaining above the minimum throughout the highest-demand

test event and recovering promptly confirms the pump, filter, and regulator are all delivering adequate performance. No further fuel system diagnosis is indicated.

29. **B. The IAC valve for a fault causing insufficient idle airflow recovery after the transition from highway speed** — Correct fuel pressure, normal ignition, near-zero LTFT, and no codes during stall events eliminate fuel delivery, ignition, and mixture faults. Hot stalling specifically at idle after highway driving — rather than at any other condition — is the characteristic pattern of an IAC valve that cannot recover idle airflow quickly enough after the transition from high-RPM highway cruise to a closed-throttle idle stop. The IAC may function adequately at steady idle but fails to add airflow fast enough during the transition, allowing RPM to drop below the idle sustain threshold and stall.
30. **C. The catalytic converter substrate is the restriction — normal upstream and elevated downstream pressure isolates the converter** — A backpressure test upstream of the converter showing normal pressure confirms no restriction exists between the exhaust manifold and the converter inlet. A backpressure test downstream of the converter showing elevated pressure confirms the restriction is between the two test points — within the converter itself. Isolating the restriction to the converter by bracketing it with normal upstream and elevated downstream readings makes the converter the confirmed fault source.

#### **DOMAIN D — EMISSIONS CONTROL SYSTEMS**

31. **A. The valve stem seals for excessive wear** — The PCV valve rattles freely — confirming it is not stuck. Manifold vacuum at the PCV port is 17 in/Hg — confirming adequate draw. The fresh air inlet is clear. Compression and leakage are normal on all cylinders — confirming ring integrity. With the PCV system confirmed functional and rings confirmed intact, the primary remaining internal oil consumption path is the valve stem seals. Worn stem seals allow oil to migrate past the stem into the combustion chamber under manifold vacuum without affecting compression or leakage test results.
32. **C. Ignition misfires delivering unburned HC while also causing post-misfire combustion that elevates exhaust temperature and NO<sub>x</sub>** — Elevated HC and NO<sub>x</sub> simultaneously with near-zero LTFT rules out a rich or lean mixture fault — mixture is correct. EGR confirmed operational rules out NO<sub>x</sub> from EGR failure. A misfire delivers raw unburned HC directly to the exhaust, elevating HC output. The unburned mixture that passes the exhaust valve ignites in the hot exhaust stream or catalytic converter, generating high-temperature post-combustion that elevates NO<sub>x</sub>. Both emissions rise simultaneously from the same misfire event.
33. **B. Replace the fuel filler neck and retest with the smoke machine** — The smoke test with the vent solenoid commanded closed directly identified the confirmed large leak source — a crack in the fuel filler neck below the cap seating area. A cracked fuel filler neck cannot be repaired reliably with epoxy in a fuel-contact environment and must be replaced to restore EVAP system integrity.

Retesting with the smoke machine after replacement confirms the large leak is eliminated and no additional leak paths exist elsewhere in the system.

34. **D. The EGR valve opens electrically but insufficient flow reaches the manifold — valve or passage fault** — The EGR valve actuates electrically on bi-directional test, confirming the motor and circuit are functional. At 2,500 RPM under light load, a correctly functioning EGR valve delivering exhaust gas to the intake manifold always produces a detectable MAP increase — exhaust gas dilutes the air charge and reduces the vacuum-to-pressure differential. No MAP change with the valve commanded open confirms either the valve is not physically opening enough to allow flow, or the EGR passages are carbon-restricted and no gas is reaching the intake despite valve movement.
35. **A. The heater element is below the 8-ohm minimum — a low-resistance element draws excess current** — Battery voltage at 12.4 volts and PCM ground resistance at 0.09 ohms are both within acceptable limits. The heater element at 6.2 ohms is below the 8-ohm minimum specification. A heater element with lower than specified resistance draws proportionally higher current through the PCM's heater control circuit. The PCM detects the overcurrent condition on the control ground side as a voltage deviation — logging it as a low voltage heater circuit fault even though supply voltage is correct.
36. **C. The bank 2 AIR distribution tube or delivery hose for a disconnection or blockage** — Bank 1 shows a strong lean response for the full 30-second run, confirming the pump is delivering adequate airflow. The bank 2 check valve is confirmed open — eliminating the check valve as the blockage. No lean response on bank 2 despite a confirmed open check valve and a confirmed adequate pump points to a fault between the check valve outlet and the bank 2 exhaust ports — a disconnected, kinked, or blocked AIR distribution tube preventing delivered air from reaching the exhaust stream.
37. **B. The downstream sensor switching at 0.4 cycles per second against an upstream rate of 1.1 confirms meaningful oxygen storage capacity — the P0420 may be caused by a downstream sensor fault** — A downstream rate of 0.4 against an upstream rate of 1.1 represents a switching ratio of approximately 2.75:1 — a meaningful buffering difference indicating the converter still has measurable oxygen storage capacity. Backpressure at 1.8 psi confirms no physical substrate collapse. A converter with this switching ratio difference may be near the efficiency threshold but should not be condemned without first verifying the downstream sensor is not slow or biased, as a degraded sensor can generate a false P0420 on a marginally functional converter.

