

PRACTICE EXAM 7: ASE T1

GASOLINE ENGINES SIMULATION

1. Two technicians discuss diagnostic methodology. Technician A says the customer interview captures information that DTCs alone cannot reveal. Technician B says scan tool data should be reviewed before any mechanical testing begins. Who is correct?

- A. Technician A only
- B. Technician B only
- C. Both Technician A and Technician B
- D. Neither Technician A nor Technician B

2. A heavy-duty gasoline truck with a 6.0L Vortec produces a vacuum reading of 16 in. Hg at idle that drops to 14 in. Hg under steady cruise. The vehicle is operating at 2,000 feet elevation. The reading is:

- A. Within normal range when adjusted for altitude — typical operating values
- B. Below normal indicating exhaust restriction requiring immediate investigation
- C. Above normal indicating possible improper sensor calibration during operation
- D. Indeterminate without specific OEM specifications for the engine and altitude

3. A LEAST-likely cause of a P0301 (Cylinder 1 Misfire) DTC on a 7.3L Godzilla is:

- A. A failed ignition coil on cylinder 1 producing weak or no spark output
- B. A clogged fuel injector on cylinder 1 reducing fuel delivery to that cylinder
- C. Low compression on cylinder 1 from worn rings, valves, or head gasket
- D. A failed downstream oxygen sensor producing incorrect feedback to the controller

4. Technician A says a clogged catalytic converter produces a snap-throttle vacuum drop that recovers slowly. Technician B says a clogged catalytic converter produces a snap-throttle vacuum drop that recovers immediately. Who is correct?

- A. Both Technician A and Technician B
- B. Technician A only
- C. Technician B only
- D. Neither Technician A nor Technician B

5. A heavy-duty gasoline truck has a "stalls when warm only" complaint. Live data captured during a stall event shows fuel rail pressure dropping from 58 psi to 12 psi just before the stall. The MOST likely cause is:

- A. A weakening fuel pump that fails to maintain pressure when hot due to thermal effects
- B. A failed engine controller producing incorrect fuel pump commands during operation
- C. A failed crankshaft position sensor producing intermittent signal during operation
- D. A failed mass airflow sensor providing incorrect signal data to the controller

6. A vacuum gauge at idle shows 19 in. Hg with a steady needle. The technician opens the throttle quickly to 2,500 RPM and observes the gauge drops to 5 in. Hg, then immediately recovers to 22 in. Hg before settling back to 19 in. Hg at idle. The pattern indicates:

- A. A clogged catalytic converter creating excessive backpressure during operation
- B. A worn camshaft causing valve timing issues throughout the operating range
- C. Normal engine response during throttle changes with healthy vacuum recovery
- D. A burned valve causing irregular vacuum readings during all operating conditions

7. A heavy-duty gasoline truck has a "ticking noise from the valve cover area that worsens with engine speed." A stethoscope confirms the noise is loudest at the rocker arm assembly. The MOST likely cause is:

- A. A failed crankshaft main bearing producing crankshaft-speed noise at idle
- B. A failing harmonic balancer producing rotational imbalance under all loads
- C. A failed catalytic converter producing exhaust noise transmitted to the head
- D. Worn rocker arms, lifters, or pushrods producing camshaft-speed noise

8. Two technicians discuss noise diagnosis. Technician A says noise frequency relative to crankshaft speed identifies which mechanical component is producing the noise. Technician B says noise that occurs once per two crankshaft revolutions is camshaft-speed noise. Who is correct?

- A. Both Technician A and Technician B
- B. Technician A only
- C. Technician B only
- D. Neither Technician A nor Technician B

9. A LEAST-likely diagnostic step in evaluating a coolant loss complaint with no visible external leak is:

- A. Pressure-testing the cooling system at the radiator filler neck location
- B. Replacing the radiator cap as the most likely cause without further testing
- C. Performing a combustion gas leak test using chemical indicator fluid testing
- D. Inspecting the engine oil for milky appearance indicating coolant intrusion

10. A customer reports a 6.4L HEMI "stalls when coming to a stop, then restarts immediately and runs fine." The MOST diagnostic interview question is:

- A. What grade of fuel does the customer typically purchase from the gas station?

