BONUS SECTION 8: I/M FAILURE DIAGNOSIS

50 Questions — Targeted Review

1. A vehicle arrives at an I/M station. The scan tool shows a solid MIL illuminated and a P0300 — Random Misfire stored as a confirmed DTC. The I/M inspector should:

A. Pass the vehicle — P0300 is a driveability code, not an emissions code

B. Fail the vehicle automatically — a solid illuminated MIL with any confirmed emissions-related DTC is an automatic I/M failure regardless of which specific DTC is stored. P0300 random misfire is emissions-related because misfires allow unburned hydrocarbons to exit the tailpipe and can damage the catalytic converter

C. Perform a tailpipe emissions test to determine if actual emissions exceed the threshold before failing

D. Require the vehicle to be retested after a warm-up drive cycle before making a pass/fail determination

2. A vehicle has a P0420 — Catalyst System Efficiency Below Threshold stored as a confirmed DTC. The MIL is illuminated. During the I/M inspection the vehicle owner states the MIL just came on yesterday and they haven't had time to repair it. The correct I/M determination is:

A. Pass the vehicle with a waiver — a MIL that came on within 24 hours of the test is exempt from I/M failure

B. Grant a temporary extension — a recently illuminated MIL qualifies for a 30-day extension

C. Fail the vehicle — any illuminated MIL at the time of I/M inspection is an automatic failure regardless of when the MIL illuminated or the vehicle owner's awareness of the fault. The time elapsed since MIL illumination is not an exemption criterion

D. Perform a tailpipe test to confirm the catalyst is actually failing before the automatic failure determination is applied

3. A vehicle has a flashing MIL during the I/M drive to the test station. The MIL stops flashing and becomes solid by the time the vehicle arrives. The OBD II scan shows a P0302 — Cylinder 2 Misfire as a confirmed DTC. The I/M result is:

A. Automatic fail — a confirmed misfire DTC with a solid MIL is an automatic I/M failure. Although the MIL is no longer flashing at the time of the test, the confirmed DTC confirms the misfire event occurred. A catalyst-damaging misfire that caused the MIL to flash leaves behind the confirmed DTC that triggers the automatic fail

B. Pass — the MIL is not flashing at the time of the test

C. Perform a tailpipe test — a non-flashing MIL requires tailpipe confirmation before failing

D. Retest after a cold soak — a misfire DTC requires confirmation during a fresh cold-start cycle

4. A vehicle presents for I/M testing with no MIL illuminated. The OBD II scan reveals a P0171 — System Lean Bank 1 stored as a PENDING code. The correct I/M determination is:

A. Automatic fail — any stored DTC including pending codes causes automatic I/M failure

B. Pass with advisory — pending codes require notification to the owner but not automatic failure

C. Pending codes do NOT cause automatic I/M failure — a pending code indicates one trip detection without confirmed MIL illumination. For OBD II I/M purposes, only confirmed DTCs with an illuminated MIL trigger automatic failure. A pending P0171 alone does not illuminate the MIL and does not trigger automatic failure, though the technician should advise the owner of the developing fault

D. Fail the vehicle — a lean code always indicates an emissions fault that fails I/M automatically

5. A 2003 vehicle arrives for I/M testing. The scan tool shows the following monitor status: Catalyst — COMPLETE, EVAP — INCOMPLETE, O2 Sensor — COMPLETE, EGR — COMPLETE, Misfire — COMPLETE, Fuel System — COMPLETE, Comprehensive Component — COMPLETE. No MIL is illuminated. No DTCs are stored. The correct I/M determination for a 2001 or newer vehicle with one incomplete non-continuous monitor is:

A. Automatic fail — all monitors must show COMPLETE status for OBD II I/M passage on all model years

B. Pass — for 2001 and newer vehicles, one incomplete non-continuous monitor is allowed for I/M passage when no MIL is illuminated and no DTCs are stored. The single incomplete EVAP monitor is within the allowable threshold

C. Require the vehicle to complete a full OBD II drive cycle and return for retest

D. Fail — EVAP is a required monitor and must show COMPLETE status regardless of vehicle model year

6. A 1998 vehicle arrives for I/M testing with no MIL and no DTCs. Monitor status shows: Catalyst — INCOMPLETE, EVAP — INCOMPLETE, O2 Sensor — COMPLETE, EGR — COMPLETE, Misfire — COMPLETE, Fuel System — COMPLETE. Two non-continuous monitors are incomplete. The correct I/M determination for a 1996–2000 model year vehicle is:

A. Fail — two incomplete monitors always fail I/M regardless of model year

B. Pass — for 1996–2000 model year vehicles, up to two incomplete non-continuous monitors are allowed for I/M passage when no MIL is illuminated and no DTCs are stored. Two incomplete non-continuous monitors on a 1996–2000 vehicle meets the allowable threshold

C. Retest required — 1998 vehicles require all monitors complete before I/M passage can be determined

D. Fail — the Catalyst monitor is a mandatory complete monitor on all model years

7. A vehicle fails I/M with a P0401 — EGR Insufficient Flow. A five-gas tailpipe analysis is performed: HC = 85 ppm, CO = 0.3%, CO2 = 14.2%, O2 = 0.8%, NOx = 1,840 ppm. The elevated emission in this five-gas result that DIRECTLY correlates to the EGR failure is:

A. Elevated HC — HC elevation is the direct result of EGR failure

B. Elevated CO — CO elevation is the direct result of EGR failure

C. Elevated CO2 — CO2 elevation is the direct result of EGR failure

D. Elevated NOx — EGR recirculates exhaust gas into the intake manifold to dilute the combustion charge and lower peak combustion temperature. NOx (oxides of nitrogen) forms at high combustion temperatures. Without EGR, combustion temperatures are unrestricted, producing elevated NOx at the tailpipe — the direct five-gas consequence of EGR system failure

8. A vehicle fails an ASM (Acceleration Simulation Mode) loaded-mode I/M test with elevated HC and CO but normal NOx. The five-gas pattern shows HC = 420 ppm, CO = 3.8%, CO2 = 12.1%, O2 = 0.4%, NOx = 85 ppm. This five-gas pattern MOST indicates:

A. A lean misfire condition — lean misfire produces elevated HC with elevated O2, not low O2

B. A catalyst failure — catalyst failure produces elevated HC and CO at the tailpipe

C. A rich combustion condition — elevated HC and CO with reduced CO_2 and low O_2 is the rich combustion pattern. Excess fuel consumes available oxygen (low O_2) and produces incomplete combustion products (high CO from oxygen-starved carbon combustion) and high HC from unburned fuel molecules. Normal NOx is consistent with rich combustion because rich mixtures lower combustion temperature

D. An EGR failure — EGR failure produces elevated NOx, not elevated HC and CO

9. A vehicle fails I/M with elevated HC only. NOx is within limits. CO is within limits. The five-gas shows HC = 680 ppm, CO = 0.15%, CO_2 = 13.8%, O_2 = 1.9%. This five-gas pattern MOST indicates:

A. Elevated HC with elevated O_2 and low CO is the misfire pattern — unburned air-fuel mixture exits the cylinder unburned (high HC), carrying its oxygen content with it (elevated O_2), without producing CO (low CO) because combustion did not occur to create incomplete combustion products. A misfire is the most common cause of isolated HC and O_2 elevation without significant CO elevation

B. A rich combustion condition — rich combustion produces elevated CO with low O_2

C. EGR system failure — EGR failure produces elevated NOx, not isolated HC elevation

D. A failed catalytic converter — catalyst failure produces elevated HC and CO together, not isolated HC with elevated O_2

10. A vehicle fails I/M with elevated NOx only. HC and CO are within limits. The MOST likely cause is:

A. A misfiring cylinder causing unburned mixture to spike NOx at the tailpipe

B. A rich air-fuel mixture causing elevated combustion temperature and NOx formation

C. A lean air-fuel mixture elevating combustion temperature — a lean mixture burns hotter than stoichiometric, increasing peak combustion temperature and driving NOx formation. Alternatively, a failed EGR system that cannot dilute the combustion charge allows unrestricted temperature rise. Both conditions produce isolated NOx elevation without significantly affecting HC or CO

D. A failed EGR system — EGR failure is the most common cause of isolated NOx elevation, but a lean air-fuel ratio can also cause elevated NOx independently

11. A vehicle fails I/M for an illuminated MIL. The DTC stored is P0440 — EVAP System Malfunction. The owner has the EVAP system repaired and the DTC cleared. The vehicle is returned for retest. The technician must verify which condition before the vehicle can pass retest:

A. The EVAP monitor must show COMPLETE status on the retest scan — clearing a DTC resets all monitors to INCOMPLETE. For a vehicle that previously failed I/M for an EVAP-related DTC, the EVAP monitor specifically must run and complete to demonstrate the repair was successful before the vehicle can pass retest

