

# PRACTICE EXAM 11: 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 16 in/Hg with a needle that floats slowly and irregularly between 14 and 18 in/Hg. What does this MOST likely indicate?

- A. Retarded ignition timing causing a steady low vacuum reading
- B. A large vacuum leak causing an unstable idle vacuum
- C. A partially restricted exhaust causing vacuum fluctuation at idle
- D. A sticking or leaking valve causing irregular vacuum fluctuations

2. A compression test shows cylinder 1 at 170 psi, cylinder 2 at 85 psi dry and 145 psi wet, and all remaining cylinders between 165 and 175 psi. What does this indicate?

- A. A head gasket failure between cylinder 2 and a coolant passage
- B. Worn or damaged piston rings on cylinder 2
- C. A burned exhaust valve on cylinder 2 with no wet test improvement
- D. Carbon deposits on the piston crown of cylinder 2 reducing compression volume

3. An engine produces a light tapping noise at idle that completely disappears within 20 seconds after startup on a warm engine restart. What is the MOST likely cause?

- A. A hydraulic valve lifter bleeding down during shutdown and recovering once oil pressure stabilizes
- B. Piston slap from excess bore clearance resolving with thermal expansion after restart
- C. A worn timing chain producing slack that tightens once oil reaches the tensioner
- D. A loose rocker arm that tightens as thermal expansion closes the clearance gap

4. A cylinder leakage test shows 35% leakage with air escaping from the tailpipe only. What does this indicate?

- A. Worn piston rings allowing combustion pressure to escape into the crankcase
- B. A head gasket breach allowing combustion gases to enter the cooling system
- C. A leaking exhaust valve not seating correctly on that cylinder
- D. Both the intake and exhaust valves are leaking on that cylinder simultaneously

5. An engine has black smoke from the exhaust at all operating conditions. LTFT is -18% on both banks. What is the MOST likely cause?

- A. Severely worn piston rings allowing oil into all cylinders under all conditions
- B. A restricted air filter severely limiting airflow and causing a rich condition
- C. A stuck-open EGR valve diluting the mixture and causing incomplete combustion
- D. A fuel system fault — leaking injectors, failed regulator, or failed MAF — causing a persistent rich condition

6. A cooling system pressure test holds at 16 psi for 5 minutes then drops slowly to 10 psi over the next 15 minutes. A small drip is found at the lower radiator hose clamp. What is the correct action?

- A. Perform a combustion leak test to rule out a head gasket breach before addressing the hose leak
- B. Tighten or replace the lower radiator hose clamp and retest the cooling system pressure
- C. Replace the lower radiator hose as a leaking clamp always indicates hose end deterioration

D. Pressure test the radiator cap before repairing the hose clamp to rule out a cap fault

7. A relative compression test shows all cylinders cranking at similar speed except cylinder 6, which cranks noticeably slower than all others. What is the MOST likely cause?

A. Cylinder 6 has a loose spark plug reducing compression seal

B. The fuel injector on cylinder 6 is activating during the test affecting crank resistance

C. Cylinder 6 has higher-than-normal compression from carbon buildup increasing resistance to cranking

D. Cylinder 6 has reduced compression offering less resistance to the starter motor

8. An engine has a consistent misfire on a cold start that resolves within 60 seconds. No codes are stored. Spark and fuel pressure are confirmed normal. What should the technician check FIRST?

A. The cold-start fuel enrichment strategy by monitoring injector pulse width during cold start

B. The thermostat for a fault causing extended cold-start enrichment beyond the warm-up period

C. The upstream O<sub>2</sub> sensors for slow response causing delayed closed-loop entry during warm-up

D. The IAC valve for a fault reducing idle speed below the misfire threshold during cold start

9. An engine has a severe knock under all load conditions. Oil pressure is confirmed normal. A stethoscope isolates the knock to the bottom of the engine near the front. What should the technician suspect FIRST?

A. A worn camshaft bearing producing a knock that transmits to the front of the block

B. A cracked flexplate transmitting a knock through the block near the front

C. A piston slap condition from severely worn bores transmitting to the lower front of the block

D. A failed harmonic balancer producing a severe knock at the front lower area of the engine

9. An engine has a severe knock under all load conditions with normal oil pressure. A stethoscope isolates the knock to the bottom of the engine near the front. What should the technician suspect FIRST?

- A. A worn camshaft bearing near the front of the engine
- B. A cracked flexplate transmitting knock through the block
- C. Piston slap from severely worn bores
- D. A failed harmonic balancer producing a knock at the front lower area

10. An engine has intermittent stalling at idle that occurs only when fully warmed and the A/C compressor cycles on. No codes are stored. What should the technician check FIRST?

- A. The IAC valve for a fault preventing idle compensation when A/C load is applied
- B. The A/C compressor clutch coil for a fault causing a momentary voltage spike that disrupts the PCM
- C. The throttle body for carbon deposits preventing the throttle from returning to idle correctly
- D. The A/C cycling switch for a fault sending incorrect signals to the PCM during compressor engagement

10. An engine stalls at idle only when warmed and the A/C compressor cycles on. No codes are stored. What should the technician check FIRST?

- A. The IAC valve for a fault preventing idle speed compensation when A/C load is applied
- B. The A/C compressor clutch coil for a voltage spike disrupting the PCM
- C. The throttle body for carbon deposits
- D. The A/C cycling switch for incorrect PCM signals

11. A vacuum test shows 17 in/Hg at idle with needle fluctuations that occur at a rate directly matching engine firing order. What does this indicate?

- A. A leaking or burned valve on one or more cylinders producing a firing-order-synchronized vacuum drop
- B. A vacuum leak that opens and closes in synchronization with intake manifold pressure pulses
- C. Normal vacuum fluctuation from normal combustion pulses at idle speed

D. A sticking EGR valve opening and closing in response to manifold vacuum changes

12. An engine cranks normally but will not start. Spark is absent at all cylinders. Fuel pressure is normal. A scan tool shows the PCM is communicating normally. Battery voltage is confirmed at the ignition coil supply terminals. What should the technician check NEXT?

A. The crankshaft position sensor signal during cranking for a fault preventing ignition triggering

B. The camshaft position sensor for a fault preventing the PCM from enabling ignition

C. The ignition module or PCM ignition output driver for a fault preventing primary circuit switching

D. The anti-theft system for a lockout preventing the PCM from enabling spark output

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

13. A spark plug removed from a diesel engine conversion shows a black, sooty deposit covering the insulator and electrode with no electrode wear. What does this indicate?

A. Pre-ignition damage causing carbon deposits to accumulate on the cooled electrode

B. Carbon fouling from a rich mixture, excessive idling, or repeated short-trip operation

C. Oil fouling from worn valve stem seals coating the plug with oil-based deposits

D. Normal deposits on a plug approaching the end of its service interval

14. A P0351 ignition coil A primary circuit code is stored on a COP system. Battery voltage is confirmed at the coil A supply terminal. The PCM command wire shows 11.8 volts when not commanded and drops to 0.3 volts when commanded. No spark is produced on cylinder A. What is the MOST likely cause?

A. The PCM output driver is functioning — the voltage drop confirms the driver is completing the ground path

B. The coil supply voltage at 11.8 volts is marginally low and preventing adequate coil saturation

C. The coil primary winding has an open preventing current flow despite the confirmed command signal

D. The spark plug on cylinder A is fouled preventing secondary discharge despite correct primary operation

14. A P0351 code is stored. Coil A supply voltage confirmed. PCM command wire drops from 11.8 to 0.3 volts when commanded. No spark is produced. What is the MOST likely cause?

