

PRACTICE EXAM 14: ASE A8 ENGINE PERFORMANCE FULL-LENGTH SIMULATION

50 Questions | 75 Minutes

DOMAIN A — GENERAL DIAGNOSIS (Questions 1–12)

1. A vacuum gauge at idle shows a reading of 16 in/Hg with a needle that drops sharply and regularly every 4 seconds and recovers immediately. At 2,000 RPM the drops occur twice as frequently. What does this MOST likely indicate?

- A. A sticking EGR valve responding to manifold vacuum changes at a fixed interval
- B. A large vacuum leak that becomes significant at a specific intake manifold resonance frequency
- C. A single cylinder misfiring — the drop interval decreasing with RPM confirms the fault is speed-dependent
- D. Retarded ignition timing causing a periodic vacuum drop that worsens with RPM increase

2. A compression test shows cylinders 1 through 4 between 155 and 170 psi. Cylinder 5 reads 155 psi dry and 170 psi wet. Cylinder 6 reads 155 psi dry and 170 psi wet. What does the wet test improvement on both cylinders 5 and 6 indicate?

- A. Worn piston rings on cylinders 5 and 6 allowing oil to temporarily seal the ring gap
- B. Both cylinders share a head gasket breach that oil temporarily seals on the wet test
- C. Carbon deposits on the pistons of cylinders 5 and 6 causing compression loss corrected by oil
- D. Normal variation — wet test improvement of 15 psi or less is within acceptable range

3. An engine produces a sharp metallic knock at idle that disappears immediately when one spark plug wire is removed. Reconnecting the wire causes the knock to return. What does this indicate?

- A. The cylinder whose wire was removed has a worn connecting rod bearing causing the knock
- B. A hydraulic lifter on the cylinder whose wire was removed is collapsed and producing the knock
- C. A piston on the cylinder whose wire was removed is cracked and the knock is combustion-related
- D. The knock is combustion-related — removing the wire eliminates combustion on that cylinder and stops detonation or a combustion-driven mechanical knock

4. A cylinder leakage test on cylinder 3 shows 22% leakage. Air is heard escaping only from the oil filler cap opening. The specification is 20% maximum. What is the MOST likely cause?

- A. A leaking exhaust valve on cylinder 3 allowing test air into the exhaust system
- B. Worn piston rings on cylinder 3 allowing test air to pass into the crankcase
- C. A head gasket breach on cylinder 3 allowing test air into the cooling system passages
- D. A leaking intake valve on cylinder 3 allowing test air into the intake manifold

5. An engine has intermittent blue smoke that appears only when the engine sits overnight and is first started — disappearing after 30 seconds of running. Compression and leakage are normal on all cylinders. What is the MOST likely cause?

- A. A leaking head gasket allowing oil to accumulate in the combustion chamber overnight
- B. Worn piston rings allowing oil to accumulate below the pistons and burn at startup
- C. Worn valve stem seals allowing oil to migrate past the seals overnight and accumulate in the combustion chambers
- D. An overfilled PCV system allowing oil mist to pool in the intake manifold during shutdown

6. A cooling system pressure test drops from 15 psi to 8 psi over 20 minutes. No external leak is visible. The engine oil appears normal with no milky discoloration. What should the technician check NEXT?

- A. The head gasket for a failure allowing pressurized coolant to enter the oil passages
- B. The radiator end tanks for hairline cracks that only weep under sustained test pressure
- C. The heater core for an internal leak that drips coolant into the HVAC housing not visible externally
- D. The water pump seal for a weep that only occurs under the applied test pressure with the engine off

6. A cooling system pressure test drops from 15 psi to 8 psi over 20 minutes with no external leak and normal-appearing oil. What should the technician check NEXT?

- A. The head gasket for failure allowing coolant into the oil passages
- B. The radiator end tanks for hairline cracks
- C. The heater core for an internal leak dripping into the HVAC housing
- D. The water pump seal for a pressure-activated weep

7. A technician performs a relative compression test. All cylinders show similar crank speed and amperage contribution except cylinder 4, which shows normal speed and normal amperage on every stroke except one — where amperage drops to near zero on alternating compression strokes. What does this MOST likely indicate?

- A. A sticking valve on cylinder 4 that seals inconsistently between firing cycles
- B. A CKP signal irregularity near the cylinder 4 position affecting every other stroke measurement
- C. The cylinder 4 fuel injector activating during the test affecting alternating stroke readings
- D. A loose spark plug on cylinder 4 causing inconsistent compression sealing on alternating strokes

8. An engine has blue smoke on startup after a hot soak of 2–3 hours following normal operation. The smoke clears within 20 seconds. No smoke is present during normal driving. What is the MOST likely cause?

- A. Worn piston rings that allow oil to accumulate under the pistons during the soak period
- B. Worn valve stem seals allowing oil to migrate down the valve stems during the hot soak period
- C. A leaking head gasket allowing oil to seep into the combustion chamber during the soak period
- D. An overfilled crankcase causing oil to be pushed into the intake manifold during the hot soak period

9. An engine has a consistent misfire on cylinder 7 that occurs only under heavy load and WOT acceleration. Compression, leakage, and ignition on cylinder 7 are all confirmed normal at idle. What should the technician check NEXT?

- A. The cylinder 7 coil for a fault that only manifests under the high cylinder pressure of WOT
- B. The cylinder 7 spark plug gap for a marginal setting that fails under high-load secondary voltage demand
- C. A vacuum leak near cylinder 7 that opens under the high manifold vacuum of WOT acceleration
- D. The cylinder 7 fuel injector for a fault causing lean delivery specifically under high-demand WOT conditions

10. An engine has a persistent oil consumption complaint. Blue smoke is present only at highway speeds above 65 mph. At idle and city driving there is no smoke. Compression is normal. What is the MOST likely cause?

- A. Worn piston rings that only allow oil consumption under the high cylinder pressures of highway speeds
- B. A PCV system fault routing excessive oil vapor into the intake specifically under highway vacuum conditions
- C. Worn valve stem seals or oil control rings that allow oil consumption only under the sustained high-vacuum conditions of highway cruise
- D. A leaking valve cover gasket allowing oil to drip onto the exhaust manifold at highway engine speeds

11. A snap-throttle vacuum test shows the needle drops to 2 in/Hg at snap-throttle and returns slowly to 16 in/Hg over 3–4 seconds before stabilizing. What does the slow recovery MOST likely indicate?

- A. A large vacuum leak reducing available vacuum that requires time to recover to the low idle baseline
- B. Weak valve springs causing delayed valve closing that reduces vacuum recovery rate after snap-throttle
- C. Retarded ignition timing causing vacuum to build slowly after the snap-throttle event
- D. A partially collapsed exhaust system restricting exhaust flow and slowing vacuum recovery

11. A snap-throttle vacuum test shows the needle dropping to 2 in/Hg at snap-throttle and returning slowly to 16 in/Hg over 3–4 seconds. What does the slow return MOST likely indicate?

- A. A large vacuum leak reducing available vacuum and slowing recovery
- B. Weak valve springs causing delayed valve closing and slow vacuum recovery
- C. Retarded ignition timing causing slow vacuum buildup after snap-throttle
- D. A partially collapsed exhaust restricting flow and slowing recovery

12. A no-start condition exists. Spark is confirmed at all cylinders. Fuel pressure is 56 psi. Injector pulse is confirmed on all cylinders. Compression is 165 psi on all cylinders. A timing light during cranking shows spark advancing normally with crank speed. What should the technician check NEXT?

- A. The crankshaft position sensor for an offset causing spark to fire at an incorrect crankshaft position
- B. The camshaft timing for a jumped chain that may be causing the valves to open at incorrect positions despite normal compression
- C. The fuel injector spray pattern under actual operating pressure for a fault preventing atomization
- D. The ignition timing base setting with the scan tool to confirm commanded versus actual timing agreement

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

13. A spark plug from a high-performance engine shows a white to light gray insulator with a slightly eroded center electrode and no deposits. The plug has been in service for 30,000 miles on a platinum-tipped plug with a 60,000-mile service interval. What does this indicate?