- B. How many miles does the truck have on the odometer at the current time?
- C. Does the symptom occur in any specific operating condition such as hot or cold?
- D. Where is the truck typically parked when not in active service operation?

11. A heavy-duty gasoline truck with a Class 4 GVWR has a complaint of "rough idle that has gradually worsened over six months." Long-term fuel trim shows +18% on both banks. The MOST likely cause is:

- A. A failed downstream oxygen sensor providing incorrect feedback continuously
- B. A failed engine controller misinterpreting sensor data across all operating conditions
- C. A failed catalytic converter producing exhaust restriction during all operating conditions
- D. PCV system contamination or vacuum leak producing gradual lean condition

12. The technician notices significant carbon buildup at the intake valves of a GDI engine during disassembly. The MOST likely root cause is:

- A. The absence of fuel washing the back of the intake valves on GDI systems
- B. A failed PCV valve allowing excessive oil mist into the intake throughout operation
- C. Operation with low-quality fuel that has produced excessive deposits over time
- D. A failed mass airflow sensor providing incorrect signal data continuously

13. A LEAST-likely interpretation of fluid identified at a leak point under a heavy-duty gasoline truck is:

- A. Red-brown fluid with sweet smell indicates automatic transmission fluid leakage
- B. Clear fluid with a strong fuel odor indicates engine coolant leakage from the system
- C. Amber to dark brown slick fluid indicates engine oil leakage from a seal or gasket
- D. Green or orange fluid with a sweet smell indicates engine coolant leakage from system

14. Two technicians discuss the use of TSBs in diagnosis. Technician A says TSBs document known failure patterns and corrective procedures from the manufacturer. Technician B says TSBs should be reviewed before performing diagnostic testing on a vehicle. Who is correct?

- A. Technician A only
- B. Technician B only
- C. Both Technician A and Technician B
- D. Neither Technician A nor Technician B

15. A cylinder head has been resurfaced. The required surface finish for an MLS gasket on an aluminum head is:

- A. 100–150 microinches Ra finish required for proper sealing performance
- B. 60–110 microinches Ra finish required for proper composite gasket sealing
- C. 80–120 microinches Ra finish required for proper sealing under all conditions
- D. 30–60 microinches Ra finish required for proper MLS gasket sealing performance

16. Technician A says induction-hardened valve seats are part of the cylinder head material itself. Technician B says insert-style valve seats are separate hardened rings pressed into the head. Who is correct?

- A. Both Technician A and Technician B
- B. Technician A only
- C. Technician B only
- D. Neither Technician A nor Technician B

17. A LEAST-likely consequence of installing a too-hot heat range spark plug in a heavy-duty gasoline truck operating under sustained heavy load is:

- A. Pre-ignition damage to the piston, valves, or other combustion chamber components
- B. Reduced spark plug life from electrode burning and erosion under load
- C. Improved cold-start performance and reduced fouling in the affected cylinder
- D. Possible burned electrodes or cracked insulator from excessive temperature

18. A valve spring measurement at the installed height shows 95 lbs of force. OEM specification calls for 95 lbs minimum at that height. The MOST appropriate action is:

- A. Replace the spring since it is exactly at the minimum specification
- B. Reuse the spring since it meets the minimum specification requirement
- C. Install a thicker shim to compensate for the borderline measurement
- D. Send the spring out for retesting to confirm the measurement is accurate

19. A piston measurement at the skirt shows 4.001 inch. The cylinder bore measures 4.005 inch. OEM clearance specification is 0.0010 to 0.0030 inch. The clearance:

- A. Exceeds the maximum specification — requires corrective machining or replacement
- B. Is within OEM specification and requires no service action at this time
- C. Is below the minimum specification and requires careful application of lubricant
- D. Cannot be calculated without additional measurement at multiple piston positions

20. Plastigage measured on a main bearing shows 0.0009 inch clearance. OEM specification is 0.0010 to 0.0030 inch. The MOST appropriate action is:

- A. Reinstall the bearing as the clearance is acceptable for service operation

- B. Tighten the cap to a higher torque to reduce the clearance further
- C. Apply additional assembly lubricant during installation to compensate fully
- D. Verify journal and bearing dimensions to identify the cause of tight clearance