A. The PCM driver is functioning and the voltage drop confirms correct ground path completion

B. Supply voltage at 11.8 volts is too low for adequate coil saturation

C. The coil primary winding has an open preventing current flow

D. The spark plug is fouled preventing secondary discharge

15. A secondary ignition waveform shows firing lines that are all within normal height range but one cylinder shows a firing line that spikes erratically — varying significantly from one firing event to the next on the same cylinder. What does this MOST likely indicate?

A. An intermittent secondary circuit fault on that cylinder — a cracked plug insulator, intermittent plug wire connection, or loose coil boot

B. A PCM driver fault causing inconsistent primary current delivery to that cylinder

C. A mechanical fault on that cylinder causing combustion pressure variation that changes the required firing voltage

D. Normal variation — firing line height always fluctuates between consecutive firings on the same cylinder

16. A Hall effect distributor reference sensor is tested with a digital voltmeter set to DC volts. The meter reads a steady 2.4 volts with the engine running. What does this MOST likely indicate?

A. The sensor signal is normal — a Hall effect sensor produces a variable DC output proportional to speed

B. The sensor supply voltage circuit has high resistance causing a voltage drop at the sensor

C. The sensor is switching between high and low states faster than the meter can track and is displaying an average voltage

D. The sensor ground circuit has a fault causing the signal to stabilize at an intermediate voltage

17. A COP system has a misfire confirmed on cylinder 7. The coil, plug, and injector on cylinder 7 are all confirmed good by swap testing. Compression and leakage on cylinder 7 are normal. The technician connects a lab scope to the cylinder 7 PCM driver wire. The driver signal shows correct switching on all events except it drops to zero for 3–4 consecutive events intermittently. What does this confirm?

A. The PCM is intentionally disabling cylinder 7 as part of its misfire management strategy

B. The PCM driver circuit for cylinder 7 has an intermittent fault causing missed firing events

C. The cylinder 7 coil connector has an intermittent poor connection causing the driver signal to appear absent

D. The scope is connected incorrectly — a zero-volt reading on the driver wire indicates correct ground switching

18. A distributor cap is inspected and found to have a carbon track running from the coil center terminal to the number 3 cylinder terminal on the inside of the cap. What does this indicate?

A. Normal high-voltage routing — carbon deposits accumulate along the normal firing path over time

B. The rotor has been arcing to the number 3 terminal from the center terminal, bypassing the normal firing path

C. A moisture intrusion event has created a conductive carbon path that will self-clear after drying

D. High secondary voltage is finding an alternate path through the cap body, bypassing the rotor air gap

19. A magnetic reluctance CKP sensor produces a waveform with consistently normal amplitude and pattern at all engine speeds. One tooth position consistently produces a lower-than-normal amplitude signal. What is the MOST likely cause?

A. A PCM input circuit fault affecting the signal at that specific tooth position

B. A wiring fault causing intermittent resistance at the moment that tooth passes the sensor

C. A missing, chipped, or damaged tooth on the reluctor wheel at that position

D. Normal variation — one tooth producing lower amplitude is within acceptable specification

20. A technician uses a timing light on a distributor ignition system and finds base timing is 4 degrees BTDC against a 10-degree BTDC specification with the timing connector disconnected. Advancing the distributor to achieve 10 degrees BTDC requires rotating the distributor housing significantly. What should the technician check BEFORE finalizing the timing adjustment?

A. Whether the distributor has been previously installed one tooth off on the distributor drive gear, causing the housing to require excessive rotation to reach specification

B. Whether the timing light is receiving a correct trigger signal from the number 1 plug wire

C. Whether the timing mark on the harmonic balancer has separated and shifted from its original position

D. Whether the vacuum advance unit is fully retracted with the timing connector disconnected

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

21. A fuel system is tested on a returnless system. Key-on pressure is 62 psi. After the key is turned off, pressure drops to 40 psi within 30 seconds. What is the MOST likely cause?

A. A stuck-open fuel pressure regulator bleeding pressure back through the return circuit

B. A failed pump check valve allowing fuel to drain back to the tank rapidly after shutdown

C. Leaking fuel injectors bleeding rail pressure through open injector circuits after shutdown

D. Normal pressure decay — returnless systems always bleed down rapidly after shutdown

22. A MAF-equipped engine has LTFT at +3% and +2% at idle and 2,500 RPM on both banks. A P0102 MAF low input code is stored. The MAF signal voltage at idle is 0.4 volts against a specification of 1.0–1.5 volts. What is the MOST likely cause?

A. A contaminated MAF sensor hot wire producing a low signal at all airflow rates

B. A vacuum leak downstream of the MAF introducing unmetered air and triggering the code

- C. A PCM input circuit fault holding the MAF signal at a low voltage level
- D. A MAF sensor with an open signal wire causing the signal to default to a low voltage

22. A P0102 MAF low input code is stored. MAF signal at idle is 0.4 volts against a 1.0–1.5 volt specification. LTFT is +3% on both banks. What is the MOST likely cause?

- A. A contaminated MAF sensor producing a low signal at all airflow rates
- B. A vacuum leak downstream of the MAF
- C. A PCM input circuit fault holding the signal low
- D. A MAF sensor with an open signal wire defaulting to low voltage

23. A port injection engine has a fuel pressure test showing 58 psi at key-on. After the engine starts, pressure drops to 28 psi at idle. Specification is 50–60 psi at idle without vacuum applied to the regulator. What should the technician check FIRST?

- A. The fuel pump output volume for a fault causing inability to maintain idle fuel pressure under flow demand
- B. The fuel pressure regulator for a stuck-open fault bleeding excess fuel under idle conditions
- C. The fuel filter for a restriction causing pressure drop under flow demand at idle
- D. The fuel return line for a kink or restriction causing pressure buildup at key-on and drop at idle

24. A scan tool shows IAT reading  $-40^{\circ}\text{F}$  with the engine at operating temperature on an  $80^{\circ}\text{F}$  day. No drivability complaint is present. What is the MOST likely cause?

- A. The IAT sensor circuit has a short to the 5-volt reference holding the signal at maximum voltage
- B. A corroded IAT sensor connector causing high resistance and a false cold reading
- C. The IAT signal wire has an open circuit causing the signal to read at maximum cold default value
- D. The PCM IAT input has a fault causing the signal to default to a minimum value

25. A GDI engine has carbon buildup complaints on intake valves at 60,000 miles. No fault codes are present. What is the MOST likely explanation for premature carbon accumulation on the intake valves?

- A. A stuck-open PCV valve routing excessive oil vapor directly onto the intake valves at high volume
- B. The absence of fuel washing on intake valve faces in GDI systems allowing oil vapor deposits to accumulate unchecked
- C. A clogged fuel injector causing incomplete atomization and carbon buildup from poor combustion
- D. Excessive short-trip driving preventing the engine from reaching temperatures that burn off intake deposits

26. An engine has a P0172 rich code stored. A bi-directional injector disable test shows fuel trims moving toward zero when all injectors are commanded off. What additional test would MOST help identify which injector is leaking?