- A. Pre-ignition damage causing the insulator to bleach white from extreme thermal stress
- B. A lean air-fuel mixture causing the plug to run hot and produce the white insulator appearance
- C. Normal appearance for a mid-service-life platinum plug operating within correct parameters
- D. Detonation damage causing the insulator to whiten and the electrode to erode prematurely

14. A P0353 ignition coil C primary circuit fault is stored. Coil C supply voltage is confirmed at 12.4 volts. The PCM command wire shows 12.1 volts at rest and 0.3 volts when commanded. Spark is produced. What is the MOST likely explanation for the stored code?

- A. The code was set during a previous intermittent fault event — current circuit operation is correct and the code should be cleared and the system monitored
- B. The 0.3-volt command signal indicates the PCM driver is borderline and should be replaced proactively
- C. A 0.3-volt residual on the command wire when grounded confirms a high-resistance ground path in the driver circuit
- D. The 12.1-volt resting voltage on the command wire confirms a short to power that set the code

15. A secondary ignition scope waveform shows a normal firing line followed by a very long spark line — three times the duration of all other cylinders — with a very low amplitude. What does a long, low-amplitude spark line MOST likely indicate?

- A. A shorted spark plug causing the arc to sustain at very low voltage for an extended duration
- B. A high-resistance plug wire causing the arc voltage to drop and prolong the burn duration
- C. Normal variation — spark line amplitude and duration vary significantly between cylinders

D. A fouled or shorted spark plug providing a very low-resistance alternate path that sustains a low-voltage arc for extended duration

16. A Hall effect CKP sensor is tested with a DVOM set to DC volts. With the engine running, the meter reads 2.1 volts. The technician then tests with a lab scope and sees a clean square wave switching between 0 and 4.8 volts. What explains the DVOM reading of 2.1 volts?

A. The DVOM is averaging the area under the square wave — a duty cycle below 50% produces a reading below half the reference voltage

B. The DVOM is averaging the rapidly switching square wave and displaying the mathematical mean of the high and low states

C. The DVOM reading of 2.1 volts indicates a signal fault — a correct Hall effect sensor should read either 0 or 5 volts, never an intermediate value

D. The DVOM is reading the AC component of the square wave signal, which averages lower than the DC reference voltage

17. A COP system has a P0307 misfire on cylinder 7. Swapping the cylinder 7 coil to cylinder 3 does not move the misfire — P0307 continues to set and P0303 does not appear. Swapping the cylinder 7 spark plug to cylinder 3 also does not move the misfire. What should the technician check NEXT?

A. The fuel injector on cylinder 7 for a fault causing lean delivery and a misfire that stays on cylinder 7

B. The compression and leakage on cylinder 7 for a mechanical fault causing the misfire to remain on that cylinder

C. The PCM driver circuit for cylinder 7 for a fault that keeps the misfire on cylinder 7 regardless of component changes

D. A vacuum leak specifically near the cylinder 7 intake port causing a lean misfire that stays on that cylinder

18. A magnetic reluctance CKP sensor is tested during cranking. The waveform shows consistent tooth amplitude and pattern except the signal drops completely to zero for the duration of one specific tooth position on every revolution. What is the MOST likely cause?

- A. A PCM input circuit fault that periodically rejects the signal at that specific crankshaft position
- B. Normal behavior — magnetic reluctance sensors have a designed reference gap that produces a brief signal dropout for PCM timing reference
- C. Electromagnetic interference from an adjacent circuit that cancels the sensor signal at that position
- D. A missing tooth on the reluctor wheel at that position — a designed or accidental absence of a tooth produces a complete signal dropout

18. A magnetic reluctance CKP waveform shows consistent teeth but one specific position produces a complete signal dropout to zero on every revolution. What is the MOST likely cause?

- A. A PCM input circuit fault rejecting the signal at that crankshaft position
- B. Normal behavior — a designed reference gap produces a brief dropout for PCM timing reference
- C. Electromagnetic interference canceling the signal at that position
- D. A missing tooth on the reluctor wheel at that position

19. A distributor ignition system has a consistent misfire on cylinder 4 at all operating conditions. Swapping the plug wire to a known-good wire does not move the misfire. Replacing the spark plug does not resolve the misfire. Compression and leakage on cylinder 4 are confirmed normal. What should the technician check NEXT?

- A. The distributor cap terminal for cylinder 4 for corrosion, carbon tracking, or physical damage
- B. The ignition module for an intermittent fault affecting only the cylinder 4 firing position
- C. The cylinder 4 fuel injector for a fault causing a lean misfire that persists despite ignition changes
- D. The PCM for a fault causing incorrect advance calculation for the cylinder 4 firing event

20. A technician replaces all spark plugs during a routine service. After reinstalling the coil-on-plug assemblies, a P0302 misfire sets immediately on test drive. The coil was confirmed good before removal. What should the technician check FIRST?

- A. Whether the replacement plug gap is correct for that specific application

- B. Whether the cylinder 2 coil boot is fully seated and making complete contact with the new spark plug
- C. Whether the replacement plug heat range is correct for that specific engine
- D. Whether the cylinder 2 spark plug was installed to the correct torque specification

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

21. A return-style fuel system shows 60 psi at key-on with the vacuum line connected to the regulator. After the engine starts and vacuum is applied naturally by idle manifold vacuum, pressure drops to 52 psi. The specification is 55 psi minimum at idle with vacuum applied. What should the technician check FIRST?

- A. The fuel pressure regulator for a fault allowing excessive pressure drop under vacuum reference at idle
- B. The fuel pump for insufficient output volume causing pressure to drop when idle fuel demand is applied
- C. The fuel filter for a restriction that reduces available pressure under idle flow demand
- D. The fuel return line for a restriction causing pressure to back up at key-on and then normalize incorrectly at idle

22. A scan tool shows MAF reading 3.1 g/s at idle on a system with a 4.5–6.0 g/s specification. LTFT is +19% on both banks. A P0101 MAF range performance code is stored. What is the MOST likely cause?

- A. A vacuum leak downstream of the MAF introducing unmetered air and triggering the performance code
- B. A contaminated MAF hot-wire element underreporting actual airflow at all operating conditions
- C. A MAF sensor signal wire with high resistance causing a reduced voltage signal at the PCM input
- D. An air filter severely clogged and restricting airflow through the MAF sensing element

23. A port injection engine has correct fuel pressure at key-on. Immediately after startup, pressure drops to zero and the engine stalls. The pump can be heard running during cranking. What should the technician check NEXT?

- A. The fuel pump relay for an intermittent fault cutting pump power after initial startup
- B. The fuel pressure regulator for a fault that vents all rail pressure immediately after engine startup
- C. The anti-theft system for a security lockout that disables the fuel pump after an initial key-on cycle
- D. The fuel pump check valve for a total failure that prevents any pressure retention after initial priming

24. A scan tool shows TPS reading 0.48 volts at idle and 4.52 volts at WOT with a smooth, continuous sweep. A P0122 TPS low input code is stored. What is the MOST likely explanation?

- A. The TPS idle voltage of 0.48 volts is within normal range — the code was set during a previous fault event
- B. A short to ground on the TPS signal wire is causing the low input code despite current normal readings
- C. The TPS WOT voltage of 4.52 volts is below the minimum required and causing the code to set
- D. The code was set because the TPS was disconnected during recent service — the current reading is correct

24. A TPS reads 0.48 volts at idle and 4.52 volts at WOT with a smooth sweep. A P0122 TPS low input code is stored. What is the MOST likely explanation?

- A. Current TPS readings are normal — the code was set during a previous fault event and should be cleared and monitored
- B. A short to ground on the TPS signal wire is causing the code despite normal current readings
- C. The WOT voltage of 4.52 volts is below the minimum required for this system
- D. The code was set because the TPS was disconnected during recent service

25. A GDI engine has a P0093 fuel system leak detected — large leak code stored. High-pressure rail pressure drops from 1,800 psi at idle to 200 psi within 3 seconds when the high-pressure pump is disabled via scan tool. What does the rapid pressure drop confirm?