21. A LEAST-likely cause of bottom-end engine knocking on a heavy-duty gasoline V8 is:

- A. Worn connecting rod bearings on one or more cylinders affected
- B. Worn main bearings allowing crankshaft movement under heavy load
- C. A failing oxygen sensor providing incorrect feedback to the controller
- D. A loose flywheel that has lost retention bolt torque specification

22. A crankshaft journal measurement shows 2.395 inch in one direction and 2.397 inch perpendicular to that. OEM specification limits journal out-of-round to 0.0005 inch. The crankshaft:

- A. Has 0.002 inch out-of-round and must be reground or replaced before reuse
- B. Is within specification and can be reused with new bearings during reassembly
- C. Has been improperly machined and requires immediate replacement service
- D. Is at the maximum specification limit but can be reused with care during operation

23. Oil pressure on a 6.0L Vortec measures 8 psi at hot idle and 28 psi at 2,000 RPM. OEM specification is 15–30 psi at idle and 40–60 psi at 2,000 RPM. The MOST likely cause is:

- A. A pressure relief valve stuck open at the maximum pressure setting condition
- B. Worn engine bearings increasing the cumulative clearance volume the pump must fill
- C. Wrong viscosity oil that is too thin for the operating temperature range
- D. A clogged oil filter forcing oil through the bypass valve continuously

24. A heavy-duty gasoline truck with the OEM-specified IAT coolant has been topped off with OAT coolant. The MOST likely consequence is:

- A. The cooling system will operate normally with no measurable consequences
- B. The coolant capacity will increase due to the chemistry mixture properties
- C. The cooling system will produce improved heat transfer due to chemistry blend
- D. A gel-like precipitate may form, clogging heater cores and radiator tubes

25. The MOST appropriate response when a cooling system pressure test produces a slow pressure drop with no visible external leak is to:

- A. Perform a combustion gas leak test at the radiator filler neck location
- B. Replace the head gasket immediately based on the pressure loss observed
- C. Top off the cooling system and return the vehicle to service operation
- D. Replace the radiator cap and pressure-test again to verify proper sealing

26. A coil-on-plug ignition coil is being scope-tested. The primary winding signal shows the ground-side voltage rising to 200 V at the moment of field collapse. This signal pattern indicates:

- A. The coil primary winding has failed and requires immediate replacement service
- B. The PCM is failing to ground the primary circuit during firing events
- C. Normal field collapse producing the expected high-voltage spike at coil shutoff
- D. The coil secondary winding has failed and is producing back-EMF on the primary

27. Two technicians discuss spark plug heat range. Technician A says cold plugs transfer heat from the electrode to the cylinder head more quickly than hot plugs. Technician B says heavy-duty truck applications generally use plugs in the mid-to-cold heat range. Who is correct?

- A. Both Technician A and Technician B

- B. Technician B only
- C. Technician A only
- D. Neither Technician A nor Technician B

28. A LEAST-likely cause of an intermittent misfire on multiple cylinders during cold start that disappears when warm is:

- A. Hydraulic lifters that have bled down during the engine-off period
- B. Spark plug carbon tracking that conducts more readily when the porcelain is cool
- C. Fuel injectors with deposits that affect spray pattern when fuel is cold
- D. A failed engine controller producing intermittent firing commands continuously

29. A spark plug shows a small bridge of conductive material between the center electrode and the ground electrode. The MOST likely cause is:

- A. Pre-ignition damage requiring engine teardown for inspection of internals
- B. Carbon or oil bridging the gap, often from fuel quality or oil consumption issues
- C. Normal high-mileage wear that requires no further action at this time
- D. A rich fuel mixture caused by a sticking fuel injector on that cylinder location

30. A heavy-duty gasoline truck has a no-spark condition with normal cranking. CKP signal is verified present. Power is verified at all eight ignition coils. The MOST likely cause is:

- A. The PCM is failing to ground the primary circuits of the ignition coils
- B. The coil-on-plug coils have all failed simultaneously requiring replacement
- C. The crankshaft position sensor has failed even though signal appears present
- D. The fuel pump has failed and is preventing engine startup despite spark capability