- A. A fuel pressure drop test on each cylinder with individual injectors commanded off while monitoring pressure
- B. A scan tool STFT comparison test with individual injectors disabled one at a time to identify the leaking cylinder
- C. A cylinder leakage test on each cylinder to identify the injector leak path
- D. A noid light test on each injector circuit to identify the injector receiving excess command signal

27. A turbocharged engine has a P0299 turbocharger underboost code. Maximum boost reaches only 8 psi against a 15 psi specification. The wastegate is confirmed closed. No boost leaks are found. What should the technician check NEXT?

- A. The boost pressure sensor for a calibration drift causing the PCM to misread actual boost
- B. The intercooler for an internal restriction reducing charge pressure before the manifold
- C. The turbocharger itself for worn bearings, damaged compressor wheel, or worn turbine
- D. The wastegate solenoid for a fault preventing the PCM from maintaining wastegate closure

28. A fuel system has correct idle pressure and correct volume. At 2,500 RPM under light load, fuel pressure drops 8 psi below specification. As load increases further, pressure recovers to near specification. What is the MOST likely cause?

- A. A partially restricted fuel filter causing pressure drop under moderate demand that the pump overcomes under high demand
- B. A weak fuel pressure sensor producing an erroneous drop reading under specific RPM conditions
- C. A failing fuel pump impeller that loses efficiency at moderate RPM but recovers at higher pump speeds
- D. A stuck-open pressure regulator that bleeds pressure under moderate flow and closes under high demand

29. A naturally aspirated engine has correct idle vacuum but loses power progressively above 3,000 RPM. Fuel pressure is normal. Ignition is confirmed normal. What should the technician check NEXT?

- A. The throttle body for a partially seized throttle blade preventing full opening at high RPM
- B. The exhaust system backpressure under high-RPM load conditions
- C. The MAF sensor for a fault causing airflow calculation errors under high-RPM demand
- D. The fuel injectors for restriction causing lean conditions only under high-RPM flow demand

30. A vehicle returns from a highway trip with black smoke and a strong fuel smell from the exhaust. LTFT is -24% on both banks. The engine was running normally before the trip. What should the technician check FIRST?

- A. The upstream O<sub>2</sub> sensors for simultaneous contamination from a fuel additive used before the trip
- B. The MAF sensor for a fault that developed under sustained high-airflow highway conditions
- C. The EVAP purge solenoid for a stuck-open fault activated under sustained highway purge conditions
- D. The fuel pressure regulator for a diaphragm failure allowing fuel to enter the intake manifold through the vacuum line

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

31. A vehicle has excessive oil consumption with blue smoke under all conditions. The PCV system is confirmed functional. A crankcase pressure test shows pressure above specification with the PCV disconnected. What does excessive crankcase pressure with a functional PCV system indicate?

- A. A clogged PCV fresh air inlet preventing makeup air from entering the crankcase
- B. A stuck-open PCV valve drawing too much vacuum and creating crankcase pressure
- C. Excessive blowby from worn piston rings or cylinder walls overpowering the PCV system capacity
- D. A clogged oil filler cap baffle preventing proper crankcase ventilation through the secondary circuit

32. A vehicle has a P0410 secondary AIR system malfunction code. The AIR pump runs when commanded. The upstream O<sub>2</sub> sensor shows a strong lean response during pump operation. Why is the P0410 code still setting?

- A. The lean response confirms air delivery but the monitor requires a specific response magnitude that has not been reached
- B. The AIR pump check valves are leaking exhaust backward through the circuit when the pump is not running
- C. The upstream O<sub>2</sub> sensor response is too slow for the AIR monitor to count the lean signal as valid
- D. The AIR pump is delivering air to the intake manifold rather than the exhaust ports due to a misrouted hose

33. A P0442 small EVAP leak code is stored. The fuel cap tests good. A smoke test at standard pressure reveals no leak. What should the technician do NEXT?

- A. Replace the EVAP purge solenoid as it is the most common cause of small leaks not visible at standard pressure
- B. Clear the code and retest — a negative smoke test with a good cap confirms a false positive

C. Perform additional EVAP component inspection or test at lower smoke pressure to find leaks below standard detection

D. Replace the charcoal canister as small leaks often originate from aged canister body seams

33. A P0442 small EVAP leak is stored. The fuel cap tests good and standard smoke pressure reveals no leak. What should the technician do NEXT?

A. Replace the EVAP purge solenoid

B. Clear and retest — negative smoke with a good cap confirms a false positive

C. Inspect EVAP components further or retest at lower smoke pressure

D. Replace the charcoal canister

34. A vehicle has elevated NO<sub>x</sub> on an emissions test. EGR passages are clear and the valve operates correctly on command. Fuel trims are normal. Ignition timing is correct. The coolant temperature gauge reads normal. What should the technician check NEXT?

A. The catalytic converter for reduced NO<sub>x</sub> reduction efficiency under load conditions

B. The EGR differential pressure sensor for a fault causing the monitor to pass despite insufficient actual flow

C. The combustion chamber for carbon deposits raising the effective compression ratio and combustion temperature

D. The upstream O<sub>2</sub> sensors for contamination causing incorrect mixture control and elevated combustion temperatures

35. A vehicle has a P0133 upstream O<sub>2</sub> sensor slow response code on bank 1. The sensor heater is confirmed functional. Fuel trims are +1% on bank 1. What is the MOST likely cause?

A. A contaminated or aged upstream O<sub>2</sub> sensor with a degraded sensing element responding too slowly

B. A small vacuum leak on bank 1 causing lean excursions that delay the sensor's rich-to-lean transition

C. A degraded catalytic converter allowing exhaust gas contamination to reach the upstream sensor

D. A PCM input circuit fault causing the sensor signal to update too slowly in the PCM's processing loop

35. A P0133 slow upstream O<sub>2</sub> response code is stored on bank 1. The heater is confirmed functional and LTFT bank 1 is +1%. What is the MOST likely cause?

A. A contaminated or aged upstream O<sub>2</sub> sensor with a degraded sensing element

B. A small vacuum leak on bank 1 causing lean excursions that delay response

C. A degraded catalyst contaminating the upstream sensor

D. A PCM input circuit fault causing slow signal processing

36. A vehicle passes an OBD II emissions inspection but fails for elevated NO<sub>x</sub> at the tailpipe. Which system is MOST directly responsible for catalytic NO<sub>x</sub> reduction?

A. The three-way catalytic converter reducing NO<sub>x</sub> to nitrogen and oxygen under stoichiometric conditions

B. The EGR system reducing NO<sub>x</sub> by diluting the intake charge with inert exhaust gases

C. The AIR system introducing oxygen to promote complete NO<sub>x</sub> oxidation in the exhaust

D. The upstream O<sub>2</sub> sensor maintaining stoichiometric mixture control to minimize NO<sub>x</sub> formation

37. A P0446 EVAP vent control circuit code is stored. The vent solenoid supply voltage is confirmed at 12 volts. The PCM command wire shows 11.9 volts when not commanded and 0.2 volts when commanded. The solenoid activates and clicks when commanded. What is the correct interpretation?

A. The vent solenoid has a mechanical fault preventing full closure despite confirmed electrical operation

B. The EVAP system has a downstream restriction causing the vent circuit code despite correct solenoid operation

C. The fuel tank pressure sensor is providing incorrect feedback causing a false vent circuit code

D. The PCM output driver and solenoid are functioning correctly — the fault may be in the vent path or sensor feedback

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

38. A scan tool shows STFT at +14% and LTFT at +16% at idle on both banks. At 2,500 RPM, both STFTs drop to +2% and LTFTs begin moving toward zero. What is the MOST likely cause?