- A. A significant internal or external leak in the high-pressure fuel system is causing rail pressure to bleed down rapidly when the pump stops compensating

- B. The high-pressure pump has a faulty check valve allowing rapid reverse flow into the low-pressure circuit
- C. The high-pressure fuel rail pressure sensor is faulty and is reporting a false rapid drop during the pump disable test
- D. Normal behavior — GDI high-pressure rail pressure always drops quickly when the pump is disabled due to system design

26. A naturally aspirated engine has LTFT at +4% and +3% on both banks at idle. At 2,500 RPM under light load, LTFT on both banks suddenly jumps to +24% and stays there until RPM drops below 2,000. What is the MOST likely cause?

- A. A MAF sensor that reads correctly at low airflow but begins underreporting above the specific RPM threshold
- B. A fuel injector that becomes restricted above a specific RPM from a heat-activated restriction
- C. A vacuum hose that collapses under the higher engine vacuum present at 2,500 RPM under light load
- D. An EVAP purge solenoid that opens at a specific RPM threshold and then closes — its effect would be negative trims

27. A turbocharged engine has a boost pressure of 18 psi at all RPM. The wastegate solenoid is confirmed functional. A scan tool shows the PCM commanding 12 psi maximum boost. What is the MOST likely cause?

- A. A wastegate solenoid calibration fault causing it to hold higher pressure than commanded
- B. A wastegate actuator that has seized in the closed position — not responding to solenoid command or exhaust pressure
- C. A boost pressure sensor reading low — the PCM believes boost is only 12 psi when actual boost is 18 psi
- D. A turbocharger compressor wheel overspeed condition causing boost to exceed commanded levels

28. A fuel-injected engine has a P0172 rich code. Fuel pressure is correct. Injector balance shows all injectors within 2%. MAF reads correctly. LTFT is -19% on both banks. A scan tool bi-directional test commands the EVAP purge solenoid closed. Within 30 seconds, LTFT begins moving toward zero on both banks. What does this confirm?

- A. The MAF sensor was reading high — closing the purge solenoid removed its effect on airflow calculation
- B. A vacuum leak was being masked by the purge solenoid — closing it reveals the underlying lean condition
- C. The fuel pressure regulator has a fault that is only detectable when purge vapor is removed from the mixture
- D. The EVAP purge solenoid was stuck open and delivering excess fuel vapor to the intake, causing the rich condition

29. A turbocharged direct injection engine runs perfectly at idle but misfires under moderate to heavy acceleration. Fuel pressure — both low and high — is confirmed correct. Ignition is confirmed normal. Compression is confirmed normal. What should the technician check NEXT?

- A. The intercooler for an internal restriction reducing charge air volume under boost
- B. The boost pressure sensor for a fault causing incorrect boost pressure readings under load
- C. The high-pressure fuel injector spray pattern and delivery volume under operating pressure
- D. The wastegate for a stuck-open condition reducing boost to zero under acceleration load

30. A vehicle has an exhaust backpressure test showing 1.2 psi at 2,500 RPM against a 3.0 psi maximum specification. A P0420 catalyst efficiency code is stored. Downstream O2 sensor switching rate matches the upstream sensor. What is the correct interpretation?

- A. The catalyst has lost its chemical oxygen storage efficiency but is not physically restricted — the P0420 is valid and the converter requires replacement
- B. The low backpressure confirms the catalyst has not collapsed — the P0420 is caused by a downstream O2 sensor fault

C. The backpressure reading below 3.0 psi confirms the catalyst and exhaust system are functioning correctly — the P0420 is a false positive

D. The downstream O2 sensor switching at the same rate as the upstream confirms the P0420 is caused by exhaust system restriction rather than catalyst degradation

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

31. A PCV system inspection finds the PCV valve rattles correctly, the fresh air inlet is unobstructed, and manifold vacuum at the PCV port is 18 in/Hg. Oil consumption is reported at 1 quart per 3,000 miles. No external oil leaks are visible. What is the MOST appropriate conclusion?

A. An acceptable oil consumption rate with no fault found — oil consumption of 1 quart per 3,000 miles is within the normal range for many engines

B. The PCV valve is stuck open causing oil consumption at the acceptable-appearing rate of 1 quart per 3,000 miles

C. A head gasket breach is consuming oil internally at a rate that appears acceptable but will worsen progressively

D. The high manifold vacuum of 18 in/Hg at the PCV port is excessive and is drawing oil into the intake at the reported rate

32. A vehicle has a P0300 random misfire stored. Fuel trims are +1% on both banks. A cylinder contribution test shows cylinder 3 dropping 30 RPM compared to 200 RPM on all other cylinders. What does this indicate?

A. Cylinder 3 has a fuel delivery fault causing minimal contribution to engine power

B. Cylinder 3 is contributing minimally — it is misfiring on most firing events and the misfire source should be identified on that cylinder specifically

C. The P0300 is a general code — cylinder 3 contribution result confirms the misfire is random across all cylinders equally

D. Cylinder 3 has a mechanical fault — its compression should be verified before checking ignition or fuel delivery

33. A P0442 small EVAP leak code is stored. A fuel cap pressure test confirms the cap seals correctly. A standard smoke test reveals no leaks. An additional low-pressure smoke test reveals a very minor seep at the purge solenoid outlet fitting. What is the correct repair?

- A. Tighten or replace the purge solenoid outlet fitting and retest with the smoke machine to confirm the repair
- B. Replace the entire purge solenoid assembly as a seeping fitting indicates internal solenoid body stress
- C. Replace the charcoal canister as it is exposed to the same vapor pressures as the leaking fitting
- D. Clear the code and retest — a minor seep at the purge solenoid fitting is within acceptable EVAP system tolerance

34. A vehicle has elevated CO on a tailpipe emissions test. LTFT is -14% on both banks. The upstream O₂ sensors are switching normally. The catalytic converter passes a backpressure test. What is the MOST likely cause?

- A. A degraded catalytic converter with reduced CO oxidation capacity despite normal backpressure
- B. A lean air-fuel mixture producing CO from incomplete combustion at the lean limit
- C. A rich air-fuel mixture producing elevated CO from incomplete combustion due to excess fuel
- D. An ignition misfire delivering unburned HC that converts to CO in the exhaust stream

35. A vehicle has a P0139 downstream O₂ sensor slow response code on bank 1. The heater circuit is confirmed functional. The upstream sensor is switching normally and fuel trims are +1% on bank 1. What is the MOST likely cause?

- A. A rich condition on bank 1 causing the downstream sensor to respond slowly from prolonged rich exposure
- B. The bank 1 upstream sensor has slow response — the P0139 code is incorrectly attributed to the downstream sensor
- C. A catalytic converter fault on bank 1 chemically contaminating the downstream sensor element
- D. A downstream O₂ sensor on bank 1 with a degraded sensing element responding too slowly to exhaust composition changes

36. An AIR pump system has confirmed pump operation and confirmed open check valves on both banks during cold start. The upstream O₂ sensors on both banks show no lean response during the full 30-second pump run cycle. What should the technician inspect FIRST?

- A. The AIR pump inlet filter for a severe blockage preventing adequate air volume output despite confirmed pump rotation
- B. The upstream O₂ sensor heaters for a fault causing both sensors to reach operating temperature too quickly
- C. The AIR distribution tubes on both banks for simultaneous blockage preventing air from reaching the exhaust ports
- D. The PCM AIR monitor calibration for a threshold setting that requires a stronger lean response than this system can produce

37. A vehicle has a P0411 secondary AIR system incorrect flow code. The AIR pump runs and check valves are confirmed open. The upstream O₂ sensor shows a lean response but the response is weaker than expected. A vacuum test at the AIR manifold port shows correct vacuum. What is the MOST likely cause?

- A. A weakened AIR pump not generating sufficient air volume despite confirmed rotation
- B. The upstream O₂ sensor has degraded response — the lean signal is present but not detected correctly
- C. The PCM AIR monitor threshold requires a stronger lean response magnitude than the system is currently delivering
- D. A partial blockage in the AIR distribution tubes reducing volume delivered to the exhaust ports despite correct pump vacuum

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

38. A scan tool shows STFT at -16% and LTFT at -18% on both banks at all engine speeds. No codes are stored. What is the MOST likely cause?