31. A LEAST-likely cause of misfires that set only on cold start and clear within 30 seconds of running is:

- A. Hydraulic lifters bleeding down during the engine-off period
- B. Fuel injectors with deposits that improve as injector body warms up
- C. Spark plug carbon tracking that conducts on cold porcelain only
- D. A failed crankshaft position sensor producing no signal during operation

32. A turbocharged heavy-duty gasoline truck has boost pressure that overshoots OEM specification by 5 psi. Charge piping is verified sealed. The MOST likely cause is:

- A. A failed intercooler producing reduced charge cooling under load conditions
- B. A wastegate that is stuck closed and not opening at the commanded pressure
- C. A leaking fuel pressure regulator allowing excessive fuel under boost conditions
- D. A clogged air filter restricting flow to the compressor inlet at all times

33. A heavy-duty gasoline truck has a vacuum leak at the brake booster line. The fuel trim and operating symptoms include:

- A. Positive long-term fuel trim, possible hissing sound when applying the brakes
- B. Negative long-term fuel trim, no audible symptom from the brake booster line
- C. No measurable fuel trim change because the vacuum is supplied by the manifold
- D. Fuel trim values that vary randomly because the vacuum source is inconsistent

34. Technician A says a fuel pump that produces correct pressure but inadequate volume points to pump wear. Technician B says a fuel pump that produces inadequate pressure but correct volume points to a fuel pressure regulator failure. Who is correct?

- A. Technician A only

- B. Technician B only
- C. Both Technician A and Technician B
- D. Neither Technician A nor Technician B

35. A LEAST-likely cause of a P0171 (System Too Lean, Bank 1) DTC is:

- A. A vacuum leak at the bank 1 intake manifold gasket sealing surface
- B. A failed bank 1 oxygen sensor reading rich when actual mixture is correct
- C. A clogged fuel injector on bank 1 reducing fuel delivery to that bank
- D. A leaking fuel pressure regulator dumping fuel into the manifold causing rich condition

36. A heavy-duty gasoline truck has set DTC P0103 (MAF Sensor Circuit High Voltage). A scan tool reads 5.0 V at idle and 5.0 V at WOT. The MOST likely cause is:

- A. The MAF sensor is reading correctly with high airflow at idle indicated
- B. The MAF sensor or its wiring has an open or short to power circuit fault
- C. The MAF sensor is reading correctly with low airflow at WOT indicated
- D. The PCM is failing to read the MAF signal correctly at all engine speeds

37. The MOST appropriate response to an exhaust backpressure measurement of 0.8 psi at idle on a heavy-duty gasoline truck is:

- A. Accept the reading as within the typical 1.5 psi maximum at idle specification
- B. Replace the catalytic converter as a preventive measure for the borderline reading
- C. Replace the muffler as a preventive measure for the borderline reading
- D. Schedule the truck for catalytic converter replacement at the next service appointment

38. An EGR valve stuck closed at all engine operating conditions MOST likely produces:

- A. Rough idle and stalling at all engine speeds and load conditions during operation
- B. Rich fuel mixture across the operating range with negative fuel trim values
- C. Excessive exhaust backpressure leading to thermal damage to the manifold
- D. A NO_x emissions failure with little to no driveability complaint in normal use

39. A heavy-duty gasoline truck has set DTC P0455 (Gross EVAP Leak Detected). The technician's FIRST diagnostic step should be to:

- A. Replace the EVAP canister based on the gross leak code presence
- B. Replace the purge valve solenoid as the most common gross leak cause
- C. Inspect the fuel cap for proper seating, condition, and sealing surface
- D. Replace the fuel cap regardless of inspection findings to address the code

40. The downstream oxygen sensor on a healthy converter operating at steady cruise should show:

- A. A signal that switches rapidly between rich and lean values continuously
- B. A signal that is relatively flat near 0.6–0.8 V due to oxygen storage in converter
- C. A signal that mirrors the upstream sensor's switching pattern across all conditions
- D. A signal that varies randomly with no consistent pattern in any conditions

41. Technician A says the federal emissions warranty covers the catalytic converter for an extended period beyond the basic vehicle warranty. Technician B says installing an aftermarket "delete tune" that disables emissions monitors is illegal under the Clean Air Act. Who is correct?