B. All monitors must show COMPLETE status before the retest can be performed

C. The MIL must remain off for a minimum of 3 drive cycles before the vehicle is eligible for retest

D. A five-gas tailpipe test must confirm emissions are within limits after the EVAP repair

12. A vehicle arrives for I/M with a scan tool connected showing Mode $06 data. Mode $06 shows several test values near but not exceeding their failure thresholds. No MIL is illuminated. No DTCs are stored. All monitors show COMPLETE. The correct I/M determination is:

A. Fail — Mode $06 near-threshold values indicate imminent failure that should be addressed before passing

B. Perform additional tailpipe testing — near-threshold Mode $06 values require supplemental testing before a pass determination

C. Pass — no illuminated MIL, no stored DTCs, and all monitors complete are the three criteria for OBD II I/M passage. Mode $06 near-threshold values are not a failure criterion for OBD II I/M testing — they are informational data for technicians but do not constitute a pass/fail criterion

D. Require a follow-up retest within 30 days — near-threshold Mode $06 values are a conditional pass requiring retest

13. A vehicle fails an idle-mode I/M test with HC = 1,240 ppm at idle. The vehicle runs normally. No MIL is illuminated. No DTCs are stored. All monitors are complete. The five-gas at idle also shows O2 = 2.8%. The MOST likely cause of elevated HC with elevated O2 at idle is:

A. A rich air-fuel mixture at idle — rich mixtures produce elevated HC with LOW O2, not elevated O2

B. A misfire at idle — elevated HC with elevated O2 at idle with no misfire DTC suggests an intermittent misfire not severe enough to set a DTC but significant enough to elevate tailpipe HC.

The elevated O2 confirms unburned mixture (with its oxygen content intact) is exiting the cylinder without combustion — the misfire pattern without a DTC indicates a mild intermittent misfire

C. A clogged catalytic converter — a clogged converter restricts exhaust flow and causes elevated HC but does not produce elevated O2

D. An EGR valve stuck open at idle allowing exhaust dilution that elevates HC — EGR dilution causes rough idle and elevated HC but produces lower O2 from exhaust gas displacement

14. A vehicle fails I/M for an illuminated MIL with P0135 — O2 Sensor Heater Circuit Bank 1 Sensor 1. The O2 sensor heater is repaired. Before releasing the vehicle for I/M retest, the technician should confirm:

A. The upstream O2 sensor switches normally between 0.1V and 0.9V at operating temperature

B. The O2 sensor heater circuit draws specified current at cold startup

C. Both the O2 sensor heater circuit repair is verified AND the O2 Sensor monitor shows COMPLETE status after the repair — P0135 is a heater circuit fault. Clearing the DTC resets the O2 Sensor monitor to INCOMPLETE. The O2 Sensor monitor must run and complete on a drive cycle after the repair to confirm the heater circuit now allows the sensor to reach operating temperature correctly and the monitor passes before the vehicle returns for I/M retest

D. The fuel trims have returned to within ±10% after the O2 heater repair confirms the sensor is now active

15. A vehicle arrives for I/M testing. The OBD II scan shows the MIL is commanded OFF but the physical MIL bulb does not illuminate during the key-on bulb check. The correct I/M action is:

A. Pass the vehicle — a MIL that does not illuminate has no DTCs present

B. Pass the vehicle — the PCM commands the MIL off confirming no active faults

C. A non-functioning MIL bulb is an automatic I/M failure — the MIL must perform its key-on bulb check illumination to demonstrate it is functional. An inoperative MIL bulb (burned out, removed, disconnected) prevents the driver from being notified of emissions faults and is an automatic I/M failure regardless of DTC status

D. Perform a five-gas test to determine if emissions are within limits before making a pass/fail determination

16. A vehicle arrives for I/M with the MIL illuminated and a P0455 — EVAP Large Leak stored. The technician performs a smoke test — a completely missing fuel cap is found. The fuel cap is replaced and the DTC is cleared. The minimum number of drive cycles typically required for the EVAP monitor to run and complete is:

A. One drive cycle — the EVAP monitor runs on every drive cycle after DTC clearing

B. Three drive cycles — three complete drive cycles are required for all monitors to complete simultaneously

C. The EVAP monitor requires specific enabling conditions including a cold soak, fuel level within 15–85%, correct ambient temperature, and specific driving profile — it typically requires one or more complete drive cycles meeting ALL enabling criteria simultaneously. The vehicle owner should be advised to perform a specific OBD II drive cycle or follow the manufacturer's monitor completion procedure to ensure the EVAP monitor enables and completes before returning for retest

D. Seven drive cycles — the EVAP monitor requires a minimum of seven drive cycles for permanent DTC erasure before the monitor can complete

17. A vehicle fails I/M with elevated HC and elevated CO at both idle and 2,500 RPM during a two-mode test. NOx is normal. O2 is low (0.2%). CO2 is slightly reduced. The MOST likely single cause producing elevated HC, elevated CO, low O2, and normal NOx simultaneously is:

A. An EGR system fault — EGR faults produce elevated NOx, not elevated HC and CO

B. A rich air-fuel mixture condition — elevated HC and CO with low O2 and slightly reduced CO2 is the rich combustion pattern across both test modes, suggesting a system-level fuel enrichment fault (leaking injectors, stuck-open EVAP purge, high fuel pressure, or failed O2 sensor stuck rich) affecting both idle and 2,500 RPM conditions equally

C. A misfire at both test speeds — misfires produce elevated HC with elevated O2, not low O2

D. A failed catalytic converter — converter failure elevates HC and CO at the tailpipe but does not produce low O2 if the catalyst is simply not converting — O2 would be present in catalyst failure

18. A vehicle has a permanent DTC (Mode $0A) stored for P0420 — Catalyst Efficiency Below Threshold. The MIL is illuminated. The catalytic converter is replaced, the DTC is cleared using Mode $04, and all monitors run and complete. The MIL goes off. However, on the next scan, Mode $0A still shows P0420 as a permanent DTC. The MOST likely explanation is:

A. The catalytic converter replacement did not resolve the fault — permanent DTCs cannot be present without an active fault

B. A scan tool software issue is displaying the permanent DTC incorrectly after clearing

C. A normal PCM behavior — Mode $04 (standard DTC clear) does NOT clear permanent DTCs. Permanent DTCs stored in Mode $0A can only be cleared by the PCM itself after the specific monitor that detected the original fault runs and PASSES during a confirmed post-repair drive cycle. The Mode $0A permanent DTC will clear automatically once the catalyst monitor passes

D. The PCM requires dealer reprogramming to clear permanent DTCs stored in Mode $0A

19. A vehicle arrives for I/M testing. The scan tool shows all monitors complete, no DTCs, and MIL off. However, the vehicle just had its battery disconnected three days ago for an alternator replacement. The owner performed highway driving for two days after reconnecting the battery. The correct I/M action depends on:

A. Whether the battery disconnection was more than 48 hours before the test — batteries disconnected more than 48 hours before testing are exempt from monitor recompletion requirements

B. Whether the vehicle qualifies for a waiver based on the repair documentation for the alternator

C. The current monitor status at the time of the test — if all monitors show COMPLETE and no MIL or DTCs are present at the time of testing, the vehicle passes OBD II I/M regardless of prior battery disconnection. The two days of driving after battery reconnection was sufficient for monitors to run and complete. The historical battery disconnection is irrelevant if monitors are currently complete

D. Whether the alternator repair was performed at a licensed repair facility — unlicensed repairs disqualify vehicles from OBD II I/M passage

20. A vehicle fails a two-mode I/M test at 2,500 RPM with elevated HC only. At idle the vehicle passes all five-gas parameters. The five-gas at 2,500 RPM shows HC = 520 ppm, CO = 0.2%, CO_2 = 14.1%, O_2 = 1.8%. The MOST likely cause is:

A. A rich mixture that only appears at 2,500 RPM — rich mixtures produce elevated CO with low O_2, not elevated HC with elevated O_2

B. A lean mixture at 2,500 RPM — lean mixtures elevate combustion temperature and NO_x but do not specifically elevate HC

C. An EGR system fault — EGR failure elevates NO_x, not HC

D. A misfire or ignition fault that only manifests at 2,500 RPM — elevated HC with elevated O_2 at the higher speed test with passing results at idle indicates a misfire or ignition fault that does not cause a DTC at idle conditions but produces incomplete combustion at the higher RPM test speed. A marginal COP coil, a spark plug that fires correctly at light load but misfires under moderate load, or an ignition timing fault that worsens at higher RPM are the most likely causes

21. A vehicle fails I/M for an illuminated MIL. The owner has limited financial resources and presents documentation showing they have spent $150 on diagnosis and repairs attempting to resolve the issue. The state I/M program provides a repair cost waiver for low-income owners. The waiver criteria requires documented repair expenses above the waiver threshold. The technician should:

A. Pass the vehicle automatically — any documented repair attempt qualifies for automatic waiver

B. Verify that the documented repair costs meet the state's minimum waiver threshold — waiver programs have specific minimum expenditure requirements (typically $150–$450 depending on state program). If the documented costs meet or exceed the threshold AND the vehicle still cannot pass I/M despite good-faith repair attempts, the waiver may be issued — but the criteria vary by state program and must be applied per the specific program requirements

C. Issue a one-year waiver extension automatically for any documented repair attempt

D. Require the vehicle to be retested after additional repairs before waiver eligibility can be evaluated

22. A vehicle passes OBD II I/M testing (no MIL, no DTCs, monitors complete) but fails the visual gas cap inspection — the cap is missing entirely. The correct I/M determination is:

A. Pass — the OBD II scan is the primary test method and the visual inspection is supplementary

B. Fail — a missing fuel cap is both a visual inspection failure AND would cause an EVAP system fault if driven far enough. Many I/M programs include a visual fuel cap inspection as a separate required component. A missing fuel cap is an automatic failure of the visual inspection portion regardless of OBD II results

C. Pass with advisory — document the missing cap and advise the owner to replace it

D. Retest — send the vehicle back without a pass or fail determination until the cap is replaced

23. A vehicle fails I/M with a P0300 — Random Misfire and a P0420 — Catalyst System Efficiency Below Threshold both stored simultaneously. The technician suspects the misfire caused the catalyst failure. The MOST logical repair sequence is:

A. Replace the catalytic converter first — an inefficient catalyst cannot be repaired by fixing the misfire

B. Diagnose and repair the P0300 misfire first, then retest the P0420 — a persistent misfire deposits unburned fuel in the catalytic converter, thermally degrading the substrate. If the misfire is repaired and the converter was not yet permanently damaged, the converter efficiency may recover. Repairing the misfire first and retesting the catalyst efficiency before replacing the converter saves the cost of an unnecessary converter replacement if the catalyst recovers

C. Replace both the catalytic converter and repair the misfire simultaneously — simultaneous replacement prevents recurrence

D. Repair the P0420 first as it directly causes the I/M failure — the misfire will self-resolve after catalyst replacement

24. A vehicle passes OBD II I/M (no MIL, no DTCs, monitors complete) but is referred for a visual inspection. The inspector finds the AIR (Secondary Air Injection) pump hose is disconnected. The AIR system is required equipment on this vehicle. The correct I/M determination is:

A. Pass — the OBD II scan confirms no active emissions faults

B. Fail — in jurisdictions that include a visual emissions component inspection, disconnected or missing required emissions equipment (AIR pump hoses, EGR components, catalytic converter, O2 sensors) is an automatic failure of the visual inspection regardless of OBD II results. A disconnected AIR system hose is considered a tampered emissions device

C. Advisory only — the disconnected hose is noted but not a failure criterion

D. Retest after reconnecting the hose — a loose hose is not considered tampered equipment

25. A vehicle arrives for I/M retest after a P0420 repair. The technician confirmed catalytic converter replacement and cleared all DTCs. The vehicle owner performed a 45-minute highway drive before the retest. The retest scan shows: MIL off, no DTCs, but Catalyst Monitor = INCOMPLETE. The correct retest determination is:

A. Pass — the MIL is off and no DTCs are present — the incomplete monitor is from the recent repair and does not constitute failure

B. Fail or require additional monitor completion — for a vehicle that failed I/M for a P0420 and is returning for retest after catalyst replacement, the Catalyst monitor specifically must show COMPLETE status. An incomplete catalyst monitor after the specific repair that was the original failure reason means the repair cannot be confirmed as successful by OBD II criteria. Additional driving to complete the catalyst monitor is required before the vehicle can pass retest

C. Pass with waiver — a 45-minute highway drive is sufficient to confirm repair success regardless of monitor status

D. Perform a five-gas tailpipe test to substitute for the incomplete catalyst monitor

26. A vehicle fails I/M for a P0171 and P0174 — System Lean Both Banks. A vacuum leak is confirmed at the intake manifold plenum gasket and repaired. DTCs are cleared. The technician must advise the vehicle owner to:

A. Return immediately for retest — repairs to vacuum leaks allow immediate retest without additional driving

B. Perform a drive cycle sufficient for the Fuel System and Oxygen Sensor monitors to run and complete before returning for retest — clearing DTCs resets all monitors. After repairing the vacuum leak and clearing codes, the vehicle requires a drive cycle that enables the Fuel System monitor and O2 Sensor monitor (the monitors most directly affected by a vacuum leak fault) to confirm the repair. The owner should follow the OBD II drive cycle procedure for the specific vehicle to ensure monitors complete before the retest

C. Return after 50 miles of driving — 50 miles of city driving is always sufficient for all monitors to complete

D. Return after the LTFT self-corrects to within ±5% — LTFT correction confirms the repair without requiring monitor completion

27. A vehicle arrives for I/M with a non-illuminated MIL. The OBD II scan shows all monitors complete and no DTCs. The visual inspection reveals the catalytic converter has been replaced with a straight pipe (catalytic converter deleted). The correct I/M determination is:

A. Pass — the OBD II scan shows no active faults confirming normal emissions operation

B. Fail — a catalytic converter delete is an illegal emissions device tampering. The visual inspection of a vehicle with a straight pipe instead of a catalytic converter is an automatic I/M failure. The OBD II system may show no active faults if the downstream O2 sensor was also removed or tricked, but the physical absence of the required catalytic converter is an automatic visual inspection failure

C. Perform a tailpipe test — confirm actual emissions exceed limits before failing for a missing catalyst

D. Advisory only — advise the owner that a converter delete may affect OBD II monitor status

28. A vehicle has a P0442 — EVAP Small Leak stored and fails I/M. The repair technician confirms the fuel cap O-ring is cracked and replaces the fuel cap. After clearing the DTC and performing a drive cycle, the vehicle owner reports the MIL came back on with P0442 again before the retest. The MOST likely cause is:

A. The replacement fuel cap is defective — back-to-back cap failures indicate a filler neck damage

B. The replacement cap did not resolve the original P0442 — a cap O-ring replacement that fails to keep P0442 from returning means the leak source was not at the cap. The EVAP monitor ran, detected the leak again, confirmed the fault, and illuminated the MIL. The original leak source — which may have been at the cap, a hose, canister, or other component — is still present. A smoke test is required to identify the actual leak location

C. The EVAP monitor has a false trigger from the DTC clear event — some EVAP monitors false-trigger after DTC clearing

D. The new fuel cap requires a programming procedure before the EVAP monitor will accept it as valid

29. A vehicle arrives at an I/M station in a state that uses an OBD II scan-only program. The scan shows: MIL illuminated, P0113 — IAT Sensor High Voltage stored as a confirmed DTC. The vehicle owner argues that P0113 is not an emissions code and should not fail I/M. The correct determination is:

A. Pass — P0113 is a sensor circuit code that does not directly cause emissions to exceed limits

B. Fail — any confirmed DTC with an illuminated MIL is an automatic I/M failure in an OBD II scan-only program, regardless of whether the specific DTC directly causes emissions to exceed a numerical threshold. The OBD II system illuminates the MIL only when a fault has emissions implications — P0113 affects air charge temperature calculation which affects fuel delivery and emissions

C. Perform a five-gas test — if emissions are within limits despite P0113, the vehicle passes

D. Pass with advisory — P0113 is a Category C code that allows conditional I/M passage with documented advisory

30. A vehicle fails an I/M test with elevated NOx at the 2,500 RPM mode only. At idle, all gases are within limits. The five-gas at 2,500 RPM: HC = 55 ppm, CO = 0.1%, CO_2 = 14.6%, O_2 = 0.9%, NOx = 2,100 ppm. The MOST likely cause is:

A. A rich mixture at 2,500 RPM causing combustion temperature elevation

B. A misfire at 2,500 RPM producing NOx from incomplete combustion — misfires produce elevated HC and O2, not isolated NOx

C. A lean air-fuel mixture at 2,500 RPM elevating combustion temperature — the five-gas results show HC and CO near zero, CO2 near normal, but high O2 and very high NOx. This lean pattern at 2,500 RPM (slightly elevated O2 with isolated NOx elevation and near-zero CO confirms lean combustion) points to a lean condition under load: a MAF undercounting fault that worsens at moderate RPM, a vacuum leak large enough to cause lean conditions under load but not at idle, or a fuel pressure drop under load

D. A failed EGR system that only affects NOx at the 2,500 RPM test mode — EGR flow is not commanded at idle on most systems, so EGR failure is detected at load/RPM conditions. A failed EGR system that cannot dilute the combustion charge at 2,500 RPM while performing adequately at idle produces isolated NOx elevation at the RPM test mode — the definitive load-mode EGR failure I/M pattern

31. A vehicle passes OBD II I/M scanning. The state program also requires a gas cap pressure test as a separate component test. The fuel cap is tested — it holds pressure to 16 inches of water column (specification minimum 14 inches) but leaks down to 8 inches within 2 minutes. The correct determination is:

A. Pass — the cap holds above the minimum pressure specification of 14 inches

B. Fail the gas cap test — a fuel cap that initially holds above specification but leaks down significantly over 2 minutes fails the pressure retention portion of the gas cap test. A valid gas cap must both achieve the minimum pressure AND hold that pressure for the duration of the test period. A cap that bleeds down confirms a leaking internal seal that will cause EVAP system problems

C. Retest the cap — a single pressure test result is insufficient for a pass/fail determination

D. Pass with advisory — document the pressure decay and advise the owner to replace the cap

32. A vehicle fails I/M with a P0301 — Cylinder 1 Misfire confirmed DTC and illuminated MIL. The repair technician diagnoses a cracked spark plug on cylinder 1 and replaces all spark plugs. The DTC is cleared. Before the retest, the technician should confirm:

A. The new spark plugs are gapped to specification before clearing the DTC

B. A post-repair drive cycle has been performed to allow the Misfire monitor and Comprehensive Component monitor to run and confirm no misfire is detected — a misfire DTC cleared without a post-repair drive cycle confirming no reoccurrence means the repair cannot be confirmed as successful by the OBD II monitor. The Misfire monitor must run under conditions that previously triggered the misfire and confirm no misfire is detected before the vehicle is sent for retest

C. The cylinder 1 coil is tested after plug replacement to confirm it was not damaged by the cracked plug

D. Compression is retested on cylinder 1 to confirm the cracked plug did not allow pressure to damage the cylinder

33. A vehicle fails I/M due to excessive HC and CO emissions at idle on a tailpipe-based I/M test. The vehicle has no stored DTCs and no illuminated MIL. The five-gas at idle: HC = 890 ppm, CO = 4.2%, O2 = 0.1%, CO2 = 12.8%, NOx = 65 ppm. The MOST likely cause of this rich failure pattern without any stored DTCs is:

A. A rich condition from a fuel injector fault — rich injector faults always generate DTCs

B. A stuck-open EVAP purge solenoid that is leaking fuel vapor at idle — a stuck-open purge solenoid causes a rich condition that does not always generate a DTC, especially if the fuel trim correction can stay within the DTC threshold. A stuck-open purge solenoid can cause elevated tailpipe HC and CO at idle (rich exhaust) without triggering a MIL if the lean correction available to the PCM keeps the fuel trim within the non-DTC range, yet still causes I/M failure from actual exhaust enrichment

C. A rich condition from a failed mass airflow sensor — MAF sensor failures generate circuit codes

D. A misfire condition causing elevated HC — a misfire at idle would produce elevated O2, not low O2 at 0.1%

34. A vehicle fails the OBD II I/M scan with a P0300 and a P0304 stored. The owner repairs cylinder 4 by replacing the coil and spark plug. The DTCs are cleared. During a post-repair test drive, P0304 does not return but P0300 — Random Misfire returns within 20 miles. The MOST likely cause of the remaining P0300 after cylinder 4 repair is:

A. The cylinder 4 repair is incomplete — P0300 after clearing confirms cylinder 4 is still misfiring

B. A separate misfire source exists on a different cylinder — a P0300 returning after P0304 is resolved indicates random misfire continues from a different source. The cylinder 4 fault was correctly identified and repaired (P0304 does not return) but another cylinder or system-level fault (vacuum leak, fuel pressure, MAF) is causing intermittent misfire on different cylinders, generating P0300 without enough consecutive misfires on any single cylinder to set a cylinder-specific code

C. The PCM requires reprogramming after misfire codes are cleared — P0300 returns from PCM memory

D. The replacement spark plug on cylinder 4 is incorrect — wrong plug heat range causes P0300

35. A vehicle arrives for I/M with the OBD II DLC covered with a sticker and the connector pins visibly bent. The OBD II scan tool cannot communicate with any module. The correct I/M action is:

A. Perform a tailpipe test to substitute for the OBD II scan that cannot be completed

B. Fail the vehicle for tampered or damaged OBD II diagnostic connector — a damaged or inaccessible OBD II DLC that prevents I/M testing is treated as a test refusal or tampering in most state I/M programs. A vehicle that cannot be scanned due to connector damage or tampering cannot pass OBD II I/M — the owner is required to restore the OBD II system to functional condition before the vehicle can be tested

C. Pass the vehicle — the OBD II system failure is not related to the vehicle's actual emissions

D. Issue a waiver — a damaged DLC qualifies for the repair cost waiver program

36. A vehicle fails I/M with elevated CO at both idle and 2,500 RPM. HC is borderline. O2 is very low (0.1%). NOx is normal. CO2 is reduced. The technician checks the upstream O2 sensor — it reads 0.88V constant (rich fixed) without switching. LTFT = -24%. The MOST likely root cause causing the I/M failure is:

A. A failed catalytic converter — the catalyst cannot convert CO if the incoming exhaust has excess CO from rich combustion

B. A stuck-open EVAP purge solenoid causing rich condition at both test speeds

C. A failed upstream O2 sensor stuck at rich voltage — the sensor stuck at 0.88V constant causes the PCM to develop maximum negative LTFT correction (-24%) in an attempt to lean out the perceived rich condition. However, the PCM has overcorrected so severely that it cannot keep up with the sensor's false rich signal, causing the fuel system to run moderately rich in the actual exhaust — producing elevated CO and HC at tailpipe and low O2 from excess fuel consumption

D. A leaking fuel pressure regulator causing system over-rich conditions at all operating conditions

37. A vehicle fails I/M with a P0420. The owner cannot afford catalytic converter replacement and applies for a cost waiver. The waiver program requires a minimum of $450 in documented repair costs. The technician has diagnosed a genuine catalyst failure after ruling out all false P0420 causes. The owner has spent $380 on the diagnosis and parts purchased but not yet installed. The correct I/M action is:

A. Issue the waiver — the owner is making a good-faith effort toward repair

B. Advise the owner that $380 does not meet the minimum $450 waiver threshold — the documented expenses must meet or exceed the state's minimum waiver amount. The owner must spend an additional $70 or more on qualifying repair activities before the waiver threshold is met. The technician should document all expenses accurately and advise the owner of the remaining amount needed to qualify

C. Issue a 90-day extension to allow the owner to accumulate sufficient repair documentation

D. Pass the vehicle — a genuine P0420 cannot be resolved without converter replacement, qualifying for automatic waiver

38. A vehicle fails I/M with both elevated HC and NOx simultaneously at the 2,500 RPM test mode. This combined gas pattern is unusual and requires careful interpretation. The MOST likely cause of simultaneously elevated HC AND NOx at 2,500 RPM is:

A. A lean misfire — a lean misfire can produce both elevated HC (from the misfiring cylinder's unburned mixture) and elevated NOx (from the high combustion temperatures in the cylinders that are firing lean without EGR dilution). A lean misfire simultaneously elevates HC from the misfiring cylinders and NOx from the correctly-firing-but-lean cylinders — the characteristic dual-gas failure pattern of a lean misfire condition

B. A rich air-fuel mixture — rich mixtures produce elevated HC and CO, not elevated NOx

C. A failed catalytic converter — catalyst failure elevates HC and CO at the tailpipe simultaneously, not HC and NOx

D. An EGR failure combined with a misfire — EGR failure alone does not elevate HC; a misfire alone does not elevate NOx to I/M failure levels without a concurrent lean condition

39. A vehicle passes OBD II I/M scanning but the state program also requires a visual underhood inspection. The inspector finds the EGR valve vacuum line has been plugged with a golf tee. The EGR monitor shows COMPLETE and no EGR-related DTCs are stored. The correct I/M determination is:

A. Pass — the EGR monitor completed confirming EGR system function despite the plugged vacuum line

B. Fail — the EGR monitor completing despite a plugged vacuum line does not make the tampering acceptable. A plugged EGR vacuum line is an intentional emissions defeat device. In programs with a visual inspection component, intentional disconnection or defeat of emissions components is an automatic I/M failure regardless of OBD II monitor status. The EGR monitor may have completed under conditions where vacuum was not needed, or the monitor may be passing incorrectly

C. Advisory only — document the plugged vacuum line and advise the owner to restore it

D. Retest after restoring the EGR vacuum line — a retest after repair is the appropriate response to a visual inspection finding

40. A vehicle fails I/M for a P0441 — EVAP Incorrect Purge Flow. After a thorough diagnosis, the technician determines the EVAP purge solenoid is stuck open. The purge solenoid is replaced and the DTC is cleared. The owner asks how to ensure the vehicle passes the I/M retest on the first attempt. The technician should advise:

A. Drive the vehicle at highway speeds for 45 minutes before the retest

B. Perform city and highway driving at varying speeds and loads for at least 30 minutes, ensuring the engine reaches full operating temperature — some EVAP monitor enabling criteria require specific conditions. The vehicle should be driven through a complete OBD II drive cycle following the manufacturer's recommended monitor completion procedure, ensuring all EVAP monitor enabling criteria (fuel level 15–85%, correct temperature, specific speed/load profile) are met to allow the EVAP monitor to run and pass before the retest

C. Disconnect and reconnect the battery immediately before the retest to force all monitors to run simultaneously

D. Ensure the fuel tank is completely full before the retest to maximize EVAP system pressure for the monitor test

41. A vehicle fails I/M for a P0300 — Random Misfire. The technician performs a thorough diagnosis and cannot find a cause — compression is normal, ignition waveforms are normal, fuel injectors balance correctly, no vacuum leaks are found. The MIL has illuminated. The MOST likely overlooked cause of random misfire without other findings is:

A. A random misfire from a faulty PCM internal misfire detection algorithm — PCM faults can generate false P0300

B. A fuel delivery volume fault — a weak fuel pump that cannot deliver adequate flow under moderate acceleration causes lean misfire at varying cylinders as fuel pressure drops intermittently.