- A. A stuck-open EVAP purge solenoid adding excess vapor that affects predominantly idle operation
- B. A persistent rich condition at all engine speeds from a fuel system fault, MAF over-reading, or leaking injector
- C. An upstream O₂ sensor contaminated on both banks simultaneously biasing fuel trims negative
- D. A MAF sensor reading slightly high at idle only — the negative trims at all speeds indicate a different fault

39. A vehicle has a P0174 bank 2 lean code. LTFT bank 2 is +21% and LTFT bank 1 is +2%. A smoke test of the bank 2 intake system finds no vacuum leaks. Fuel pressure is normal. A cylinder contribution test shows all bank 2 cylinders contributing equally. What should the technician check NEXT?

- A. The bank 2 upstream O₂ sensor for contamination or a lean-biased output causing false lean trims
- B. The bank 2 fuel injectors for restriction — equal contribution does not rule out a uniform flow reduction
- C. The bank 1 upstream O₂ sensor for contamination affecting the bank 2 comparison fuel trim
- D. An exhaust manifold leak on bank 2 introducing oxygen upstream of the bank 2 O₂ sensor

39. P0174 bank 2 lean with LTFT at +21%. Bank 1 LTFT is +2%. No vacuum leaks found on bank 2. Fuel pressure is normal. All bank 2 cylinders contribute equally on cylinder contribution test. What should the technician check NEXT?

- A. The bank 2 upstream O₂ sensor for contamination or lean-biased output
- B. The bank 2 fuel injectors for restriction — equal contribution does not rule out uniform flow reduction
- C. The bank 1 upstream O₂ sensor for contamination affecting the bank 2 fuel trim comparison
- D. An exhaust manifold leak on bank 2 introducing oxygen upstream of the bank 2 O₂ sensor

40. A scan tool shows the upstream O2 sensor on bank 1 producing a waveform that switches between 0.1 and 0.9 volts but the switching rate is very slow — one complete cycle every 8 seconds instead of the normal 1–2 cycles per second. LTFT bank 1 is +1%. What is the MOST likely cause?

- A. A bank 1 vacuum leak causing slow lean-to-rich cycling as the PCM slowly corrects for the unmetered air
- B. A bank 1 fuel delivery fault causing slow fuel trim cycling from insufficient injector response time
- C. A bank 1 upstream O2 sensor with a degraded sensing element producing abnormally slow voltage transitions
- D. Normal O2 sensor behavior on a vehicle at light-throttle cruise — switching rate decreases naturally at lower loads

41. A vehicle has a P0172 rich code on bank 1. LTFT bank 1 is -22% and LTFT bank 2 is +2%. All bank 1 injectors pass a balance test within 2%. MAF sensor readings are confirmed correct. Fuel pressure is normal at all operating conditions. What should the technician check NEXT?

- A. The bank 1 upstream O2 sensor for contamination or a bias toward the rich voltage range
- B. The bank 1 intake manifold for a vacuum leak that would increase fuel delivery requirements and cause a rich code
- C. The EVAP purge solenoid for a stuck-open fault delivering excess vapor to bank 1 specifically
- D. A head gasket breach on bank 1 allowing combustion gases to contaminate the upstream O2 sensor

42. A scan tool freeze frame for a P0171 bank 1 lean code shows ECT at 201°F, RPM at 820, and load at 9%. What operating condition does this freeze frame describe?

- A. Hard acceleration on a fully warmed engine at moderate RPM
- B. Highway cruise on a fully warmed engine at light throttle
- C. Cold engine idle during the warm-up phase before closed-loop operation
- D. A fully warmed engine idling at light load — consistent with a vacuum leak or MAF fault at idle

43. A vehicle has a U0155 lost communication with instrument cluster code stored in the PCM. The instrument cluster operates normally and displays all data correctly. The scan tool communicates with both the PCM and the cluster. What is the MOST likely explanation?

- A. The code was set during a previous intermittent communication event — current operation is normal and the code should be cleared and monitored
- B. The cluster is receiving data correctly from other modules but is not responding to the PCM specifically
- C. The CAN bus has a soft fault that only affects PCM-to-cluster communication during specific operating conditions
- D. The PCM has stored the code erroneously — the instrument cluster communication path has never been interrupted

44. A vehicle has STFT at +2% and LTFT at +3% at idle on both banks. At highway cruise the STFT drops to 0% and LTFT stabilizes at +1% on both banks. After EVAP monitor runs, LTFT drops to -4% on both banks for approximately 3 minutes then returns to +1%. What does the LTFT drop during the EVAP monitor represent?

- A. A MAF sensor fault that produces a rich reading during the specific airflow conditions of the EVAP monitor run cycle
- B. A vacuum leak that temporarily seals when the EVAP vent solenoid closes during the monitor run
- C. Normal EVAP purge operation — when the purge solenoid opens during the monitor, fuel vapor is added to the intake causing the PCM to reduce fuel delivery
- D. A downstream O2 sensor fault causing incorrect catalyst efficiency readings during the EVAP monitor cycle

45. A vehicle has an intermittent stall with no codes stored. A scan tool captures a stall event. At the moment of stall, RPM drops to zero but the CKP sensor signal continues showing normal pattern. All other sensor inputs read normal. What does CKP signal present with zero RPM scan tool reading indicate?

- A. The scan tool CAN bus communication has an intermittent fault causing incorrect RPM display during the stall

B. The CKP signal is present but the PCM has stopped processing it — a PCM power or ground dropout is causing the stall

C. A CKP sensor waveform fault that appears correct on the scope but is being rejected by the PCM input circuit

D. The engine has stalled and the CKP signal is being generated by crankshaft momentum for a brief period after the stall

46. A vehicle has a P0128 coolant below thermostat regulation code. The thermostat was replaced 6 months ago and the code returned after 2,000 miles. The ECT reads 178°F after 20 minutes of highway driving against a 190–210°F specification. What should the technician check BEFORE replacing the thermostat again?

A. The cooling fan for a fault running continuously and overcooling the engine at highway speed

B. The coolant for contamination lowering the effective thermostat opening temperature below specification

C. The ECT sensor for a calibration drift causing a slightly low reading despite correct coolant temperature

D. The radiator cap for a low-pressure rating allowing excessive coolant circulation before the thermostat can maintain temperature

46. A P0128 returned after a thermostat replacement 6 months ago. ECT reads 178°F after 20 minutes of highway driving. What should the technician check BEFORE replacing the thermostat again?

A. The cooling fan for a fault running continuously and overcooling the engine

B. The coolant for contamination lowering the effective thermostat opening temperature

C. The ECT sensor for a calibration drift causing a low reading despite correct temperature

D. The radiator cap for a low-pressure rating allowing excessive coolant circulation

47. A vehicle has a P0300 random misfire stored with normal fuel trims, confirmed normal ignition on all cylinders, and confirmed normal compression. A scope test of all fuel injector waveforms shows cylinder 5 injector pulse width is 20% shorter than all other cylinders at the same operating condition. What does this confirm?

A. The PCM is commanding less fuel to cylinder 5 — an individual cylinder fuel trim fault or injector characterization error is reducing cylinder 5 injection duration

B. A cylinder 5 injector with high internal resistance is causing the PCM to shorten its command to compensate

C. The cylinder 5 injector is opening more slowly than others, making the effective pulse width appear shorter on the scope

D. A PCM output driver fault on cylinder 5 is clipping the injection pulse width at the electrical output stage

48. A vehicle has all OBD II monitors complete except the EGR monitor after 600 miles of post-battery-replacement driving. The EGR valve operates correctly on bi-directional test. No codes are stored. What is the MOST likely reason the EGR monitor has not completed?

A. A small EGR passage restriction is preventing the monitor from detecting sufficient flow during its evaluation

B. The EGR monitor has not been prevented from running — the specific temperature, RPM, and load conditions required to enable it have not been simultaneously satisfied during any drive event

C. The DPFE sensor has a calibration drift that prevents the EGR monitor from confirming adequate flow

D. The EGR monitor requires the O2 sensor monitor to complete first — the O2 monitor must be verified before EGR evaluation

49. A vehicle has LTFT at +2% on bank 1 and +21% on bank 2 at idle. At 2,500 RPM, bank 1 LTFT remains at +2% and bank 2 LTFT drops to +5%. An exhaust manifold leak is confirmed upstream of the bank 2 O2 sensor. What is the correct repair and verification procedure?