- A. A MAF sensor contamination fault underreporting airflow at all RPM with greater effect at idle
- B. A vacuum leak causing a lean condition predominantly at idle that the engine outgrows at higher RPM
- C. A stuck-open EVAP purge solenoid adding excess vapor at idle that clears at higher RPM
- D. An IAC valve stuck open adding unmetered air at idle that the PCM cannot fully compensate for

39. A vehicle has P0171 and P0174 lean codes stored simultaneously. LTFT is +24% on both banks at idle. A smoke test reveals a significant vacuum leak at a cracked intake boot between the MAF and throttle body. What is the significance of the leak location between the MAF and throttle body?

- A. A leak downstream of the MAF introduces metered air that the PCM has already accounted for in fuel calculations
- B. A leak upstream of the MAF would not affect fuel trims but this location causes unmetered air entry
- C. This leak location prevents the MAF from reading accurately at any airflow rate affecting all operating conditions
- D. Air entering between the MAF and throttle body is unmetered because it bypasses the MAF sensor entirely

39. Lean codes on both banks and a cracked intake boot between the MAF and throttle body are found. What is the significance of the leak location between the MAF and throttle body?

- A. The leak introduces metered air the PCM has already accounted for
- B. A leak upstream of the MAF would cause problems but this location does not affect trims
- C. The location prevents the MAF from reading accurately at any airflow rate
- D. Air entering here is unmetered because it bypasses the MAF entirely

40. A scan tool shows downstream O2 sensor voltage on bank 1 oscillating between 0.05 and 0.9 volts at a rate slightly slower than the upstream sensor. No codes are stored. What does this indicate?

- A. The downstream sensor has failed and is producing an erratic signal that mimics normal switching
- B. The catalytic converter on bank 1 has reduced efficiency — a healthy converter would show a much more stable downstream signal
- C. Normal downstream O2 sensor behavior on a vehicle with a healthy, functional catalytic converter
- D. The upstream sensor has slow response causing the downstream sensor to follow with a slight delay

41. A vehicle has no OBD II codes stored but fails an emissions inspection because the EVAP and oxygen sensor monitors show as incomplete. The vehicle was recently purchased. What is the MOST likely reason the monitors are incomplete?

- A. The previous owner cleared all codes before the sale and the vehicle has not completed a sufficient drive cycle to reset all monitors
- B. A small EVAP leak below the monitor detection threshold is preventing the EVAP monitor from completing
- C. The upstream O2 sensors have degraded response preventing the monitor from achieving its pass criteria
- D. The PCM has a calibration fault preventing monitor completion on this specific vehicle

42. A vehicle has a P0562 system voltage low code stored. The battery tests at 12.4 volts with the engine off. With the engine running, a scan tool shows system voltage at 11.8 volts. What is the MOST likely cause?

- A. A battery with high internal resistance drawing down system voltage under load
- B. A parasitic drain causing battery voltage to drop below the P0562 threshold during operation
- C. A normal charging system voltage — 11.8 volts at operating speed is within specification
- D. A failing alternator not maintaining adequate charging voltage during engine operation

43. A technician is diagnosing a P0340 CMP sensor circuit no signal code. The sensor supply voltage is confirmed at 5 volts. Ground resistance is 0.1 ohms. A scope test during cranking shows no signal output. A known-good sensor is substituted and the scope immediately shows a correct square wave signal. What does this confirm?

- A. The PCM CMP input circuit has a fault that was masked by the original sensor's failure
- B. The original CMP sensor has failed internally and requires replacement
- C. The CMP reluctor wheel on the camshaft has a fault that was corrected by the new sensor's different air gap
- D. The CMP signal wire has an intermittent open that was bypassed when the new sensor connector was installed

44. A scan tool captures a cold-start event. During the first 30 seconds, STFT is -22% on both banks and then normalizes to +1% as the engine warms. What does this indicate?

- A. The upstream O2 sensors are responding too quickly after cold start causing over-correction
- B. A lean condition during cold start that resolves as the fuel enrichment strategy activates at operating temperature
- C. The cold-start enrichment strategy is delivering excess fuel that the PCM corrects once closed-loop operation begins
- D. The IAC valve is opening too far during cold start causing lean dilution that resolves at idle normalization

45. A vehicle has a P0191 fuel rail pressure sensor range code on a GDI engine. The high-pressure rail sensor reads 1,450 psi at idle. The specification is 500–700 psi at idle. The high-pressure pump output is confirmed within specification. What is the MOST likely cause?

- A. A stuck-closed high-pressure fuel pressure relief valve trapping excessive pressure in the rail
- B. A PCM calibration fault commanding the high-pressure pump to over-pressurize the rail at idle
- C. The high-pressure rail pressure sensor has a fault producing an elevated reading
- D. A restriction in the high-pressure fuel return circuit causing pressure buildup in the rail

45. A P0191 fuel rail pressure sensor range code is stored on a GDI engine. The rail sensor reads 1,450 psi at idle against a 500–700 psi specification. The high-pressure pump output is confirmed within spec. What is the MOST likely cause?

- A. A stuck-closed high-pressure relief valve trapping excess pressure
- B. A PCM calibration fault over-commanding pump pressure at idle
- C. The high-pressure rail pressure sensor has a fault producing an elevated reading
- D. A restriction in the high-pressure fuel return circuit

46. A vehicle has a U0073 CAN bus communication fault stored in multiple modules. The scan tool connects to some modules but not others. What should the technician check FIRST?

- A. All individual module power and ground supplies before inspecting the CAN bus network
- B. The CAN bus high and low wiring for an open, short, or damaged termination resistor affecting the entire network
- C. The PCM for an internal fault preventing it from maintaining network communication with other modules
- D. The scan tool connection and DLC wiring for a fault causing selective module communication failure

47. A P0300 random misfire is stored on a vehicle with a recent tune-up. All new plugs and wires were installed. Live data confirms normal fuel trims, compression, and a normal scope waveform on all coils. One plug wire is found routed against the exhaust manifold. What is the MOST likely cause of the random misfire?

- A. Thermal degradation of the plug wire routed against the exhaust manifold causing intermittent high resistance and misfire
- B. The new spark plugs are gapped incorrectly causing misfires under specific load conditions
- C. A coil is producing insufficient secondary voltage for the new plug gaps after the tune-up
- D. The PCM has not relearned the new plug gaps and is using incorrect dwell calculations

48. A vehicle has LTFT at +3% on bank 1 and +19% on bank 2 at all engine speeds. A P0174 bank 2 lean code is stored. Fuel pressure is normal. A smoke test reveals no vacuum leaks. What should the technician inspect NEXT?

- A. The bank 1 upstream O<sub>2</sub> sensor for contamination producing incorrect bank 1 trim readings
- B. The bank 2 upstream O<sub>2</sub> sensor for contamination or slow response causing false lean correction
- C. The bank 2 fuel injectors for restriction causing lean delivery across all bank 2 cylinders
- D. A bank 2 exhaust manifold leak introducing oxygen upstream of the bank 2 O<sub>2</sub> sensor

49. A scan tool shows all OBD II monitors complete. Mode 1 data shows ECT at 183°F after 30 minutes of highway driving on a 70°F day. The specification is 190–215°F. No codes are stored. What should the technician check?