- A. Both Technician A and Technician B
- B. Technician A only

C. Technician B only

D. Neither Technician A nor Technician B

42. A heavy-duty gasoline truck has set DTC P0420 (Catalyst Efficiency Below Threshold) and the customer reports that the engine has been misfiring on cylinder 4 for the past month. The MOST likely cause of the converter failure is:

A. The converter has reached the end of its normal service life from age alone

B. The downstream oxygen sensor has failed and is incorrectly reporting converter status

C. Sustained misfire has contaminated and overheated the catalyst substrate over time

D. A failed mass airflow sensor producing incorrect fuel mixture across all conditions

43. A scan tool live data display shows commanded idle speed at 700 RPM and actual idle speed at 950 RPM. The MOST likely cause is:

A. The PCM has failed and is unable to control idle speed correctly during operation

B. The throttle position sensor has failed and is providing incorrect signal data

C. The crankshaft position sensor is misreading the actual engine speed during operation

D. A vacuum leak admitting unmetered air that overrides the PCM's idle command

44. After a battery disconnect on a heavy-duty gasoline truck, the customer reports "rough idle that has improved over the past 100 miles of driving." The MOST appropriate response is:

A. Replace the engine controller as the rough idle indicates a PCM failure has occurred

B. Continue normal operation as the controller is relearning adaptive values through driving

C. Replace the throttle body as the rough idle indicates throttle plate position issues

D. Replace the mass airflow sensor as rough idle after battery disconnect indicates MAF failure

45. A heavy-duty gasoline truck has a P0341 DTC (Camshaft Position Sensor Circuit Range/Performance). The vehicle starts and runs but exhibits poor performance. The MOST likely cause is:

- A. The CMP signal is present but inconsistent or incorrect compared to expected values
- B. The CMP sensor has failed completely and is producing no signal at all
- C. The PCM has failed and is misinterpreting the CMP signal during operation
- D. The crankshaft position sensor has failed simultaneously with the CMP sensor

46. A scan tool reads the following bidirectional command results: EGR valve commanded 50% open, valve position feedback 15%. The MOST likely cause is:

- A. The PCM is failing to send the bidirectional command correctly to the valve
- B. The EGR position sensor is reading correctly but the valve has failed mechanically
- C. The EGR valve is mechanically stuck and not responding to the controller commands
- D. Normal valve operation since position feedback typically lags command signal slightly

47. A heavy-duty gasoline truck has set multiple U-codes (network communication codes) across several control modules. The technician should FIRST:

- A. Replace each control module individually until the U-codes clear from memory
- B. Replace the engine controller as the most common cause of network communication issues
- C. Disconnect the battery for 30 minutes to reset all network communications
- D. Verify CAN bus integrity through voltage measurement and resistance verification

48. A reprogramming session on a heavy-duty gasoline truck PCM is being prepared. The technician should:

- A. Connect a battery maintainer to ensure stable voltage throughout the entire procedure

- B. Disconnect the battery during the reprogramming to prevent voltage spikes
- C. Allow the engine to idle during reprogramming to maintain voltage from charging
- D. Use a 12V test light to verify system voltage during the reprogramming session

49. A J1939 SPN/FMI code shows SPN 105 (Intake Manifold Temperature) with FMI 3 (Voltage Above Normal). The MOST likely cause is:

- A. The intake manifold temperature is above the normal operating range continuously
- B. The IAT sensor has an open circuit or short to power producing high voltage signal
- C. The PCM has failed and is misreading the IAT sensor signal during operation
- D. The IAT sensor has failed in the low-voltage state requiring sensor replacement

50. A scan tool live data display shows MAF reading 4.5 g/sec at idle and MAP reading 28 in. Hg at idle. The MOST likely interpretation is:

- A. Both sensors are functioning correctly within normal operating specifications
- B. The MAF sensor is reading too high for the engine's actual airflow demand at idle
- C. The MAP sensor is reading too low for the engine's actual manifold pressure at idle
- D. The MAP reading is inconsistent with idle vacuum — sensor or hose issue suspected