- A. Replace the bank 2 upstream O2 sensor as it has been exposed to atmospheric oxygen and is likely contaminated
- B. Repair the exhaust manifold leak, clear the P0174 code, and verify LTFT bank 2 normalizes after a complete drive cycle
- C. Replace the bank 2 upstream O2 sensor and repair the exhaust manifold leak simultaneously before retesting
- D. Repair the exhaust manifold leak and replace the catalytic converter as it may have been oxygen-contaminated during the leak period

50. A vehicle has all OBD II monitors complete. Mode 6 data shows the catalyst monitor test value at 85% of the maximum allowed threshold. No P0420 code is stored. What is the MOST appropriate action?

- A. No action required — the monitor passed and no code exists
- B. Replace the catalytic converter proactively — an 85% threshold value always indicates imminent converter failure
- C. Perform a downstream O2 sensor response test to confirm the Mode 6 reading before any action
- D. Inform the customer the catalyst efficiency is degrading and recommend monitoring at the next service interval before the threshold is exceeded

PRACTICE EXAM 14: ANSWER KEY AND EXPLANATIONS

DOMAIN A — GENERAL DIAGNOSIS

- 1. C. A single cylinder misfiring — the drop interval decreasing with RPM confirms a speed-dependent fault** — A vacuum needle dropping at a regular interval that becomes twice as frequent when RPM doubles confirms the drop is occurring at a fixed number of crankshaft revolutions — specifically every time one cylinder reaches its power stroke. At idle, that cylinder fires once every two seconds based on the engine's RPM and cylinder count. At 2,000 RPM, the same cylinder fires twice as frequently, producing drops twice as often. This direct RPM-proportional relationship is the diagnostic signature of a single consistently misfiring cylinder, distinguishing it from a sticking EGR valve or vacuum leak that would not double in frequency with doubled RPM.
- 2. A. Worn piston rings on cylinders 5 and 6** — Both cylinders show compression 15 psi below the mid-range of the other cylinders and both improve by exactly 15 psi on the wet test. The wet test improvement confirms oil temporarily sealed the ring gap on both cylinders, identifying the rings as the leak path. A head gasket breach between two cylinders would show adjacent cylinder pairs with equal low readings and no wet test improvement. Carbon deposits do not create a ring-seal leak that oil can improve. The consistent wet test response on both cylinders confirms ring seal as the fault, even though the loss is modest.
- 3. D. The knock is combustion-related — removing the wire eliminates the combustion event** — A knock that immediately disappears when a specific plug wire is removed and immediately returns when it is reconnected confirms the knock is directly caused by or driven by the combustion event in that specific cylinder. Removing the wire eliminates spark delivery to that cylinder, stopping combustion entirely on that cylinder. If the knock was purely mechanical — worn bearings, piston slap — it would continue regardless of whether that cylinder fires. The fact that the knock is entirely dependent on combustion occurring in that cylinder confirms it is combustion-driven — detonation, pre-ignition, or a combustion-driven mechanical event specific to that cylinder.
- 4. B. Worn piston rings on cylinder 3 allowing test air to pass into the crankcase** — Air escaping exclusively from the oil filler cap opening confirms the test air is passing through the piston rings into the crankcase and exiting through the valve cover oil filler opening. The crankcase ventilates through the valve cover, making the oil filler cap the most accessible exit point for pressurized crankcase air during leakage testing. The 22% leakage — slightly above the 20% maximum — combined with the crankcase escape path confirms worn ring seal as both the source of the leakage

and the location above specification. No other seal failure routes air exclusively to the oil filler opening.

5. **C. Worn valve stem seals allowing oil to migrate overnight** — Blue smoke only at first startup after an overnight sit that clears within 30 seconds is the definitive presentation of worn valve stem seals. During the overnight shutdown period, oil slowly migrates past the degraded valve stem seals and accumulates in the intake ports and combustion chambers by gravity and capillary action. At first startup, this accumulated oil is burned immediately, producing the visible blue smoke burst. Once the accumulated oil is consumed — within seconds — no further oil is available at that rate and the smoke clears. Normal compression and leakage confirm the rings are intact, eliminating ring wear as the oil path.
6. **C. The heater core for an internal leak dripping into the HVAC housing** — The pressure test confirms a slow internal leak — pressure drops without any external drip or puddle visible. Normal oil appearance eliminates a head gasket failure communicating with the oil passages. A heater core internal leak allows pressurized coolant to seep into the HVAC housing and evaporate or drain inside the dashboard — producing no visible external drip and no oil contamination. This is a common cause of slow cooling system pressure loss with no external leak and normal oil. The HVAC housing drain or a damp carpet under the dashboard are confirming indicators of heater core leakage.
7. **A. A sticking valve on cylinder 4 that seals inconsistently between firing cycles** — Normal average crank speed on cylinder 4 confirms the cylinder is generally encountering normal compression resistance. However, the alternating zero-amperage contribution on every other compression stroke indicates the cylinder is intermittently contributing no resistance at all on those specific strokes. A valve that sticks open on alternating compression strokes allows the cylinder to fill normally and then fail to seal during compression — producing normal resistance when the valve seats and zero resistance when it sticks open. The alternating pattern is consistent with a mechanical valve fault that is position-dependent on the cam lobe cycle.
8. **B. Worn valve stem seals allowing oil to migrate during the hot soak period** — Blue smoke specifically after a 2–3 hour hot soak following normal operation that clears within 20 seconds points to oil accumulation during the soak period rather than during normal operation. After a long drive, the engine bay reaches peak temperature. During the soak, the engine stops circulating oil but remains extremely hot. This combination of heat and stopped circulation allows oil to migrate more aggressively past degraded valve stem seals than during normal operation. The accumulated oil burns on restart, producing the brief blue smoke burst that clears once the accumulated oil is consumed and normal operating conditions resume.
9. **D. The cylinder 7 fuel injector for a fault causing lean delivery under high-demand WOT** — Compression, leakage, and ignition on cylinder 7 are confirmed normal at idle — all mechanical and ignition components are functioning correctly under low-demand conditions. A misfire that appears exclusively under heavy load and WOT acceleration — when fuel demand is highest —

with all other systems confirmed normal points to a fuel delivery fault that is only apparent under maximum demand. A partially restricted injector that delivers adequate fuel at idle pulse widths but cannot flow sufficient volume at the longer WOT pulse widths creates a lean condition under maximum demand that is completely absent at idle — producing the load-specific misfire described.

10. **C. Worn valve stem seals or oil control rings allowing consumption under sustained high-vacuum highway cruise** — Blue smoke exclusively at highway speeds above 65 mph with no smoke at idle or city driving and normal compression narrows the oil consumption path to a condition specific to sustained highway cruise. Extended highway cruise produces sustained high intake manifold vacuum from the combination of moderate RPM and light throttle — the highest sustained vacuum of any driving condition. Worn valve stem seals or degraded oil control rings that are borderline under normal conditions allow oil to be drawn past under this sustained high-vacuum environment, producing the speed and vacuum-specific oil consumption and smoke pattern described.
11. **B. Weak valve springs causing delayed valve closing and slow vacuum recovery** — A normal snap-throttle drop confirms the engine responds correctly to the sudden throttle opening. However, slow recovery — taking 3–4 seconds to return to the idle baseline after throttle closure — indicates the engine is slow to re-establish the normal pumping efficiency that creates manifold vacuum. Weak valve springs that cannot close intake valves rapidly enough after the snap-throttle event allow intake charge to escape back through the briefly delayed-closing valves, slowing the reestablishment of normal compression efficiency and delaying vacuum recovery. A restricted exhaust would cause progressive vacuum collapse under sustained RPM, not specifically slow snap-throttle recovery.
12. **D. The ignition timing base setting — confirm commanded versus actual timing agreement** — Spark is confirmed on all cylinders, fuel pressure and injection are confirmed, compression is confirmed normal, and the timing light confirms spark is advancing normally with RPM. All fundamental systems check out. A no-start with all systems confirmed functional suggests the engine's fundamental combustion conditions are not being met despite apparently correct individual component operation. Confirming that commanded timing from the PCM matches actual crankshaft timing via simultaneous scan tool and timing light comparison identifies whether the ignition system is firing at the correct crankshaft position — a base timing offset not detectable by individual component testing can prevent starting despite normal component function.