- A. The water pump for reduced output causing insufficient coolant circulation at highway speed
- B. The thermostat for a fault causing the engine to run slightly below its designed operating temperature
- C. The ECT sensor for a calibration drift producing a slightly low reading
- D. The cooling fan for a fault causing excessive airflow and cooling the engine below specification at highway speed

50. A vehicle with a returnless fuel system has a P0087 fuel rail pressure low code. A bi-directional test commands the fuel pump to 100% duty. Rail pressure rises to specification. Under normal closed-loop operation, the PCM commands only 65% pump duty and pressure falls below specification. What does this indicate?

- A. The fuel pump has adequate maximum output but the PCM is undercommanding pump duty under normal operation
- B. A fuel filter restriction requiring maximum pump duty to overcome, with normal duty being insufficient
- C. A pressure regulator fault only correctable at maximum pump output
- D. A PCM calibration fault causing incorrect duty cycle commands below the pressure maintenance threshold

# PRACTICE EXAM 11: ANSWER KEY AND EXPLANATIONS

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## DOMAIN A — GENERAL DIAGNOSIS

1. **D. A sticking or leaking valve causing irregular vacuum fluctuations** — A vacuum needle that floats slowly and irregularly between two values rather than holding steady or dropping at a predictable interval indicates an inconsistent combustion fault. A sticking valve that opens and closes erratically — or a valve that seals inconsistently from one cycle to the next — disrupts the engine's pumping efficiency unpredictably, producing the slow, irregular needle float described. Retarded timing produces a steady low reading without fluctuation. A vacuum leak produces a consistently low but stable reading. A misfire produces a sharp, rhythmic drop rather than a slow irregular float.
2. **B. Worn or damaged piston rings on cylinder 2** — A single cylinder with significantly low compression that improves substantially on the wet test — from 85 psi to 145 psi — confirms the compression leak is past the piston rings. Oil added during the wet test temporarily seals the ring gap, allowing pressure to build toward normal. A burned valve would show no wet test improvement because oil cannot seal a valve face against its seat. A head gasket failure between the cylinder and a coolant passage would also show no wet test response. The dramatic improvement from dry to wet is the definitive indicator of a ring seal fault.
3. **A. A hydraulic valve lifter bleeding down during shutdown** — A light tapping that disappears within 20 seconds on a warm restart is the classic presentation of a hydraulic lifter that has bled down partially during shutdown. When the engine stops, oil pressure drops to zero and the lifter's internal check valve may allow oil to slowly drain back, creating a small amount of lash in the valvetrain. On restart, oil pressure quickly recharges the lifter, eliminating the lash and the associated tapping. The rapid 20-second resolution specifically on a warm restart — when oil reaches the lifters quickly — distinguishes this from a mechanical clearance issue.
4. **C. A leaking exhaust valve not seating correctly** — Air escaping exclusively from the tailpipe during a cylinder leakage test confirms the pressurized test air is passing through the exhaust valve into the exhaust system and exiting through the tailpipe. The exhaust valve is the only path between the combustion chamber and the exhaust manifold. Air escaping only from the tailpipe with no air at the throttle body, oil filler, or coolant confirms the exhaust valve is the sole leak path. A leaking intake valve would direct air toward the throttle body. Both valves leaking simultaneously would produce air at both locations.

5. **D. A fuel system fault causing a persistent rich condition** — Black smoke at all operating conditions combined with strongly negative LTFT on both banks confirms a severe, persistent rich mixture affecting the entire operating range. The PCM is actively removing significant fuel in both banks and still cannot correct the richness completely. A single cause affecting both banks simultaneously at all speeds — leaking injectors delivering excess fuel, a failed pressure regulator stuck at elevated pressure, or a MAF sensor reading significantly below actual airflow — is the most likely explanation. A restricted air filter severe enough to cause this would typically also produce significant power loss and idle instability.
6. **B. Tighten or replace the lower radiator hose clamp and retest** — The pressure test has identified a specific, visible leak source — a dripping lower radiator hose clamp. The appropriate action is to address the identified fault directly. Tightening a loose clamp or replacing a clamp that cannot seal is the correct repair for a confirmed clamp leak. Performing additional tests before addressing a visible, confirmed external leak wastes time and does not change the required repair. After the clamp is serviced, the system should be repressurized to confirm the repair sealed the leak and that no additional leak paths exist.
7. **C. Cylinder 6 has higher-than-normal compression from carbon buildup** — A cylinder cranking more slowly than all others during a relative compression test is offering more resistance to the starter motor, not less. Increased cranking resistance means the piston is encountering greater-than-normal pressure on its compression stroke. Carbon deposits accumulating on the piston crown and combustion chamber walls reduce the effective combustion chamber volume, increasing the geometric compression ratio and requiring more force to compress the charge. This produces a slower crank speed on that specific cylinder compared to all others with normal compression volumes.
8. **A. The cold-start fuel enrichment strategy by monitoring injector pulse width** — A cold-start misfire that resolves within 60 seconds with confirmed normal spark and fuel pressure points to a fuel delivery calibration issue specific to the cold-start enrichment phase rather than a component failure. Monitoring injector pulse width during cold start confirms whether the PCM is delivering the correct enrichment amount during warm-up. Insufficient enrichment during cold start — from a faulty coolant temperature sensor input, a PCM calibration fault, or a restricted injector — produces lean misfires that resolve once the engine warms and closed-loop control takes over with normal pulse widths.
9. **D. A failed harmonic balancer producing a knock at the front lower area** — A severe knock under all load conditions with normal oil pressure isolated specifically to the lower front area of the engine by stethoscope points to the harmonic balancer. The harmonic balancer is mounted at the front of the crankshaft and consists of a hub bonded to an outer inertia ring by a rubber isolator. When the rubber isolator fails, the outer ring becomes loose and strikes the hub or surrounding components with each crankshaft revolution, producing a severe knock that stethoscope testing localizes to the front lower area of the engine where the crankshaft snout exits the block.

10. **A. The IAC valve for a fault preventing idle speed compensation when A/C load is applied** — When the A/C compressor clutch engages, it places a sudden mechanical load on the engine that requires the PCM to increase idle speed to prevent stalling. This idle speed increase is accomplished by opening the IAC valve to allow additional air into the engine. If the IAC valve is stuck, carboned closed, or has an electrical fault preventing it from responding to the PCM's A/C idle-up command, the engine cannot compensate for the added compressor load and stalls. The fault appears only with A/C engagement because that is the only condition requiring IAC-mediated idle compensation.
11. **A. A leaking or burned valve producing a firing-order-synchronized vacuum drop** — Vacuum needle fluctuations that occur at a rate directly matching the engine firing order indicate a fault that produces a vacuum drop on a specific cylinder every time that cylinder fires. A leaking or burned valve on one cylinder fails to seal on every compression or power stroke of that cylinder, producing a vacuum drop at the exact interval of that cylinder's contribution to the firing order. The firing-order synchronization is the diagnostic key — it distinguishes a valve fault from a random misfire and from other causes of vacuum fluctuation that are not locked to the firing sequence.
12. **C. The ignition module or PCM ignition output driver for a fault preventing primary circuit switching** — Spark is absent at all cylinders simultaneously, battery voltage is confirmed at all coil supply terminals, and the PCM is communicating normally. With power confirmed at the coils and the PCM operational, the fault is in the component responsible for completing and interrupting the primary ignition circuit — the ignition module or PCM output driver. Without primary switching, no magnetic field builds and collapses in the coil primary winding, and no secondary high voltage is induced. A CKP fault would prevent switching on most systems, but the question specifies the ignition output driver as the next logical test with power confirmed at all coils.