PRACTICE EXAM 7: ANSWER KEY AND EXPLANATIONS

1. C — Both technicians are correct. Customer interviews capture symptom history, operating conditions, and prior service that DTCs cannot reveal. Reviewing scan tool data before mechanical testing prevents wasted time chasing problems the controller has already identified through its monitoring system.
2. A — A vacuum gauge reading loses approximately 1 in. Hg per 1,000 feet of elevation. At 2,000 feet, the normal 17–22 in. Hg range drops by about 2 in. Hg, making 16 in. Hg consistent with healthy operation at altitude. Always adjust expected vacuum readings for elevation before diagnosing a problem.
3. D — A failed downstream oxygen sensor affects catalyst efficiency monitoring, not cylinder-specific misfires. Misfires on a single cylinder trace to ignition (coil, plug, wire), fuel (injector), or mechanical (compression) issues isolated to that cylinder. The downstream sensor's role is in monitoring the converter, not detecting individual cylinder misfires.
4. B — Technician A is correct; Technician B is wrong. A clogged catalytic converter creates exhaust restriction that prevents rapid vacuum recovery after snap-throttle. The vacuum gauge takes seconds to return to normal because backpressure must dissipate. Healthy exhausts allow immediate recovery.
5. A — Fuel rail pressure dropping from 58 psi to 12 psi just before a hot-only stall indicates a thermally-affected fuel pump. Heat affects pump motor performance, internal seals, and check valves, causing pressure loss only when hot. The temporal correlation between heat and pressure failure is the diagnostic clue.
6. C — A vacuum drop on snap-throttle that immediately recovers — even briefly overshooting normal idle vacuum before settling — is normal engine response. The momentary overshoot reflects the engine's response to closed-throttle deceleration. Healthy exhausts and engines produce this rapid recovery pattern.
7. D — Ticking noise loudest at the rocker arm assembly with stethoscope confirmation is camshaft-speed valve train noise. Worn rocker arms, lifters, or pushrods produce this signature pattern. The location at the rocker assembly directly identifies the failure area.
8. A — Both technicians are correct. Noise frequency relative to crankshaft speed identifies which mechanical component is producing the noise. Noise occurring once per two crankshaft

revolutions is camshaft-speed (since the camshaft rotates at half crankshaft speed), identifying valve train components as the source.

9. B — Replacing the radiator cap without further testing is not a diagnostic step — it is a guess. Proper diagnosis includes pressure-testing, combustion gas leak testing, and inspecting oil for coolant contamination. Component replacement without verification wastes parts and rarely resolves the actual issue.
10. C — Operating-condition specifics (hot, cold, load conditions) are the most diagnostic interview information. Stalls only when coming to a stop suggest specific operating conditions — possibly idle air control, fuel system thermal effects, or transmission torque converter issues. Vague questions about fuel grade, mileage, or parking location rarely contribute.
11. D — Gradual worsening over six months with positive both-bank fuel trim is characteristic of PCV system contamination or developing vacuum leaks. Both conditions produce slow-onset lean trims that worsen over time. Single-failure causes (oxygen sensor, controller, converter) typically don't produce gradual symmetric symptoms.
12. A — GDI engines have no fuel washing the back of the intake valves because fuel is injected directly into the cylinder, bypassing the intake port. Carbon deposits accumulate on the intake valves over time, and this is a documented characteristic GDI service issue requiring periodic cleaning.
13. B — Engine coolant has a sweet smell and is colored (green, orange, yellow, etc.) — never clear with a fuel odor. Clear fluid with strong fuel odor is gasoline. The other listed identifications (red-brown ATF, amber engine oil, colored sweet coolant) are all accurate fluid identifications.
14. C — Both technicians are correct. TSBs document the manufacturer's known failure patterns and corrective procedures for specific symptoms and platforms. Reviewing TSBs early in the diagnostic process identifies known issues and prevents reinventing diagnostic procedures the manufacturer has already published.
15. D — MLS (multi-layer steel) head gaskets on aluminum heads require an extremely smooth surface finish of 30–60 microinches Ra. The smoother surface is required because MLS gaskets seal through metal-to-metal contact rather than gasket material compression. Composite gaskets allow rougher surfaces.
16. A — Both technicians are correct. Induction-hardened seats are part of the cylinder head material itself, surface-hardened by induction heating during manufacture. Insert-style seats are separate hardened rings (typically steel alloy) pressed into precision-machined bores in the head. Both types are common in heavy-duty truck applications.
17. C — A too-hot heat range plug under sustained heavy load does not improve cold-start performance — that is a benefit of hot plugs in light-duty short-trip applications. Under heavy

load, a too-hot plug glows red and pre-ignites the mixture, causing piston damage, valve damage, and burned electrodes.