DOMAIN B — IGNITION SYSTEM DIAGNOSIS AND REPAIR

13. **C. Normal appearance for a mid-service-life platinum plug** — A white to light gray insulator with minimal electrode erosion at 30,000 miles on a 60,000-mile platinum plug is exactly the expected appearance of a plug at the midpoint of its service life operating under correct combustion conditions. The light gray to white insulator color indicates the plug is operating at its designed temperature range — hot enough to self-clean but not hot enough to cause thermal damage. Slight

center electrode erosion is normal and expected on a platinum plug at 30,000 miles. Pre-ignition and detonation damage would show blistering, melting, or mechanical erosion with discoloration beyond the normal operating range.

14. **A. The code was set during a previous intermittent fault event — current operation is correct** — Supply voltage is confirmed at 12.4 volts, the PCM command wire drops from 12.1 volts at rest to 0.3 volts when commanded, and spark is produced normally. This is the expected, correct behavior of a PCM-driven coil circuit — the wire rests near battery voltage when the driver is open and drops to near zero when the driver grounds the circuit. With all circuit elements confirmed functional and spark confirmed produced, the current system operation is correct. The stored P0353 code was set during a previous event when the circuit was actually faulted. Clearing the code and monitoring for recurrence is the appropriate action.
15. **D. A fouled or shorted spark plug providing a very low-resistance alternate path** — A normal firing line confirms adequate secondary voltage was produced to initiate the arc. However, a very long arc duration at very low amplitude indicates the arc is being sustained at abnormally low voltage for an extended time. A fouled or shorted spark plug with carbon bridging across the gap provides a resistive — rather than open — path that allows current to flow continuously at low voltage without the arc extinguishing normally. The available secondary energy is dissipated slowly through this low-resistance path over an extended duration rather than being delivered as a normal-amplitude spark. The result is a long, dim spark line that represents energy being wasted through the fouled plug's alternate conduction path.
16. **B. The DVOM is averaging the rapidly switching square wave** — A Hall effect sensor produces a clean digital square wave — switching between ground and reference voltage at the engine's firing frequency. A standard digital voltmeter cannot track individual switching events at engine speed and instead displays the mathematical average of the high and low voltage states over time. With a square wave switching between 0 and 4.8 volts, the average depends on the duty cycle. A reading of 2.1 volts — slightly below half of 4.8 volts — indicates the signal spends slightly less than 50% of its time at the high state. The lab scope correctly shows the true waveform that the DVOM cannot capture due to its slow sampling rate.
17. **C. The PCM driver circuit for cylinder 7 for a fault keeping the misfire on cylinder 7** — Both the coil and spark plug swaps have been performed without moving the misfire from cylinder 7 — confirming neither the coil nor the plug is the cause. With both swappable ignition components confirmed not at fault, the fault must reside in the fixed portion of the cylinder 7 ignition circuit — the PCM output driver, the wiring between the PCM and the coil connector, or the ground path specific to the cylinder 7 circuit. These components remain associated with cylinder 7 regardless of which coil or plug is installed, explaining why the misfire stays on cylinder 7 through multiple component changes.
18. **D. A missing tooth on the reluctor wheel at that position** — A magnetic reluctance sensor generates its voltage signal from the magnetic field change as each tooth passes. A missing tooth

— whether by design as a reference gap or by accidental damage — produces no magnetic field change at that position, resulting in a complete signal dropout to zero for the duration that position passes the sensor. The consistency — occurring at exactly the same crankshaft position every revolution — confirms a fixed physical condition rather than an electrical intermittent. On most engines, a single missing or reduced tooth is intentionally designed into the reluctor wheel as a reference marker that the PCM uses to establish crankshaft position reference — distinguishing TDC from other positions.

19. **A. The distributor cap terminal for cylinder 4 for corrosion, carbon tracking, or physical damage** — The plug wire swap not moving the misfire eliminates the wire. The new spark plug not resolving the misfire eliminates the plug. Confirmed normal compression and leakage eliminate mechanical causes. With the wire and plug — the two swappable components — both confirmed not at fault, and with mechanical causes eliminated, the fault lies in the fixed secondary circuit component specific to cylinder 4 that cannot be swapped without disassembly — the distributor cap terminal for cylinder 4. Corrosion, carbon tracking, or physical damage at that specific cap terminal prevents adequate secondary voltage delivery to cylinder 4 regardless of which wire or plug is installed.
20. **B. Whether the cylinder 2 coil boot is fully seated and making complete contact** — A misfire appearing immediately after a routine plug replacement on a previously good coil points directly to the installation process rather than component failure. When reinstalling coil-on-plug assemblies after plug replacement, incomplete seating of the coil boot — the rubber insulator that contacts the spark plug — is the most common cause of immediate post-service misfires. A coil boot not fully pressed down onto the new plug leaves an air gap in the secondary circuit that causes the high voltage to arc through the boot material rather than across the plug gap. This produces a misfire that sets immediately on the first test drive after service.

DOMAIN C — FUEL, AIR INDUCTION, AND EXHAUST SYSTEMS

21. **A. The fuel pressure regulator for a fault allowing excessive pressure drop under vacuum reference** — Key-on pressure of 60 psi with the vacuum line connected confirms the pump is delivering adequate pressure to the rail. When the engine starts and idle manifold vacuum is applied naturally to the regulator, pressure drops to 52 psi — 3 psi below the 55 psi minimum specification. On a correctly functioning return-style system, vacuum applied to the regulator reduces rail pressure by approximately 5–8 psi from the static spring pressure setting. An excessive drop below the minimum specification with vacuum applied indicates the regulator's vacuum reference diaphragm is allowing too much pressure reduction — either a weakened spring or an oversensitive diaphragm responding more than designed to the vacuum reference.
22. **C. A MAF sensor signal wire with high resistance causing a reduced voltage signal** — A MAF reading of 3.1 g/s — well below the 4.5–6.0 g/s idle specification — with positive LTFT on both banks and a P0101 performance code indicates the sensor is underreporting actual airflow. The PCM is compensating with +19% LTFT, confirming it is detecting a lean condition caused by the

under-reading MAF. A signal wire with high resistance between the sensor and the PCM reduces the voltage level that the PCM receives relative to what the sensor is actually producing, causing the PCM to calculate a lower airflow than actual. This differs from a contaminated sensor, which would produce a low signal at the sensor itself rather than in the wiring path.

23. **B. The fuel pressure regulator for a fault that vents all rail pressure immediately after startup** — The pump is confirmed running during cranking and pressure builds normally, allowing the engine to start. Immediately after startup, pressure drops to zero and the engine stalls. A regulator that fails completely open — or a regulator diaphragm that ruptures — allows all fuel to return to the tank with no resistance, collapsing rail pressure to zero within seconds of the engine starting. The pump continues running but cannot maintain any rail pressure against a completely open return path. This fault is distinct from a check valve failure — a check valve fault causes pressure loss after shutdown, not during operation.
24. **D. The code was set because the TPS was disconnected during recent service** — Current TPS readings of 0.48 volts at idle and 4.52 volts at WOT with a smooth, continuous sweep represent correct, normal TPS operation within the expected voltage range. A P0122 low input code stored with current readings that are normal indicates the code was triggered during a specific event — most likely a recent service during which the TPS connector was disconnected momentarily. Disconnecting the TPS with the ignition on causes the signal wire to drop to zero or near zero, triggering a low input code. The current correct readings confirm the TPS is functional and the stored code is a historical artifact from the service event.
25. **A. A significant internal or external leak in the high-pressure fuel system** — A correctly functioning GDI high-pressure fuel system retains rail pressure for a substantial period after the pump is disabled — the system's volume and injector sealing maintain pressure. A drop from 1,800 psi to 200 psi within only 3 seconds confirms a very large, rapid leak path in the high-pressure circuit. This rate of pressure loss cannot be explained by normal injector sealing leakage or system volume discharge — a significant leak path exists either externally through a fitting, fuel line, or injector body, or internally through a failed injector allowing fuel to flood the combustion chamber. The P0093 large leak code combined with this pressure drop rate confirms a substantial high-pressure system integrity failure.
26. **C. A vacuum hose that collapses under higher engine vacuum at 2,500 RPM under light load** — Normal LTFT at idle confirms the system is operating correctly at low vacuum. The sudden jump to +24% LTFT specifically when RPM increases to 2,500 under light load — where manifold vacuum is highest — and the return to normal when RPM drops below 2,000 is the specific pattern of a vacuum hose that physically collapses under the higher vacuum present at that operating condition. An aged or softened vacuum hose that maintains its shape at low idle vacuum collapses its internal passage when the higher vacuum of light-throttle elevated RPM exceeds its structural integrity, suddenly introducing a large unmeasured air leak that drives the bilateral positive fuel trim spike.