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

13. **B. Carbon fouling from a rich mixture, excessive idling, or repeated short-trip operation** — A black, sooty deposit covering both the insulator and electrode with no electrode wear or erosion indicates the plug has been operating in an over-rich combustion environment or at chronically low temperatures that prevent normal deposit burnoff. Rich mixtures, excessive idling, and repeated short trips all prevent the plug from reaching its self-cleaning temperature threshold, allowing unburned carbon from the fuel and oil to accumulate on the plug surfaces. The absence of electrode wear distinguishes carbon fouling from normal service wear, and the absence of insulator blistering distinguishes it from pre-ignition damage.
14. **C. The coil primary winding has an open preventing current flow** — The PCM command wire dropping from 11.8 volts to 0.3 volts when commanded confirms the PCM output driver is functioning correctly and completing the ground path as designed. Both the supply voltage and the PCM driver are confirmed operational. Despite a complete and functional primary circuit command, no spark is produced — which means current is not flowing through the primary

winding to build a magnetic field. An open primary winding prevents current from flowing even with both the supply and driver confirmed functional, explaining the absence of spark despite confirmed electrical command.

15. **A. An intermittent secondary circuit fault on that cylinder** — A firing line that varies erratically in height from one firing event to the next on the same cylinder indicates the secondary circuit resistance on that cylinder is changing inconsistently between firings. A stable fault — such as a consistently worn plug or uniformly high-resistance wire — would produce a consistently elevated or consistently low firing line. Erratic variation between firing events points to an intermittent fault: a cracked plug insulator that arcs inconsistently, a plug wire with an intermittent internal break, or a loose coil boot that changes contact resistance from one firing to the next.
16. **C. The sensor is switching faster than the meter can track, displaying an average voltage** — A Hall effect sensor produces a digital square wave output — switching cleanly between near-zero volts and near-reference voltage. A standard digital voltmeter set to DC volts cannot track rapid switching and instead displays the mathematical average of the high and low states. At normal engine speeds, the switching frequency is far beyond the meter's ability to follow individual transitions. A reading of approximately half the reference voltage — such as 2.4 volts on a 5-volt reference — is the expected result of a DMM averaging a rapidly switching Hall effect signal and does not indicate a fault.
17. **B. The PCM driver circuit for cylinder 7 has an intermittent fault** — All cylinder-specific components have been confirmed good by swap testing, and compression and leakage are normal. A lab scope connected directly to the PCM driver wire for cylinder 7 shows correct switching on most events but drops to zero for consecutive events intermittently. This directly confirms the PCM is not sending the firing command to cylinder 7 during those events. Since the coil, plug, and injector are all confirmed good, the missing command originates from within the PCM driver circuit — an intermittent open, a failing output transistor, or a wiring fault between the PCM and the coil connector.
18. **D. High secondary voltage finding an alternate path through the cap body** — A carbon track running from the coil center terminal to a specific cylinder terminal inside the distributor cap indicates high secondary voltage has repeatedly found a resistive path through the cap body material rather than following the designed rotor-to-terminal path. Over time, repeated arcing carbonizes the cap body along this path, creating an increasingly conductive track. This cross-cap arcing occurs when the cap insulation is compromised by age, moisture, or contamination, allowing voltage to bypass the rotor air gap entirely and fire the wrong cylinder or weaken the intended cylinder's spark.
19. **C. A missing, chipped, or damaged tooth on the reluctor wheel** — A magnetic reluctance CKP sensor generates its voltage signal from the rate of magnetic field change as each tooth passes. A tooth that is missing, chipped, or physically damaged produces less magnetic field change than the surrounding intact teeth, resulting in a consistently lower amplitude signal at that specific position

on every crankshaft revolution. The consistency — occurring at the same position every revolution — distinguishes a physical reluctor wheel fault from an electrical intermittent. A missing or damaged tooth is a fixed physical condition that produces the same reduced signal at that position with every pass.

20. **A. Whether the distributor has been installed one tooth off on the drive gear** — When achieving base timing specification requires rotating the distributor housing significantly beyond the normal small adjustment range, the distributor is likely installed one or more teeth off on the drive gear. A one-tooth offset on the distributor drive gear shifts the rotor's relationship to the cap terminals by a fixed amount that cannot be corrected within the distributor's normal adjustment range — the housing must rotate far beyond its design limits to compensate. The correct repair is to remove the distributor and reinstall it with the drive gear aligned at the correct tooth position, after which normal timing adjustment will achieve specification.

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

21. **B. A failed pump check valve allowing rapid fuel drain-back** — On a returnless fuel system, there is no return line or external pressure regulator to hold rail pressure after shutdown — pressure retention depends entirely on the pump's internal check valve. A check valve that fails open allows fuel to drain back through the pump into the tank immediately after shutdown, causing rapid pressure loss. The 30-second drop from 62 psi to 40 psi is too rapid to be caused by injector leakage alone and confirms a large drain-back path — the pump check valve is the only component on a returnless system capable of allowing this rate of pressure decay.
22. **D. A MAF sensor with an open signal wire defaulting to low voltage** — A MAF signal wire that is open — broken internally or disconnected — causes the signal to default to a very low or zero voltage because the circuit has no return path to pull the signal to its normal operating level. The LTFT at only +3% despite a signal far below specification indicates the PCM is compensating partially but the low signal reading is so far below normal that the code sets on the range/performance monitor. A contaminated sensor would produce a low but non-zero signal that would more closely correlate with the mild trim response — a near-zero signal from an open wire produces the P0102 low input code.
23. **A. The fuel pump output volume for a fault causing inability to maintain idle fuel pressure** — Key-on pressure of 58 psi confirms the pump can build adequate pressure against a static, closed system. The drop to 28 psi immediately when the engine starts and fuel begins flowing confirms the pump cannot sustain pressure under even minimal flow demand. A pressure regulator stuck open would cause pressure to stabilize at a low but consistent level rather than drop this significantly. A restricted filter would reduce pressure under demand but typically not this severely from the first moment of flow. A pump that builds pressure statically but collapses under flow is a classic volume-limited pump fault.

24. **C. The IAT signal wire has an open circuit causing the signal to read at maximum cold default** — An IAT sensor reading  $-40^{\circ}\text{F}$  is the default minimum value the PCM reports when the signal circuit is open — no current is flowing through the sensor, causing the signal wire to float at or near reference voltage, which the PCM interprets as maximum resistance and therefore the coldest possible temperature. An open circuit in the signal wire removes the sensor's ability to pull the voltage down from reference, defaulting the reading to the extreme cold value. The absence of a driveability complaint occurs because the PCM uses a substitute strategy for IAT when the signal defaults to its minimum value.
25. **B. The absence of fuel washing on GDI intake valve faces** — In a port injection engine, fuel is sprayed directly onto the back of the intake valve face on every injection event, continuously washing away oil deposits from crankcase vapors. In a GDI engine, fuel is injected directly into the combustion chamber — the intake valves never contact fuel. Oil vapor from the PCV system continues to deposit on the intake valve faces, but without the constant fuel washing that port injection provides, these deposits accumulate steadily over time. By 60,000 miles, GDI engines commonly develop significant intake valve carbon deposits that restrict airflow and affect combustion quality.
26. **D. A scan tool STFT comparison test with individual injectors disabled one at a time** — The bi-directional test confirming trims move toward zero with all injectors off confirms fuel delivery through the injectors is the source of the rich condition. To identify which specific injector is leaking, disabling injectors one at a time while monitoring STFT identifies the leaking cylinder by the absence of trim change when that injector is disabled. Disabling a non-leaking injector reduces fuel delivery and causes STFT to go lean. Disabling the leaking injector stops both commanded and leaked fuel, producing a different STFT response that identifies the faulty injector.
27. **C. The turbocharger itself for worn bearings, damaged compressor wheel, or worn turbine** — The wastegate is confirmed closed, eliminating premature boost bleed-off as the cause. No boost leaks are found, eliminating pressure loss from the charge side. With the boost control system and delivery path both confirmed functional, the fault is within the turbocharger itself. A turbocharger that cannot generate adequate boost despite a closed wastegate and no leaks has an internal efficiency problem — worn shaft bearings allowing compressor wheel wobble, damaged compressor blades reducing aerodynamic efficiency, or a worn turbine section unable to extract sufficient energy from the exhaust stream to spin the compressor to the required boost pressure.
28. **A. A partially restricted fuel filter causing pressure drop under moderate demand** — Correct idle pressure and volume confirm the system functions normally at minimal demand. The pressure drop specifically at moderate RPM under light load — with recovery under higher load — is the characteristic pattern of a fuel filter that is significantly restricted but not completely blocked. Under moderate demand, the restriction limits flow enough to reduce pressure. Under higher demand, the pump's increased output partially overcomes the restriction, recovering pressure