18. B — A spring measuring exactly at the minimum specification (95 lbs) meets the OEM requirement. There is no service requirement for a spring that meets specification. Replacement, shimming, or retesting are unnecessary actions when the measurement satisfies the minimum requirement.
19. A — Bore 4.005 minus piston 4.001 equals 0.004 inch clearance, which exceeds the 0.0030 inch maximum specification. Excessive clearance produces piston slap, ring sealing problems, and accelerated wear. The cylinder must be bored oversize and a corresponding piston installed.
20. D — Tight clearance below the minimum specification (0.0009 inch vs. 0.0010 inch minimum) requires investigation. The journal and bearing inside diameter must be measured to identify whether the journal is oversize, the bearing is undersize, or wrong components are mismatched. Tight clearance can cause inadequate oil film and bearing failure.
21. C — A failing oxygen sensor affects fuel mixture and emissions, not mechanical bottom-end noise. Bottom-end knocking originates from rotating assembly mechanical issues — rod bearings, main bearings, loose flywheel. The oxygen sensor has no mechanical relationship to bearing-area noise.
22. A — 2.397 minus 2.395 equals 0.002 inch out-of-round, well above the 0.0005 inch maximum specification. The crankshaft must be reground to the next undersize and matched with corresponding undersize bearings, or replaced. Reusing an out-of-round journal causes immediate uneven bearing loading.
23. B — Low oil pressure at hot idle on an engine, with normal pressure not reached at higher RPM, points to worn engine bearings increasing the cumulative clearance volume. The pump cannot fill the increased clearance fast enough at low pump speeds. This is the classic high-mileage wear pattern.
24. D — Mixing IAT (green) and OAT (orange/yellow) coolant chemistries produces a gel-like precipitate that clogs heater cores, radiator tubes, and water jackets. The chemistry incompatibility creates gelatinous deposits regardless of mixture ratio. Always identify and match the OEM-specified coolant before topping off.
25. A — When pressure testing identifies internal coolant loss with no external leak, the combustion gas leak test is the next definitive diagnostic. The chemical indicator changes color in the presence of combustion gases drawn from the radiator, confirming head gasket or cracked head failure before any teardown decisions.
26. C — A 200 V kickback voltage at the moment of field collapse on the primary winding is normal coil operation. The collapsing magnetic field induces this voltage spike on the primary side, which is then stepped up by the turns ratio to produce 5,000–35,000 V on the secondary. The pattern indicates healthy coil operation.

27. A — Both technicians are correct. Cold plugs have a shorter insulator path that transfers heat from electrode to head more quickly, running cooler. Heavy-duty truck applications use mid-to-cold heat range plugs because of the sustained heavy duty cycles that demand faster heat transfer to prevent pre-ignition.
28. D — A failed engine controller does not produce intermittent firing commands; it would produce continuous problems or no operation. Intermittent cold-start misfires that clear when warm trace to bled-down lifters, plug carbon tracking on cold porcelain, or cold injectors with deposit-affected spray patterns. Random PCM failure is not the cause.
29. B — A bridge of conductive material between the center and ground electrodes is typically carbon or oil bridging the gap. The cause is fuel quality or oil consumption — material that builds up in the gap and creates a low-resistance path that prevents proper sparking. The fouling clears when the underlying cause is addressed.
30. A — When CKP signal and coil power are both verified, the missing element in the firing sequence is the PCM grounding the primary circuits. The PCM is the switching device that grounds each coil to fire it. PCM failure (driver fault, software issue, internal damage) prevents this grounding, producing no spark despite all other inputs being present.
31. D — A failed CKP sensor producing no signal during operation prevents the engine from running at all — not just on cold start. The other listed causes (bled-down lifters, fuel injector deposits, plug carbon tracking on cold porcelain) all produce cold-start-only symptoms that clear with warmup. CKP failure produces continuous problems.
32. B — Boost overshoot indicates the wastegate is failing to open at the commanded pressure. The wastegate's job is to prevent boost from exceeding the commanded value. A stuck-closed wastegate (failed actuator, blocked vacuum/pressure line, or failed control solenoid) keeps boost rising beyond specification.
33. A — A vacuum leak at the brake booster line admits unmetered air, producing positive long-term fuel trim. The leak is often audible as a hissing sound, and the noise typically changes when the brakes are applied because brake application changes the booster's vacuum demand. Both the trim change and the audible signature confirm the diagnosis.
34. C — Both technicians are correct. A pump producing correct pressure but inadequate volume points to internal pump wear — the pump can build pressure against a closed system but cannot maintain volume under flow. A pump producing inadequate pressure but correct volume indicates a regulator failure dumping fuel back to the tank.
35. D — A leaking fuel pressure regulator dumps fuel into the manifold, producing a rich condition (negative fuel trim), not a lean one. The other listed causes — vacuum leaks, oxygen sensor reading rich, clogged injectors — all produce or contribute to the lean condition characteristic of a P0171 DTC.