Low fuel pressure at moderate to high demand causes different cylinders to misfire randomly as the pressure insufficiency does not consistently affect the same cylinder — producing P0300 without a cylinder-specific code. Fuel pressure monitoring under actual driving conditions (not just idle) is required

C. A spark plug fouling condition — fouled plugs produce consistent cylinder-specific misfires, not random misfires

D. An EGR valve stuck open at partial positions causing intermittent combustion dilution

42. A vehicle fails I/M with a P0172 — System Rich Both Banks. Fuel trims are STFT = -18%, LTFT = -14% at idle. The technician replaces the upstream O2 sensors on both banks and clears the DTCs. At the post-repair check, fuel trims are still STFT = -14%, LTFT = -3%. P0172 has not returned within 50 miles of driving. The MOST likely assessment is:

A. The O2 sensor replacement fully resolved the rich condition — the improved fuel trims confirm the sensors were the cause

B. The rich condition is partially improved but not fully resolved — STFT of -14% still indicates a significant active rich source. The LTFT improving to -3% suggests the long-term learned correction has reset, but the persistent -14% STFT indicates an active rich source is still present. The O2 sensor replacement may have been unnecessary or only partially addressed the fault — the active rich source must be identified and corrected before the vehicle will reliably pass I/M retest

C. The vehicle is ready for I/M retest — P0172 not returning within 50 miles confirms the repair

D. The fuel trims will continue to improve over the next 100 miles of driving — no additional repair is needed

43. A vehicle fails OBD II I/M for an illuminated MIL and a P0131 — O2 Sensor Low Voltage Bank 1 Sensor 1. The technician replaces the upstream Bank 1 O2 sensor. After replacement and DTC clearing, the MIL returns within one drive cycle with P0131 again. The MOST likely cause of the repeat P0131 after sensor replacement is:

A. The replacement O2 sensor is defective — back-to-back O2 sensor failures require investigation

B. A fault in the O2 sensor signal circuit — the sensor wiring between the sensor and the PCM may have a short to ground pulling the signal wire to low voltage. Replacing the sensor without testing the signal wire for a short to ground leaves the wiring fault in place — the new sensor's signal output is pulled to near zero by the wiring fault, producing P0131 with the new sensor installed

C. A lean exhaust condition causing the new sensor to correctly read low voltage — a confirmed lean condition would generate P0171 alongside P0131

D. A PCM input circuit fault — a PCM input fault would have been present before the sensor replacement

44. A vehicle presents for I/M with a scan showing a P0420 stored as a PERMANENT DTC in Mode $0A. The MIL is illuminated. The P0420 is also in Mode $03 (confirmed DTCs). The vehicle owner asks why the code appears twice and whether clearing it will help before the test. The technician should explain:

A. Clearing the DTC before the test is recommended — clearing the DTC in Mode $03 will turn off the MIL and allow passage if monitors were already complete

B. Clearing the DTC will turn off the MIL but the permanent DTC in Mode $0A will remain — if the I/M program checks Mode $0A, the permanent DTC will still cause failure. Additionally, clearing the DTC resets all monitors to INCOMPLETE, causing a monitor readiness failure. Clearing the DTC immediately before an I/M test is counterproductive and does not resolve the emissions fault

C. The permanent DTC in Mode $0A is from a different fault than the Mode $03 DTC — two separate P0420 faults are present

D. Clearing the DTC will clear both Mode $03 and Mode $0A simultaneously — modern scan tools clear all DTC modes at once

45. A vehicle fails I/M with elevated HC, CO, and reduced CO2 at both idle and 2,500 RPM on a tailpipe-based test. NOx is slightly low. The five-gas pattern with low NOx alongside elevated HC, CO, and reduced CO2 MOST indicates:

A. A lean misfire condition — lean misfires produce elevated HC and O2 with low CO and elevated NOx

B. A rich misfire condition — elevated HC and CO from excess fuel, reduced CO2 from inefficient combustion, and low NOx from cooler-than-normal combustion temperatures (rich combustion is cooler than lean combustion and produces less NOx) — the pattern of elevated HC + elevated CO + reduced CO2 + low NOx is the rich misfire signature, where both excess fuel and poor combustion quality combine to produce the worst HC and CO emissions

C. An EGR system failure — EGR failure produces elevated NOx, not reduced NOx

D. A failed catalytic converter — catalyst failure elevates HC and CO but NOx would be normal or elevated, not reduced

46. A vehicle fails I/M with a P0455 — EVAP Large Leak. The technician finds and repairs a cracked EVAP vapor hose. The DTC is cleared. The vehicle owner reports they need to pass I/M retest urgently — they need the vehicle registered the next day. The technician performs an EVAP monitor force-run using the scan tool's bidirectional controls. The EVAP monitor passes. The MOST appropriate action is:

A. Send the vehicle for retest immediately — the monitor passed under forced conditions confirming the repair

B. Verify the EVAP monitor passed under real-world conditions rather than just under forced scan tool command — some EVAP monitor force-run functions only test specific components, not the full pressure decay test the OBD II monitor performs during a drive cycle. The technician should confirm whether the bidirectional command performs a full monitor completion or only a functional component test. If only a component test was run, the vehicle requires a real drive cycle for the full EVAP monitor to run and complete before the retest can confirm repair success

C. Replace the EVAP canister simultaneously — forced monitor completion without canister replacement never produces a passing result

D. Advise the owner to drive the vehicle for exactly 100 miles before the retest — 100 miles always completes all monitors

47. A vehicle passes OBD II I/M but the state program includes a visual inspection for the presence of a functioning catalytic converter. The inspector notes the catalytic converter appears new (bright shiny finish) and the vehicle has 187,000 miles on the odometer. The inspector is not suspicious of tampering. The correct I/M action is:

A. Fail the vehicle — a new-appearing converter on a high-mileage vehicle indicates converter replacement to pass I/M

B. Pass the vehicle — a new-appearing catalytic converter on a high-mileage vehicle is not evidence of tampering. Catalytic converters are replaced legitimately for emissions-related failures (P0420), mechanical damage, or after misfire damage. A new converter that is correctly installed passes the visual inspection, and OBD II scan confirmation of no active P0420 after the new converter confirms the emissions system is functional

C. Require documentation proving legitimate converter replacement before passing

D. Perform an extended road test to confirm the new converter is performing correctly

48. A vehicle fails I/M for a P0136 — Downstream O2 Sensor Circuit Bank 1 Sensor 2. The sensor is replaced and the DTC is cleared. During the post-repair drive cycle, no DTCs return. However, the catalyst monitor shows INCOMPLETE after the drive cycle. The MOST likely explanation is:

A. The downstream O2 sensor replacement damaged the catalytic converter

B. The catalyst monitor did not receive the correct enabling conditions during the post-repair drive — the catalyst monitor requires the downstream O2 sensor to be functioning and warmed up before it can evaluate catalyst efficiency. A post-repair drive cycle that does not include the sustained highway cruise phase required for the catalyst monitor to run and complete will leave the catalyst monitor incomplete. The specific OBD II drive cycle for this vehicle must be followed to allow the catalyst monitor to complete

C. The new downstream O2 sensor requires 100 miles of break-in before the catalyst monitor will accept its readings

D. A catalyst fault exists that is preventing the catalyst monitor from completing

49. A vehicle arrives for I/M with the MIL illuminated. The scan shows P0340 — CMP Sensor Circuit Bank 1 stored as a confirmed DTC. The vehicle owner argues that the camshaft position sensor is not an emissions component and should not cause I/M failure. The technician should explain:

A. The owner is correct — P0340 is a powertrain code unrelated to emissions and should not fail I/M

B. Perform a five-gas test to determine if emissions are actually elevated before failing the vehicle

C. Any confirmed DTC that illuminates the MIL is an automatic I/M failure in an OBD II scan program — the PCM illuminates the MIL only for faults with emissions implications. A P0340 CMP sensor fault has emissions implications because camshaft position data is used for sequential fuel injection timing, variable valve timing control, and ignition timing — faults that can increase emissions. The OBD II system's MIL illumination decision IS the emissions determination; separate emission measurement is not required for OBD II scan-based I/M