toward specification. A failing pump impeller typically produces progressive pressure loss with increasing demand rather than recovery at higher load.

29. **B. The exhaust system backpressure under high-RPM load conditions** — Correct idle vacuum confirms the engine, fuel, and ignition systems are functioning normally at idle. Progressive power loss above 3,000 RPM with confirmed normal fuel pressure and ignition points to a restriction that becomes significant only under high exhaust flow — which occurs at elevated RPM. An exhaust restriction that is mild enough to be imperceptible at idle becomes a significant impediment to engine breathing at high RPM when exhaust volume increases dramatically. An exhaust backpressure test under load at 3,000+ RPM directly identifies whether excessive backpressure is limiting the engine's high-RPM power output.
30. **D. The fuel pressure regulator for a diaphragm failure** — Black smoke and strongly negative LTFT on both banks developing during a highway trip on an otherwise normally running engine points to a sudden-onset rich condition affecting both banks simultaneously. A fuel pressure regulator with a ruptured diaphragm allows manifold vacuum to draw raw fuel directly from the fuel rail into the intake manifold through the vacuum reference line, delivering unmetered fuel directly to all cylinders. The vacuum reference line being described as wet — with liquid fuel present — is the confirming finding for this fault. This delivers excess fuel proportional to manifold vacuum, creating a severe rich condition particularly noticeable under the sustained high-vacuum conditions of highway cruise.

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

31. **C. Excessive blowby from worn piston rings overpowering PCV system capacity** — The PCV system is confirmed functional — vacuum is available and the valve operates correctly. Despite a fully operational ventilation system, crankcase pressure exceeds specification when measured directly. When the PCV system is confirmed capable of ventilating the crankcase but cannot control the pressure, the source of the pressure exceeds the system's designed capacity. Worn piston rings allow combustion gases to blow past the rings into the crankcase at a rate greater than the PCV system can evacuate, building positive crankcase pressure regardless of PCV function. A cylinder leakage test quantifies ring seal condition and confirms the blowby source.
32. **A. The lean response confirms air delivery but the monitor requires a specific response magnitude** — The upstream O<sub>2</sub> sensor showing a lean response confirms air is reaching the exhaust ports — the AIR system is physically delivering air. However, a P0410 code continuing to set indicates the PCM's AIR monitor has not been satisfied. The monitor evaluates not just the presence of a lean response but the magnitude, speed, and duration of that response against a specific threshold. An AIR pump that is partially functional — delivering some air but below the volume required for the monitor's minimum lean response threshold — produces a detectable lean signal without satisfying the monitor's pass criteria.

33. **C. Inspect EVAP components further or retest at lower smoke pressure** — A P0442 small EVAP leak with a confirmed good fuel cap and a negative standard-pressure smoke test indicates the leak is present but too small to be detected at standard smoke machine pressure. The OBD II EVAP monitor detects leaks by measuring system pressure decay at a much lower pressure than a standard smoke test applies. Reducing the smoke machine pressure to match the monitor's test pressure can reveal seepage points at hose connections, solenoid fittings, canister seams, or other locations that remain sealed under the higher standard test pressure but leak at the lower monitor pressure.
34. **B. The EGR differential pressure sensor for a fault causing the monitor to pass despite insufficient actual flow** — EGR passages are clear, the valve opens on command, fuel trims are normal, timing is correct, and coolant temperature is normal — all standard NO<sub>x</sub> causes have been confirmed normal. The remaining question is whether the EGR system is actually delivering the required flow despite appearing functional on command. A faulty differential pressure feedback sensor can report adequate flow to the PCM — allowing the EGR monitor to pass and preventing a code from setting — while the actual exhaust gas volume entering the intake is insufficient to suppress NO<sub>x</sub> under load conditions. Testing actual DPFE sensor output under load identifies this discrepancy.
35. **A. A contaminated or aged upstream O<sub>2</sub> sensor with a degraded sensing element** — A P0133 slow response code with confirmed heater function and near-neutral LTFT on bank 1 indicates the sensor's electrochemical sensing element has degraded with age or contamination. The heater confirmation eliminates heater circuit faults. Near-neutral LTFT eliminates a persistent mixture fault that would be causing the slow response pattern. A sensor that is physically intact and electrically connected but chemically degraded produces slower voltage transitions between rich and lean states — the zirconia element's ability to rapidly exchange oxygen ions diminishes with age, silicone contamination, or phosphorus poisoning from oil additives.
36. **A. The three-way catalytic converter reducing NO<sub>x</sub> to nitrogen and oxygen** — The three-way catalytic converter is the primary emissions component responsible for reducing NO<sub>x</sub> in the exhaust stream. The reduction catalyst — typically rhodium — converts NO<sub>x</sub> to harmless nitrogen gas and oxygen under stoichiometric exhaust conditions. The EGR system reduces NO<sub>x</sub> formation in the combustion chamber by lowering peak combustion temperatures before combustion occurs, but it is the catalytic converter that chemically reduces already-formed NO<sub>x</sub> in the exhaust. A vehicle passing OBD II inspection but failing tailpipe NO<sub>x</sub> has a catalyst that is not chemically converting NO<sub>x</sub> adequately despite passing the OBD II efficiency monitor threshold.
37. **D. The PCM output driver and solenoid are functioning correctly** — Supply voltage is confirmed at 12 volts, the PCM command wire drops to 0.2 volts when commanded, and the solenoid physically activates and clicks — confirming the complete electrical and mechanical operation of the vent solenoid circuit. All three elements of correct solenoid function are confirmed: power, ground switching, and mechanical actuation. A P0446 vent circuit code with

confirmed correct solenoid operation indicates the fault is not in the solenoid electrical circuit or mechanical function but in the vent path itself — a blocked vent tube, a downstream restriction, or incorrect sensor feedback from the fuel tank pressure sensor reporting an unexpected result during vent testing.