27. **B. A wastegate actuator that has seized in the closed position** — The wastegate solenoid is confirmed functional and the PCM is commanding 12 psi maximum boost. Despite the solenoid actively trying to regulate boost to the commanded level, actual boost is 18 psi — 6 psi above command. A wastegate that is physically seized in the closed position cannot open regardless of the solenoid's command. With the wastegate unable to open and bleed exhaust pressure away from the turbine, the turbine and compressor continue accelerating unconstrained by the wastegate's regulation function, allowing boost to exceed the PCM's commanded target. The solenoid's correct operation without boost response confirms the mechanical wastegate is not responding to any control input.
28. **D. The EVAP purge solenoid was stuck open delivering excess fuel vapor** — Commanding the purge solenoid closed is a bi-directional test that eliminates canister vapor delivery as a variable. When LTFT begins recovering toward zero within 30 seconds of closing the purge solenoid, the source of the excess fuel that was causing the -19% rich condition is confirmed to be the purge vapor. A stuck-open purge solenoid continuously draws fuel vapors from the charcoal canister directly into the intake manifold — adding unmetered fuel to both banks simultaneously at all engine speeds. Closing the solenoid stops the vapor delivery and the PCM begins recovering the LTFT toward stoichiometry, directly confirming the purge solenoid as the cause.
29. **C. The high-pressure fuel injector spray pattern and delivery volume under operating pressure** — Fuel pressure at both low and high pressure circuits is confirmed correct, ignition is confirmed normal, and compression is confirmed normal — all fundamental systems are functioning. The misfire occurring under moderate to heavy acceleration on a GDI engine with confirmed correct high-pressure rail pressure points to a delivery quality fault rather than a pressure fault. A high-pressure GDI injector that is partially clogged, has a damaged spray tip, or has worn internal components may maintain correct rail pressure while delivering an incorrect spray pattern — poor atomization, incorrect spray angle, or reduced actual volume — creating a lean misfire specifically under the higher fuel demand of acceleration.
30. **A. The catalyst has lost its chemical oxygen storage efficiency — the P0420 is valid** — Backpressure of 1.2 psi at 2,500 RPM is well below the 3.0 psi maximum, confirming the catalytic converter substrate is not physically collapsed or restricted. However, the downstream O₂ sensor switching at the same rate as the upstream sensor confirms the converter has lost its oxygen storage capacity — a chemically depleted catalyst cannot buffer exhaust oxygen content changes, causing the downstream sensor to mirror the upstream pattern. Physical restriction and chemical depletion are separate failure modes — the backpressure test rules out physical collapse while the downstream sensor switching pattern confirms chemical depletion. Both findings together confirm the P0420 is valid and converter replacement is required.

DOMAIN D — EMISSIONS CONTROL SYSTEMS

31. **D. An acceptable oil consumption rate — 1 quart per 3,000 miles is within the normal range** — The PCV system is confirmed fully functional — the valve rattles correctly, the fresh air inlet

is clear, and manifold vacuum at the PCV port is normal. No external oil leaks are visible. Oil consumption of 1 quart per 3,000 miles is widely recognized as within the acceptable normal range for many gasoline engines, particularly higher-mileage units. Many manufacturers specify up to 1 quart per 1,000 miles as acceptable. With a fully functional PCV system, no external leaks, and a consumption rate within the accepted normal range, the most appropriate conclusion is that no fault requiring repair has been identified.

32. **B. Cylinder 3 is contributing minimally — the misfire source should be identified on that cylinder** — A cylinder contribution test showing cylinder 3 dropping only 30 RPM compared to 200 RPM on all other cylinders confirms cylinder 3 is contributing very little power to the engine — it is misfiring on the vast majority of its firing events. The P0300 random misfire code combined with a single cylinder identified as the near-complete misfire source indicates the random code has been generated by one consistently weak cylinder rather than truly random misfires across multiple cylinders. The diagnosis is now focused on cylinder 3 specifically — identifying whether the cause is ignition, fuel delivery, or mechanical on that one cylinder.
33. **A. Tighten or replace the purge solenoid outlet fitting and retest** — The low-pressure smoke test has directly identified the specific fault — a very minor seep at the purge solenoid outlet fitting. The correct repair is to address the identified component directly. Tightening a loose fitting or replacing one that cannot seal is the appropriate targeted repair for a confirmed fitting leak. Retesting with the smoke machine after the repair confirms the leak has been eliminated. Replacing the entire solenoid assembly, charcoal canister, or additional components without evidence of their failure wastes parts. A single confirmed minor leak point requires only that point's repair followed by verification testing.
34. **C. A rich air-fuel mixture producing elevated CO from incomplete combustion** — Elevated CO with LTFT at -14% on both banks confirms a persistent rich condition that the PCM is actively trying to correct by substantially reducing fuel delivery. CO is produced when combustion lacks sufficient oxygen to fully oxidize fuel carbon to CO₂ — excess fuel from a rich mixture creates exactly this oxygen-deficient combustion environment. The normally switching upstream O₂ sensors confirm the sensors are functional and the PCM is receiving accurate rich feedback. The catalytic converter passing backpressure testing does not rule out reduced CO oxidation efficiency, but the negative LTFT directly identifies the rich mixture as the primary source of the elevated CO.
35. **D. A downstream O₂ sensor on bank 1 with a degraded sensing element** — The heater circuit is confirmed functional, eliminating heater-related slow response. The upstream sensor is switching normally and LTFT is near zero, confirming correct upstream mixture control and no persistent fuel fault on bank 1. A P0139 downstream slow response code with a confirmed functional heater, normal upstream operation, and neutral fuel trims on bank 1 points to the downstream sensor's own sensing element as the fault. The electrochemical zirconia element degrades with age, thermal cycling, and chemical exposure — a degraded element responds more

slowly to changes in exhaust oxygen content, producing the slow voltage transitions that trigger the P0139 monitor threshold.

36. **A. The AIR pump inlet filter for a severe blockage** — The pump is confirmed rotating and check valves are confirmed open on both banks — the mechanical delivery path is intact on both sides. Both upstream O₂ sensors showing no lean response despite confirmed pump rotation and open check valves indicates the pump is not generating adequate air volume output despite mechanical operation. A severely blocked pump inlet filter starves the pump of atmospheric air input — the pump rotates but cannot move sufficient air volume to produce a detectable lean signal at either bank's upstream sensor. The pump runs normally by mechanical indicators while producing negligible airflow due to restricted inlet, explaining the complete absence of lean response on both banks simultaneously.
37. **C. The PCM AIR monitor threshold requires a stronger lean response than the system is currently delivering** — The pump runs, check valves are open, vacuum at the AIR manifold port is correct, and a lean response is present — the AIR system is physically delivering air to the exhaust. However, a P0411 incorrect flow code continues to set because the lean response magnitude, while present, does not reach the PCM's minimum threshold for a monitor pass. The system is partially functional — delivering some air and producing a detectable lean signal — but the air volume is insufficient to satisfy the monitor's minimum lean excursion requirement. A weakened pump delivering air at reduced volume, partial distribution tube blockage reducing delivery efficiency, or a slightly degraded check valve reducing effective output can produce this pattern.