D. P0340 is a Category B code that allows conditional I/M passage on the first occurrence only

50. A vehicle fails I/M with elevated HC at idle during a tailpipe-based test. HC = 740 ppm. After inspection, the technician finds a disconnected PCV valve hose that is causing a vacuum leak into the intake manifold. The PCV hose is reconnected. The MOST likely mechanism by which a disconnected PCV hose causes elevated HC at idle is:

A. A disconnected PCV hose allows unfiltered air to enter the intake manifold, diluting the fuel mixture and causing a lean misfire that elevates HC

B. A disconnected PCV hose eliminates the vacuum that holds the intake manifold gaskets sealed, causing manifold gasket leaks that introduce raw fuel vapors into the exhaust

C. A disconnected PCV hose creates an unmetered air leak into the intake manifold — the unmetered air causes the PCM to command a richer mixture than the actual air-fuel ratio requires. Simultaneously, crankcase hydrocarbons that should be captured by the PCV system are now venting to atmosphere from the open hose end rather than being drawn into the intake and burned. The combination of PCM enrichment response to the vacuum leak and the direct HC release from the open crankcase vent produces elevated tailpipe HC

D. A disconnected PCV hose allows rich crankcase vapors to enter the intake manifold and enrich the combustion mixture, causing incomplete combustion of the excess fuel and elevated HC

BONUS SECTION 8: ANSWER KEY AND EXPLANATIONS

1. B — Automatic I/M Failure for Illuminated MIL — An illuminated MIL (solid, not flashing) with any confirmed emissions-related DTC is an automatic I/M failure in all OBD II I/M programs. P0300 random misfire is directly emissions-related — misfires allow unburned hydrocarbons to exit the tailpipe and thermally damage the catalytic converter. The specific DTC type is irrelevant to the automatic failure determination — any confirmed DTC causing MIL illumination triggers automatic I/M failure.

2. C — Automatic Fail Regardless of MIL Illumination Timing — OBD II I/M programs do not provide exemptions based on when the MIL illuminated. The sole criteria is the condition at the time of testing: MIL illuminated plus confirmed DTC equals automatic failure. A MIL that illuminated yesterday carries the same I/M consequence as one that illuminated six months ago. There is no grace period, recency exemption, or awareness-based exception in standard OBD II I/M programs.

3. A — Automatic Fail from Confirmed Misfire DTC — A confirmed DTC stored in the PCM with an illuminated MIL (even if no longer flashing) is an automatic I/M failure. The MIL may have stopped flashing because the catalyst-damaging misfire rate decreased, but the confirmed P0302 DTC remains in memory confirming the fault occurred. The prior flashing MIL indicates the misfire rate was severe enough to potentially damage the catalyst — a confirmed DTC with a previously flashing MIL is an automatic I/M failure.

4. C — Pending Codes Do NOT Fail I/M — A pending DTC represents a single-trip detection that has not yet been confirmed by a second drive cycle. The PCM does not illuminate the MIL for a pending code. OBD II I/M programs require an illuminated MIL with a confirmed DTC for automatic failure. A pending P0171 with no MIL illumination does not meet the automatic failure criteria. The vehicle passes OBD II I/M, though the technician should advise the owner that a fault is developing.

5. B — One Incomplete Monitor Allowed for 2001+ Vehicles — EPA OBD II I/M regulations allow 2001 and newer vehicles to pass I/M with one incomplete non-continuous monitor when no MIL is illuminated and no confirmed DTCs are stored. A single incomplete EVAP monitor on a 2003 vehicle with all other monitors complete, no MIL, and no DTCs meets the I/M passage criteria. The vehicle passes.

6. B — Two Incomplete Monitors Allowed for 1996–2000 Vehicles — EPA OBD II I/M regulations recognize that 1996–2000 model year vehicles had less robust monitor completion capability. Two incomplete non-continuous monitors are allowed for I/M passage on 1996–2000 vehicles when no MIL is illuminated and no confirmed DTCs are stored. The 1998 vehicle with two incomplete non-continuous monitors, no MIL, and no DTCs meets the allowable threshold and passes.

7. D — Elevated NOx from EGR Failure — EGR recirculates a portion of exhaust gas back into the intake manifold to dilute the incoming air-fuel charge. This dilution reduces peak combustion temperature. NOx forms when combustion temperature exceeds approximately 2,500°F. Without EGR dilution, peak combustion temperatures are unrestricted, driving NOx formation. A P0401 EGR failure produces elevated NOx as its direct five-gas signature — the other gases (HC, CO, CO2) remain relatively normal unless other faults are also present.

8. C — Rich Combustion Pattern — Elevated HC and elevated CO with low O2 (0.4%) and slightly reduced CO2 is the definitive rich combustion five-gas signature. Excess fuel in the combustion chamber consumes all available oxygen (low O2), produces carbon monoxide from oxygen-starved combustion of excess carbon (high CO), and elevates unburned hydrocarbon output (high HC). CO2 is reduced because combustion efficiency is lower. Normal NOx is consistent with rich combustion — excess fuel actually lowers combustion temperature below lean combustion temperatures, reducing NOx formation.

9. A — Misfire Pattern — Elevated HC with elevated O2 and low CO at idle is the misfire five-gas signature. During a misfire, the air-fuel charge exits the cylinder unburned — carrying its full hydrogen carbon content (high HC), retaining its original oxygen content (elevated O2 since the oxygen was not consumed in combustion), and producing minimal CO (no combustion occurred to create incomplete combustion products). This three-gas combination — high HC, high O2, low CO — is the misfire pattern distinguishable from rich (high HC, low O2, high CO) and lean (low HC, high O2, low CO) patterns.

10. D — EGR Failure Most Common for Isolated NOx, Lean Also Possible — Isolated NOx elevation without significant HC or CO changes is the characteristic EGR system failure pattern (EGR cannot dilute combustion temperature, NOx rises) or a lean air-fuel mixture pattern (lean combustion is hotter, driving NOx). Since both causes are valid and the question asks for the most likely, EGR failure and lean mixture are both correct considerations — the question acknowledges both. In practice, EGR failure is confirmed by testing the EGR system, and lean mixture is confirmed by fuel trim analysis.

11. A — EVAP Monitor Must Complete for Retest — Clearing a DTC resets all OBD II monitors to INCOMPLETE status. For a vehicle returning for retest after an EVAP-related failure (P0440), the EVAP monitor specifically must run and pass to demonstrate the repair resolved the leak. If the EVAP monitor remains incomplete at retest, the repair cannot be confirmed as successful through OBD II monitor criteria. For 2001+ vehicles, one incomplete monitor may be allowed, but the monitor specifically related to the failure reason should ideally be complete.

12. C — Pass — Mode $06 is Not an I/M Failure Criterion — OBD II I/M pass criteria are: no illuminated MIL, no confirmed DTCs, and monitor readiness thresholds met. Mode $06 near-threshold values are informational data showing how close individual component tests are to their calibrated thresholds — they are used by technicians for predictive maintenance but are not a pass/fail criterion in the OBD II I/M program. The vehicle passes based on confirmed no-MIL, no-DTC, and all monitors complete status.

13. B — Misfire at Idle Pattern — Elevated HC (1,240 ppm) with elevated O2 (2.8%) at idle with no DTC is consistent with an intermittent misfire not severe enough to meet the DTC threshold but severe enough to cause tailpipe HC failure. An idle misfire that doesn't set P030X may be from a very mildly misfiring cylinder that contributes intermittently — the tailpipe sees the average HC output including the intermittent misfire events. The elevated O2 confirms unburned mixture is exiting the cylinder — the O2 content of the air-fuel charge exits intact because combustion is not occurring.

14. C — O2 Sensor Heater Repair Verified AND Monitor Must Complete — A P0135 heater circuit fault causes the O2 sensor to take longer to reach operating temperature, potentially causing the O2 Sensor monitor to fail (sensor not achieving switching within the expected time window). After heater circuit repair, the O2 Sensor monitor must run under conditions that evaluate heater performance and confirm the sensor reaches operating temperature correctly and the monitor passes — both confirming the physical repair is correct and confirming OBD II readiness for the I/M retest.

15. C — Non-Functioning MIL is Automatic Failure — The MIL is required by OBD II regulations to illuminate during the key-on engine-off bulb check to confirm it is functional. An inoperative MIL — from a burned-out bulb, a removed bulb, a disconnected MIL circuit — prevents the vehicle's OBD II notification system from functioning. A driver cannot be warned of emissions faults by a MIL that cannot illuminate. I/M programs treat a non-functional MIL as an automatic failure because it defeats the core purpose of the OBD II emissions notification system.