## **DOMAIN E — COMPUTERIZED ENGINE CONTROLS INCLUDING OBD II**

38. **C. Fuel trims are within the normal operating range on both banks — no fault is indicated** — STFT at +1% and LTFT at +2% on bank 1 and STFT at +1% and LTFT at +3% on bank 2 are both well within the  $\pm 10\%$  accepted normal range. Complete monitors with no stored codes

confirms the PCM's self-diagnostic system found no fault. Minor bilateral positive corrections within normal limits at all speeds require no diagnostic action.

39. **A. An exhaust manifold leak downstream of the bank 1 O2 sensor** — The bank 1 O2 sensor is switching normally between 0.1 and 0.9 volts, confirming it is accurately reflecting a real rich exhaust condition. MAF, fuel pressure, and injector balance are all confirmed correct — no excess fuel is being commanded. With all delivery inputs confirmed correct and the sensor confirmed accurately switching, the unidentified source of excess fuel or reducing agent on bank 1 is an exhaust manifold leak downstream of the sensor. A downstream manifold leak allows exhaust backflow containing rich combustion products to reach an upstream sensor position, creating a false rich reading that drives negative LTFT without a corresponding fuel delivery fault.
40. **D. The cold-start enrichment strategy is over-delivering fuel — the ECT may be reading colder than actual** — The engine is in open-loop during cold start — STFT corrections during this phase reflect the PCM responding to O2 sensor feedback as closed-loop entry approaches. STFT at -14% for 90 seconds indicates the PCM is actively removing fuel during late open-loop because the delivered quantity exceeds what the O2 sensor confirms is needed. After closed-loop entry, STFT normalizes immediately — confirming mixture is correct under closed-loop control. An ECT reading colder than actual causes the PCM to apply a richer-than-needed open-loop enrichment map, producing the negative STFT correction as the engine approaches closed-loop.
41. **D. Normal EVAP canister purge delivering fuel vapor at cruise conditions** — LTFT at +2% and +3% throughout all driving confirms a slightly lean base condition within normal range. The scan tool directly confirms the EVAP purge solenoid was commanded open during the LTFT drop — establishing a confirmed causal relationship. Canister vapor delivered during the commanded purge adds unmetered fuel to both banks, causing the PCM to reduce fuel delivery bilaterally to -5%. LTFT returning to baseline when purge ends confirms the solenoid closes correctly and the vapor delivery stops.
42. **B. The throttle body bore for a carbon deposit bypassing the closed throttle plate** — The IAC valve is confirmed functional and the throttle plate closes fully — eliminating both as the excess air source. A smoke test reveals no vacuum leaks — eliminating unmetered air from an external source. Carbon deposits in the throttle body bore that have built up around the throttle plate create a bypass air channel that remains open even when the throttle plate is fully closed. This bypass delivers uncontrolled idle air independent of IAC command, raising idle speed beyond the PCM's ability to reduce it through normal IAC control.
43. **A. A rubber intake component that shrinks below 35°F creating a vacuum leak not detectable by standard smoke testing** — LTFT at +22% when the code sets confirms a significant lean condition developing only at cold temperatures. A standard smoke test performed cold reveals no leak — but smoke testing at ambient temperature may not replicate the dimensional change that occurs at very cold temperatures. Rubber intake components — boots, couplings, and grommets — contract at low temperatures, creating gap leaks that are not present at shop temperature. A cold-

specific bilateral lean misfire with near-zero LTFT when warm is the defining pattern of a cold-induced rubber shrinkage vacuum leak.