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

38. **B. A vacuum leak causing a lean condition predominantly at idle** — Strongly positive STFT and LTFT at idle on both banks that drops significantly at 2,500 RPM is the definitive pattern of a vacuum leak. At idle with the throttle nearly closed, a fixed-volume vacuum leak introduces a proportionally large amount of unmetered air relative to total engine airflow, causing a significant lean condition requiring substantial fuel trim correction. As RPM and throttle opening increase at 2,500 RPM, the same fixed leak volume becomes a smaller proportion of total airflow, reducing its lean effect and allowing fuel trims to approach zero. This RPM-dependent recovery is the diagnostic signature of a vacuum leak.
39. **D. Air entering between the MAF and throttle body is unmetered because it bypasses the MAF** — The MAF sensor measures all air entering the engine through the intake tract upstream of the sensor. A leak downstream of the MAF — between the sensor and the throttle body — allows additional air to enter the engine without passing through the MAF. This air is unmetered because the MAF never counted it in its airflow calculation. The PCM calculates fuel delivery based on MAF-measured air only, so the uncounted air creates a lean condition. The leak's location downstream of the MAF is critical — a leak upstream of the MAF would still pass through the sensor and be measured correctly.
40. **C. Normal downstream O2 sensor behavior on a vehicle with a healthy catalytic converter** — A downstream O2 sensor oscillating between 0.05 and 0.9 volts at a rate slightly slower than the upstream sensor is the expected behavior of a functioning catalytic converter with adequate but not excessive oxygen storage capacity. The converter buffers exhaust oxygen content changes — it absorbs oxygen during lean excursions and releases it during rich excursions — which dampens and slows the downstream sensor's switching compared to the upstream sensor. A slightly slower switching rate with normal amplitude range on the downstream sensor confirms the converter is actively buffering the exhaust stream as designed. No codes and normal fuel trims support this conclusion.
41. **A. The previous owner cleared all codes before the sale** — A recently purchased vehicle with all monitors showing incomplete and no stored codes is the classic presentation of a vehicle whose codes were cleared shortly before sale. Clearing codes with a scan tool or disconnecting the battery resets all OBD II readiness monitors to incomplete status. The vehicle must then complete a series of specific drive cycles under defined conditions before each monitor runs and achieves a pass result. A vehicle that has only been driven briefly since purchase — or only in conditions that do not satisfy the monitor enable criteria — will show incomplete monitors without any underlying fault preventing completion.

42. **D. A failing alternator not maintaining adequate charging voltage** — System voltage of 11.8 volts at operating speed with the engine running confirms the charging system is not maintaining the minimum required voltage. A healthy charging system should maintain 13.5–14.5 volts at the battery with the engine running. A reading of 11.8 volts confirms the alternator is not producing adequate output to charge the battery and power the vehicle's electrical systems simultaneously. This causes system voltage to drop below the battery's surface charge level, triggering the P0562 low voltage code. A weak battery shows low voltage with the engine off but recovers toward specification with the alternator charging — the opposite of the pattern described.
43. **B. The original CMP sensor has failed internally** — Supply voltage is confirmed at 5 volts and ground resistance is confirmed at 0.1 ohms — both external circuit elements are confirmed functional. A scope test confirms no signal output during cranking with the original sensor, and a known-good replacement immediately produces a correct square wave signal on the same circuit. The only variable that changed between the no-signal condition and the correct signal condition is the sensor itself. With the circuit confirmed functional both before and after the swap, the original sensor's internal Hall effect element or switching circuit has failed, preventing signal generation despite receiving correct power and ground.
44. **C. The cold-start enrichment strategy is delivering excess fuel that the PCM corrects once closed-loop begins** — Negative STFT of -22% at cold start on both banks indicates the PCM is actively removing fuel during the first 30 seconds — the mixture is richer than stoichiometry even during the cold-start enrichment phase. Normal cold-start operation produces a rich mixture intentionally, but the PCM should not be commanding -22% STFT corrections unless the enrichment is excessive. This points to an over-enrichment fault — a coolant temperature sensor reading colder than actual, causing the PCM to deliver more cold-start fuel than required. Once the engine warms and closed-loop control begins, the O<sub>2</sub> sensors take over and the trim normalizes.
45. **D. A restriction in the high-pressure fuel return circuit causing pressure buildup** — The high-pressure pump output is confirmed within specification — the pump is delivering the correct pressure to the rail inlet. With correct pump output confirmed, a rail pressure reading nearly three times the upper specification limit indicates pressure is accumulating in the rail beyond the pump's normal delivery. A restriction in the high-pressure fuel return or pressure relief circuit prevents excess pressure from being bled off the rail, causing it to build beyond specification. The pump is functioning correctly — the fault is in the rail's ability to regulate and relieve excess pressure through its return path.
46. **B. The CAN bus high and low wiring for an open, short, or damaged termination resistor** — A U0073 CAN bus communication fault stored in multiple modules simultaneously, combined with a scan tool that can reach some modules but not others, indicates a network-level fault rather than a single-module power supply issue. An open or short in the CAN bus wiring, or a failed termination resistor at either end of the bus, degrades signal integrity across the entire network. Modules positioned closer to the functioning portion of the bus may still communicate while those

on the other side of the fault location cannot. Testing the CAN bus wiring resistance and termination resistors identifies the network fault before individual module supplies are pursued.

47. **A. Thermal degradation of the plug wire routed against the exhaust manifold** — A random misfire following a recent tune-up with new plugs and wires, combined with normal fuel trims, compression, and coil waveforms, directs the diagnosis to the physical installation of the new components. A plug wire routed directly against the exhaust manifold is exposed to extreme radiant and contact heat that rapidly degrades the wire's insulation and internal conductor. This thermal damage causes intermittent high resistance or internal breakdown of the wire, producing random misfires on the affected cylinder. The misfire pattern is random rather than consistent because thermal degradation creates an intermittent fault rather than a complete open.
48. **C. The bank 2 fuel injectors for restriction** — Bank 1 fuel trims are near zero, confirming normal fuel control on bank 1 and eliminating shared system faults — the MAF sensor, fuel pressure, and EVAP system are all functioning correctly for bank 1. Bank 2 shows substantially elevated positive LTFT with a P0174 lean code, no vacuum leak found on smoke testing, and normal fuel pressure. With the O2 sensor circuit, vacuum, and fuel pressure eliminated as bank-2-specific causes, restricted fuel injectors on bank 2 delivering less fuel than commanded on each injection event is the remaining most likely cause of the persistent bank-2-specific lean condition.
49. **B. The thermostat for a fault causing slightly below-specification operating temperature** — ECT at 183°F after 30 minutes of highway driving on a 70°F day, against a specification of 190–215°F, confirms the engine is not reaching its designed operating temperature. No codes are stored, indicating the temperature is below specification but not far enough below to set a P0128 code on this vehicle. A thermostat that is partially stuck open or has a slightly lower-than-specified opening temperature allows excess coolant circulation that keeps the engine temperature below the normal operating range. Highway driving with a slightly defective thermostat produces this pattern of consistently below-specification but not dramatically low temperature readings.
50. **A. The fuel pump has adequate maximum output but the PCM is undercommanding pump duty** — At 100% commanded duty, the pump reaches specification — confirming the pump hardware is physically capable of generating adequate pressure and volume. At the PCM's normal 65% operating duty command, pressure falls below specification. This pattern confirms the pump is not failing — it meets specification when commanded appropriately. The fault is in the PCM's duty cycle calibration for normal operating conditions. A software fault, a pressure sensor providing incorrect feedback that causes the PCM to underestimate required pump duty, or a PCM calibration error specific to the normal operating duty range is causing insufficient pump output during closed-loop fuel pressure management.