16. C — EVAP Monitor Requires Specific Enabling Conditions — The EVAP monitor is one of the most difficult monitors to complete because it requires a specific set of simultaneous conditions: appropriate cold soak (typically overnight), fuel level within 15–85%, correct ambient and coolant temperature range, specific speed and load profile, and no active DTCs. Simply driving the vehicle does not guarantee EVAP monitor completion — the owner must follow the manufacturer's specific EVAP monitor drive cycle procedure to ensure all enabling criteria are met during a single drive cycle.

17. B — Rich Air-Fuel Mixture Condition — Elevated HC and elevated CO at both idle and 2,500 RPM with low O2 (0.2%) and slightly reduced CO2 across both test speeds confirms a system-level fuel enrichment fault affecting all operating conditions equally. Normal NOx is consistent with rich combustion (excess fuel cools the combustion process, reducing peak temperatures below NOx formation thresholds). A fault affecting both test speeds simultaneously points to a persistent enrichment source: leaking injectors, stuck-open EVAP purge, overly high fuel pressure, or a failed upstream O2 sensor stuck rich.

18. C — Permanent DTC Cleared Only by Monitor Pass — Mode $04 (standard DTC clear command) removes confirmed DTCs from Mode $03 and turns off the MIL, but does NOT clear permanent DTCs stored in Mode $0A. Permanent DTCs were introduced specifically to prevent vehicle owners from clearing DTCs before I/M testing to fraudulently pass. Mode $0A permanent DTCs are cleared only by the PCM itself — after the specific monitor responsible for the original fault runs and confirms a PASSING result during a verified post-repair drive cycle. This is by design to prevent manipulation.

19. C — Current Monitor Status Determines I/M Result — OBD II I/M evaluates the current state of the vehicle's OBD II system at the time of testing. Historical events — battery disconnection, DTC clearing, component replacement — are irrelevant if the vehicle's current OBD II status shows no MIL, no DTCs, and all monitors complete. Two days of highway driving after battery reconnection was sufficient for monitors to complete. The vehicle passes based on its current confirmed status.

20. D — Misfire or Ignition Fault at 2,500 RPM — Elevated HC (520 ppm) with elevated O2 (1.8%) at 2,500 RPM with passing results at idle is the misfire pattern — specifically a load-dependent misfire or ignition fault. The elevated O2 confirms unburned mixture is exiting the cylinder at the higher speed test. Passing results at idle mean the fault only manifests under the moderate load and speed of the 2,500 RPM test mode. A marginal ignition component, a spark plug with a wide gap that fires at light load but misfires under compression load, or a coil with reduced high-load output are the primary suspects.

21. B — Verify Documented Costs Meet Waiver Threshold — Repair cost waiver programs have specific minimum expenditure thresholds that must be met with documented receipts. The technician cannot issue a waiver based on partial documentation or good intentions — the specific state program requirements must be applied. If the $150 documented cost does not meet the state's threshold (often $150–$450 depending on program), the waiver cannot be issued. The technician must accurately inform the owner of the remaining amount needed and document all qualifying expenses clearly.

22. B — Missing Fuel Cap Fails Visual Inspection — Many I/M programs include a visual fuel cap inspection as a mandatory separate component test. A missing fuel cap is an EVAP system component that is required to be present and functional. The absence of a fuel cap is an automatic visual inspection failure independent of OBD II scan results. The OBD II system may not yet show a P0455 if the cap was recently removed, but the physical absence of the required component fails the visual portion of the inspection.

23. B — Repair Misfire First, Then Retest Catalyst — A persistent misfire deposits unburned fuel into the catalytic converter during each misfire event. This unburned fuel ignites in the hot converter, creating extremely high temperatures (1,200–1,800°F) that thermally degrade the catalyst substrate. If the misfire is repaired early enough, the catalyst may not yet have reached the point of permanent substrate damage — the catalyst efficiency monitor may pass after misfire repair if the catalyst has not been permanently destroyed. Repairing the misfire first prevents further catalyst damage and may avoid a costly converter replacement.

24. B — Automatic Fail for Tampered Emissions Equipment — In I/M programs with a visual emissions component inspection, the presence of required emissions equipment is mandatory. A disconnected AIR pump hose is considered an intentional defeat of the secondary air injection emissions system — a form of emissions tampering. Regardless of OBD II scan results, a vehicle with disconnected or missing required emissions equipment fails the visual inspection portion of the I/M test automatically in programs that include this inspection component.

25. B — Catalyst Monitor Must Complete for P0420 Retest — When a vehicle fails I/M specifically for a P0420 (catalyst efficiency fault) and returns after catalytic converter replacement, the Catalyst monitor must run and pass to confirm the replacement resolved the efficiency fault. An incomplete Catalyst monitor at retest means the OBD II system has not yet evaluated the new converter's efficiency — the repair cannot be confirmed as successful. Additional monitor-enabling driving following the manufacturer's catalyst monitor completion procedure is required before the retest.

26. B — Perform Drive Cycle for Monitor Completion — Clearing DTCs after a vacuum leak repair resets the Fuel System monitor and O2 Sensor monitor to INCOMPLETE. These monitors use upstream O2 sensor data to evaluate closed-loop fuel control function — the same systems most affected by the vacuum leak. Following the OBD II drive cycle procedure for the specific vehicle ensures the Fuel System monitor and O2 Sensor monitor run under the correct enabling conditions (temperature, load, speed) and confirm the repair has restored normal closed-loop fuel control before the I/M retest.

27. B — Automatic Fail for Catalytic Converter Tampering — Removal of the catalytic converter and installation of a straight pipe is illegal emissions tampering under federal and state law. In I/M programs with visual inspection, the physical absence of a required catalytic converter is an automatic failure regardless of OBD II scan results. A downstream O2 sensor that was removed or repositioned can prevent P0420 from setting, making the OBD II scan appear normal despite the missing converter. The visual confirmation of a straight pipe in place of the converter is the controlling failure criterion.

28. B — Original Leak Source Not at Fuel Cap — The P0442 returning after cap replacement confirms the cap was not the sole or actual leak source. The EVAP monitor ran a complete test, detected the pressure decay, confirmed the fault, and stored P0442 again — a second confirmed detection of the same leak. A smoke test on the EVAP system is now required to identify the actual physical leak location. Common alternative sources after a negative cap test include: cracked

EVAP hoses, canister body cracks, vent solenoid seat leakage, and fuel tank sending unit gasket failure.

29. B — Any Confirmed DTC with Illuminated MIL is Automatic Failure — OBD II I/M programs using scan-only testing apply a simple rule: illuminated MIL plus confirmed DTC equals automatic failure. The PCM's MIL illumination decision is the emissions determination — the PCM only illuminates the MIL for faults that have been determined to increase emissions above 1.5 times the FTP standard. P0113 (IAT sensor high) affects intake air temperature calculations used in fuel injection and ignition timing computations, which have direct emissions implications. The MIL illumination IS the emissions finding.

30. D — EGR Failure at 2,500 RPM Test Mode — A five-gas pattern of near-zero HC, very low CO, normal CO_2, slightly elevated O_2, and very high NO_x (2,100 ppm) at 2,500 RPM with passing results at idle is the EGR failure I/M pattern. EGR is not commanded at idle on most systems — its primary function is under moderate load and speed. At the 2,500 RPM loaded test mode, the PCM commands EGR flow to dilute combustion temperature. A failed EGR system cannot dilute the charge, allowing NO_x to spike. Passing idle results confirm the fault is specifically load/RPM dependent — the EGR failure pattern.

31. B — Fail the Gas Cap Test for Pressure Decay — A fuel cap must achieve the minimum test pressure AND maintain that pressure throughout the test period. A cap that achieves 16 inches of water column (above the 14-inch minimum) but decays to 8 inches within 2 minutes has a leaking internal seal — the check valve or O-ring is not maintaining the required seal over time. The pressure retention requirement is as important as the initial pressure achievement. This cap fails the retention portion of the gas cap pressure test and requires replacement.

32. B — Post-Repair Drive Cycle to Confirm No Misfire — A misfire DTC cleared after a physical repair (new spark plug) does not confirm the repair was successful — it only confirms the DTC history was cleared. The Misfire monitor must run under the driving conditions that previously triggered the misfire and confirm no misfire is detected. A cracked spark plug can fail under specific load and RPM conditions — the post-repair drive cycle must include those conditions to confirm the new plug fires correctly under the same demanding conditions that caused the original failure.

33. B — Stuck-Open EVAP Purge Solenoid Without DTC — A rich condition with elevated HC and CO (4.2%), very low O_2 (0.1%), and reduced CO_2 at both test speeds without any DTCs is consistent with a stuck-open EVAP purge solenoid causing continuous fuel vapor delivery at idle. The critical diagnostic clue is no DTCs — a rich condition severe enough to fail tailpipe I/M tests should generate P0172, but if the fuel trim correction keeps STFT and LTFT within the DTC threshold (±25% on most platforms), the PCM never illuminates the MIL while actual tailpipe emissions fail the I/M numerical threshold.