44. **C. An intermittent CAN bus connection or ground fault caused a temporary loss of PCM communication** — The PCM communicates normally with the scan tool — confirming it is operational and broadcasting on the network. The secondary module stores a U0100 as a historical fault, confirming communication was lost at some point but has since been restored. A U0100 stored in a secondary module with current normal PCM communication and no other symptoms is the pattern of a resolved intermittent CAN bus fault — a loose connector, a corroded ground, or a momentary bus interruption that has since recovered.
45. **B. Normal EVAP canister purge operation adding fuel vapor during the cruise segment** — STFT at +2% and LTFT at +3% throughout all driving confirms the base fuel system is near stoichiometric with no developing fault. The 2-minute bilateral LTFT drop to -4% at highway cruise with return to baseline is the signature of a timed EVAP purge event. Without a scan tool confirmation of the purge solenoid state, correlating the LTFT drop duration and bilateral symmetry with known purge behavior at cruise conditions identifies normal purge operation as the cause.
46. **B. The vehicle has not been driven sufficiently for the monitors to complete** — The battery was replaced 4 days ago, resetting all monitor readiness flags. The O2 sensor and catalyst monitors require specific enable conditions — particular coolant temperatures, vehicle speed ranges, load levels, and steady-state cruise durations — that may not have been met in 180 miles of mixed driving. These two monitors are among the most demanding in terms of enable conditions. No codes and all other monitors complete confirm no fault is blocking completion — additional drive cycles meeting the specific monitor enable conditions are required.
47. **A. An exhaust manifold leak on bank 1 upstream of the O2 sensor** — Bank 1 LTFT at +24% dropping to +5% at 2,500 RPM — with confirmed correct injector balance, correct fuel pressure, and no vacuum leaks — eliminates fuel delivery and unmetered air as causes. An idle-specific unilateral lean correction that significantly diminishes at elevated RPM is the pattern of an exhaust manifold leak upstream of the O2 sensor. At idle, low exhaust velocity and high manifold vacuum draw ambient oxygen into the exhaust stream through the leak, producing a false lean signal. At elevated RPM, increased exhaust backpressure reduces oxygen intrusion, normalizing the trim.
48. **D. Perform a contribution test at 2,500 RPM — the idle test may miss a load-sensitive fault on cylinder 3** — All systems are confirmed normal under the idle conditions of the standard contribution test. Mode 6 showing cylinder 3 at 88% of the maximum misfire threshold confirms cylinder 3 is the specific cylinder approaching the code-setting limit — but the fault is not appearing under idle test conditions. A contribution test at 2,500 RPM under load replicates the operating condition where the cylinder 3 misfire is accumulating, applying sufficient combustion load to reveal a fault that idle testing cannot.

49. **B. One or more bank 1 injectors are leaking when commanded off** — All bank 1 injectors pass the balance test within 3% — confirming correct commanded delivery when open. MAF, fuel pressure, and bank 2 LTFT are all confirmed correct. LTFT moving from -20% toward zero within 15 seconds of commanding all bank 1 injectors off directly confirms the injectors are the source of the excess fuel. When injectors are commanded off, excess fuel delivery stops and LTFT corrects — confirming injectors are delivering fuel when they should be electrically closed, identifying internal seat leakage as the fault.
50. **C. Check for pending codes — a fault developing toward the code-setting threshold may appear as a pending code** — All monitors are complete with no stored codes and normal fuel trims, ruling out obvious current faults. A gradual 3-month power loss without triggering codes or trims suggests a fault accumulating toward but not yet reaching the confirmation threshold. A pending code visible in Mode 6 or generic OBD II pending code data may identify the developing fault before it confirms — directing diagnosis to a specific system before committing to more invasive testing such as compression, fuel pump load testing, or backpressure evaluation.