DOMAIN E — COMPUTERIZED ENGINE CONTROLS INCLUDING OBD II

38. **B. A persistent rich condition at all engine speeds from a fuel system fault, MAF over-reading, or leaking injector** — STFT at -16% and LTFT at -18% on both banks at all engine speeds confirms a severe, persistent rich condition that the PCM cannot fully correct throughout the entire operating range. The magnitude — nearly 20% correction required at all speeds — indicates a significant fuel delivery excess. A shared system fault affecting both banks simultaneously at all operating conditions — a MAF sensor reading significantly above actual airflow, a fuel pressure regulator stuck at elevated pressure, or multiple leaking injectors — is required to produce this bilateral, all-speed negative trim pattern. A stuck-open purge solenoid would typically show predominantly idle-specific effects with high-RPM recovery.
39. **D. An exhaust manifold leak on bank 2 introducing oxygen upstream of the bank 2 O₂ sensor** — Bank 1 LTFT near zero confirms shared system components — MAF, fuel pressure, and EVAP — are functioning correctly. Bank 2 shows strongly positive LTFT with no vacuum leaks found and normal fuel pressure. Equal cylinder contribution on all bank 2 cylinders eliminates injector restriction as a bank-2-specific cause — restricted injectors would produce unequal contribution. A bank 2 exhaust manifold leak upstream of the bank 2 upstream O₂ sensor introduces atmospheric oxygen into the exhaust stream before it reaches the sensor, causing the sensor to detect a lean

exhaust condition and signal the PCM to continuously add fuel — generating the elevated positive LTFT on bank 2 only.

40. **C. A bank 1 upstream O2 sensor with a degraded sensing element producing slow voltage transitions** — Switching rate of one cycle every 8 seconds — compared to normal 1–2 cycles per second — is dramatically slower than normal closed-loop fuel control. LTFT bank 1 at +1% is essentially neutral, confirming no persistent lean or rich bias exists. A sensor that switches correctly between the correct voltage range but at an abnormally slow rate with neutral LTFT confirms the sensing element is chemically degraded — it can still detect the direction of mixture change but its electrochemical response is so slow that it takes 8 seconds to complete a cycle that should take less than 1 second. Neutral LTFT eliminates a fuel delivery fault as the cause of the slow cycling.
41. **A. The bank 1 upstream O2 sensor for contamination or a bias toward the rich voltage range** — All bank 1 injectors pass a balance test within 2%, confirming no injector leakage. MAF sensor readings are correct. Fuel pressure is normal at all conditions. With all fuel delivery components confirmed functional and balanced, and no shared system fault present — confirmed by normal bank 2 LTFT — the PCM's perception that bank 1 is running rich must originate from the sensor providing the bank 1 mixture feedback. A bank 1 upstream O2 sensor contaminated or biased toward the rich voltage range causes the PCM to incorrectly perceive bank 1 as running rich and remove fuel, generating negative LTFT — without any actual rich condition existing.
42. **D. A fully warmed engine idling at light load** — ECT at 201°F confirms the engine is fully at operating temperature and in closed-loop fuel control mode. RPM at 820 is consistent with idle speed — not highway cruise or acceleration. Engine load at 9% confirms very light load — consistent with an unloaded idle condition. Together these freeze frame parameters describe a fully warmed engine sitting at idle under minimal load — the operating condition most associated with vacuum leaks and MAF idle under-reading faults that produce P0171 lean codes. This freeze frame directs the diagnosis toward idle-specific lean causes rather than load-dependent or RPM-dependent faults.
43. **A. The code was set during a previous intermittent communication event** — The instrument cluster is operating normally, displaying all data correctly. The scan tool communicates with both the PCM and the cluster. All current communication is confirmed functional. A U0155 code stored in the PCM with confirmed current normal operation indicates the communication interruption occurred at some previous point — possibly during a battery replacement, a low-voltage event, or a momentary connector disturbance — and has since resolved. The appropriate action is to clear the stored code, confirm current normal operation of all affected systems, and monitor for recurrence before pursuing additional diagnosis of a fault that may no longer exist.
44. **C. Normal EVAP purge operation delivering fuel vapor when the purge solenoid opens** — The LTFT behavior pattern described is the expected result of normal EVAP canister purging during the monitor run cycle. When the EVAP monitor runs, it commands the purge solenoid open

to flow canister vapors into the intake manifold. These fuel vapors add to the existing fuel delivery, temporarily enriching the mixture. The PCM responds by reducing fuel delivery — LTFT dropping to -4% — to compensate for the added vapor. When the purge cycle completes and the solenoid closes, the vapor contribution stops and LTFT returns to its normal baseline. This temporary LTFT decrease during EVAP purging is normal, expected behavior confirming the EVAP system is functioning correctly.

45. **B. The CKP signal is present but the PCM has stopped processing it — a PCM power or ground dropout** — The CKP sensor is confirmed generating a normal signal during the stall event — confirming the crankshaft is still rotating and the sensor is functioning. However, the scan tool shows zero RPM simultaneously, indicating the PCM has stopped receiving or processing the CKP input despite the signal being present on the wire. All other sensor inputs reading normal at the moment of stall further suggests the sensors themselves are functioning but the PCM has momentarily lost its ability to process inputs and generate outputs. A PCM power supply voltage dropout — too brief to affect all communication — causes the processor to reset, stopping engine management functions and causing the stall while the CKP signal continues independently.
46. **C. The ECT sensor for a calibration drift causing a slightly low reading** — The thermostat was replaced only 6 months ago and the P0128 returned, which reduces the likelihood of another thermostat failure so soon after replacement. Before replacing a recently replaced component, the accuracy of the measurement driving the diagnosis must be confirmed. An ECT sensor with a slight calibration drift toward the low end of its range — caused by aging thermistor characteristics — could read 178°F when actual coolant temperature is 188°F or higher. A temperature just 2–3°F below the regulation threshold would set the P0128 while the thermostat is actually functioning correctly. Confirming actual coolant temperature with an independent measurement before replacing the thermostat again prevents an unnecessary second replacement.
47. **A. The PCM is commanding less fuel to cylinder 5 — an individual cylinder fuel trim fault** — A scope test directly capturing the injector command from the PCM shows cylinder 5 receiving a 20% shorter pulse width command than all other cylinders at identical operating conditions. This confirms the PCM itself is intentionally delivering less fuel to cylinder 5 — not a component fault in the injector or its driver circuit. An individual cylinder fuel trim — available on some PCM calibrations — that has learned an incorrect adjustment for cylinder 5, or an injector characterization error in the PCM's calibration for that cylinder, would cause the PCM to systematically under-command fuel delivery to cylinder 5, producing the lean misfire confirmed by the P0300 code.
48. **B. The specific enable conditions for the EGR monitor have not been simultaneously met** — The EGR valve is confirmed functional by bi-directional testing and no codes are stored, confirming no active fault is preventing monitor execution. The EGR monitor has among the most specific enable criteria of all OBD II monitors — typically requiring a defined engine warm-up state, specific RPM ranges, defined load conditions, and particular vehicle speed windows all

occurring in a defined sequence within a single drive event. Six hundred miles of post-reset driving is substantial but does not guarantee these specific conditions have been met simultaneously. Mixed urban and highway driving patterns frequently fail to execute the exact sequence required to enable and complete the EGR monitor.

49. **B. Repair the exhaust manifold leak, clear the code, and verify LTFT bank 2 normalizes** — The cause of the bank 2 lean condition has been directly identified — a confirmed exhaust manifold leak upstream of the bank 2 O2 sensor introducing atmospheric oxygen into the exhaust stream. The correct repair is to address the confirmed fault directly — repair the exhaust manifold leak. After the repair, the oxygen contamination of the exhaust stream is eliminated, removing the false lean signal from the bank 2 O2 sensor. Clearing the P0174 code and confirming LTFT bank 2 returns to the normal range after a complete drive cycle verifies the repair resolved the fault. Replacing the O2 sensor is not indicated — it was responding correctly to the oxygen being introduced by the leak.
50. **D. Inform the customer the catalyst efficiency is degrading and recommend monitoring** — Mode 6 data showing the catalyst monitor test value at 85% of the maximum allowed threshold indicates the catalytic converter is still passing its efficiency evaluation — no P0420 code has set — but is closer to the failure threshold than ideal. This is precisely the type of predictive information Mode 6 is designed to surface — identifying gradual efficiency degradation before it crosses the failure threshold. The appropriate response is to inform the customer of the finding, explain that the converter is degrading and approaching its efficiency limit, and recommend monitoring at future service intervals or proactive replacement before the efficiency drops below the threshold and triggers a MIL illumination.