34. B — Separate Misfire Source on Different Cylinder — P0304 not returning confirms the cylinder 4 repair was successful. P0300 returning without P0304 (or any other cylinder-specific code) confirms a different source is causing random misfire — affecting different cylinders without accumulating enough consecutive misfires on any single cylinder to set a cylinder-specific DTC. System-level causes of random misfire — low fuel pressure under acceleration, a MAF sensor undercounting causing lean conditions under varying loads, or an intermittent vacuum leak — must be investigated.

35. B — Fail for Tampered or Inaccessible OBD II Connector — OBD II regulations require the DLC to be accessible and functional for I/M testing. A DLC with bent pins and a sticker covering it that prevents scan tool communication is treated as tampering or deliberate obstruction of I/M testing in most state programs. The vehicle cannot pass OBD II I/M without a functional communication connection. The owner is required to restore the DLC to working condition — including straightening or replacing the connector and repairing any CAN bus faults preventing communication — before the vehicle can be tested.

36. C — Failed Upstream O2 Sensor Stuck Rich — A sensor producing a constant 0.88V rich signal causes the PCM to develop extreme negative LTFT (-24%) to correct the false rich reading. With LTFT at -24%, the PCM is commanding significantly less fuel than the base calibration to try to satisfy the sensor's constant rich signal. Despite this maximum correction, the sensor continues to demand more lean correction than the PCM can deliver — the fuel system runs rich enough in actual exhaust to produce elevated CO and HC at the tailpipe and fail the tailpipe I/M test.

37. B — $380 Does Not Meet the $450 Waiver Threshold — State I/M waiver programs have specific minimum expenditure requirements that must be met with documented receipts for qualifying repair work. If the documented expenses do not reach the minimum threshold, the waiver cannot be issued regardless of the good-faith nature of the repair efforts. The technician must inform the owner accurately of the shortfall and advise what additional qualifying repair expenses would bring the total to the threshold amount — not round up or approximate the waiver qualification.

38. A — Lean Misfire Pattern — A lean misfire simultaneously produces two opposing gas signatures: elevated HC from the misfiring cylinders (unburned mixture) and elevated NOx from the correctly-firing lean cylinders (lean combustion is hotter, driving NOx formation). The misfiring cylinders contribute elevated HC while the lean-running firing cylinders produce elevated NOx — both appearing in the tailpipe exhaust simultaneously. This dual-failure pattern of HC and NOx elevation together is the characteristic lean misfire I/M failure signature that distinguishes it from a simple rich condition or a simple EGR failure.

39. B — Automatic Fail for Intentional Emissions Tampering — A golf tee deliberately plugging the EGR vacuum line is not an accidental disconnection — it is an intentional emissions defeat device. State I/M programs with visual inspection components treat any intentional tampering with emissions equipment as an automatic failure. The EGR monitor completing under conditions where vacuum was not required (or because the OBD II monitor uses alternative sensing) does not legitimize the tampering. The vehicle fails the visual inspection for deliberate emissions equipment defeat regardless of OBD II results.

40. B — Perform OBD II Drive Cycle for EVAP Monitor — The EVAP monitor has specific enabling criteria that must all be met simultaneously during a single drive cycle: cold soak temperature, fuel level 15–85%, ambient temperature range, specific speed and load profile, and no active DTCs. Random city or highway driving does not guarantee all criteria are met. The technician should provide the customer with the manufacturer's specific EVAP monitor completion procedure — including initial cold soak requirements, city driving phase, highway cruise phase, and deceleration phase — to ensure the EVAP monitor runs and passes before the retest.

41. B — Fuel Delivery Volume Fault — Comprehensive testing at idle (compression, waveforms, injector balance, vacuum) all normal confirms there is no cylinder-specific fault at idle conditions. A weak fuel pump that cannot deliver adequate volume at moderate to high demand causes fuel pressure to drop intermittently during acceleration — affecting different cylinders randomly as the pressure insufficiency does not consistently cause the same cylinder to misfire first. This load-dependent random misfire requires fuel pressure testing under actual driving conditions (not just idle static test) to capture the pressure drop event.

42. B — Rich Condition Partially Resolved but Not Complete — An STFT of -14% at idle after O2 sensor replacement indicates an active rich source is still present. The significant improvement in LTFT (from -14% to -3%) reflects the LTFT resetting after DTC clear, not an actual correction of the active source. The -14% STFT is a real-time correction confirming the PCM is actively correcting a rich exhaust condition. P0172 not returning within 50 miles may indicate the trim is staying just within the DTC threshold, but the vehicle will likely fail I/M if the active rich source is not identified and resolved.

43. B — Short to Ground on O2 Sensor Signal Wire — A replacement O2 sensor producing the same P0131 within one drive cycle confirms the sensor itself is not the fault. The signal circuit between the sensor and the PCM has a short to ground that pulls the signal wire toward zero volts regardless of which sensor is installed. The short to ground is in the harness wiring — at a chafed section, a connector with a terminal contacting the harness ground, or a pinched wire section — and must be located and repaired. Installing a third sensor without repairing the wiring fault will produce the same result.

44. B — Clearing DTC Before Test is Counterproductive — Mode $04 DTC clearing turns off the MIL and removes confirmed DTCs from Mode $03, but does NOT clear permanent DTCs from Mode $0A. If the I/M program checks Mode $0A (which all programs should per EPA regulations), the permanent P0420 will still cause failure. More critically, clearing the DTC resets all monitors to INCOMPLETE — adding a monitor readiness failure to the existing permanent DTC issue.

Clearing DTCs immediately before an I/M test is never the correct approach and typically guarantees failure.

45. B — Rich Misfire Signature — The combination of elevated HC + elevated CO + reduced CO2 + low NOx is the rich misfire pattern. Elevated HC comes from unburned fuel molecules from both the excess fuel and incomplete combustion. Elevated CO results from oxygen-starved combustion of excess carbon. Reduced CO2 reflects overall combustion inefficiency. Low NOx (below normal) occurs because rich combustion temperatures are lower than stoichiometric combustion — excess fuel acts as a heat sink, reducing peak temperature below the NOx formation threshold. This low-NOx characteristic distinguishes rich misfire from lean misfire (which produces high NOx).

46. B — Verify Full Monitor Completion Under Real-World Conditions — Scan tool bidirectional EVAP monitor commands typically test specific components (purge solenoid operation, vent solenoid operation) but may not perform the full OBD II pressure decay leak test that actually sets or passes the P0455 monitor. A component function test passing does not confirm the full EVAP monitor pass. The technician must determine whether the bidirectional command runs the complete monitor or only individual component tests before declaring the vehicle ready for I/M retest based on the forced test result.

47. B — Pass — New Converter is Not Evidence of Tampering — A new-appearing catalytic converter on a high-mileage vehicle is completely normal and expected — high-mileage vehicles frequently require catalytic converter replacement for legitimate emissions-related failures. A new converter that passes OBD II I/M (no P0420, all monitors complete, no MIL) confirms the emissions system is functioning correctly. Visual inspection of a correctly installed new converter is a pass regardless of vehicle mileage — mileage alone is not a failure criterion.

48. B — Catalyst Monitor Requires Specific Drive Cycle Conditions — The catalyst monitor requires the downstream O2 sensor to be functional (now confirmed after replacement) and requires a sustained highway cruise phase at moderate speed with specific temperature and load conditions. A post-repair drive cycle that consisted primarily of city driving or short trips likely did not meet the highway cruise enabling requirement for the catalyst monitor. The owner should follow the manufacturer's catalyst monitor completion procedure — typically including sustained highway driving at 55–65 mph for several minutes — to allow the catalyst monitor to evaluate the converter efficiency.

49. C — Any Confirmed DTC with Illuminated MIL Fails OBD II I/M — The OBD II system's design principle is that the PCM illuminates the MIL only for faults that have been calibrated to increase emissions above 1.5 times the FTP standard. This calibration decision is made by the manufacturer and approved by the EPA — the MIL illumination IS the emissions finding. P0340 CMP sensor faults affect sequential injection timing, variable valve timing, and ignition timing — all of which directly affect combustion efficiency and emissions. The MIL ON determination supersedes any individual assessment of whether a specific code is emissions-related.

50. C — PCV Disconnect Causes Unmetered Air Leak and Direct HC Release — A disconnected PCV hose creates two simultaneous problems: first, it introduces unmetered air into the intake manifold (a vacuum leak) causing the PCM to enrich the mixture to compensate for the false-lean O2 sensor response; second, the open PCV hose end allows crankcase blowby gases — which contain unburned hydrocarbons from combustion blowby past the piston rings — to vent to the atmosphere instead of being drawn back into the intake and burned. The direct HC release from the open crankcase vent, combined with any PCM enrichment response, elevates tailpipe HC at idle.