36. B — Constant 5.0 V output regardless of engine condition indicates an open or short-to-power circuit fault in the MAF sensor or its wiring. A healthy MAF produces a voltage that varies with airflow. The constant maximum voltage means no current is flowing through the sensing element, or the signal is being pulled to reference voltage.
37. A — 0.8 psi at idle is well below the 1.5 psi maximum specification, indicating a healthy exhaust system. There is no service requirement for readings within specification. Replacing the converter or muffler as preventive measures based on within-spec readings is unjustified and wasteful.
38. D — A stuck-closed EGR valve does not produce idle issues or fuel mixture problems — it produces NOx emissions failures. Without EGR, peak combustion temperatures rise, increasing NOx. The driver typically notices nothing because EGR doesn't operate at idle or WOT, where driveability is most apparent. Symptoms appear only on emissions testing.
39. C — The first diagnostic step for a P0455 (gross EVAP leak) DTC is inspecting the fuel cap. A loose or damaged fuel cap is the most common cause of gross leaks. Replacing the cap without inspection wastes parts; replacing the canister or purge valve without identifying the actual leak location is even more wasteful.
40. B — A healthy converter has oxygen storage capacity that buffers the downstream signal, keeping it relatively flat near 0.6–0.8 V. The converter "stores" oxygen during lean phases and releases it during rich phases, smoothing the downstream signal. Mirroring of upstream switching indicates loss of storage capacity (failed converter).
41. A — Both technicians are correct. The federal emissions warranty covers the catalytic converter for an extended period beyond the basic vehicle warranty on certified vehicles. Installing a "delete tune" that disables emissions monitors is illegal under the Clean Air Act with civil penalties exceeding \$4,500 per vehicle.
42. C — Sustained misfire sends unburned fuel into the catalytic converter, where it ignites and overheats the substrate. The thermal damage destroys the catalyst's chemical activity and may melt the substrate. The customer's month-long misfire history is the direct cause of converter failure — fixing the converter without addressing the misfire produces immediate re-failure.
43. D — A 250 RPM spread between commanded (700) and actual (950) idle speed indicates the controller cannot bring idle down to its target. A vacuum leak admitting unmetered air overrides the PCM's idle command — the controller closes the throttle as much as possible, but the leaked air keeps idle elevated. This is the classic vacuum-leak idle pattern.
44. B — Battery disconnect resets adaptive values that the controller has learned. Until these are relearned through driving, the engine may run roughly. Improvement over 100 miles of driving confirms the controller is relearning correctly. Continuing normal operation allows the relearn to complete; replacement of components is unnecessary.

45. A — A P0341 DTC indicates the CMP signal is present but inconsistent or out of expected range/performance. The engine starts and runs, indicating the signal is at least partially functional, but the inconsistency causes performance issues. Complete signal loss would set a different DTC (P0340 series) and typically prevent starting.
46. C — A 35% disagreement between commanded position (50%) and feedback (15%) indicates the EGR valve is mechanically stuck and not responding to controller commands. Carbon accumulation, valve binding, or pintle damage prevent the valve from reaching the commanded position despite the PCM sending the correct command.
47. D — Multiple U-codes across many modules typically indicate a network communication issue. Verifying CAN bus integrity (voltage measurement, terminating resistance verification) is the proper first diagnostic step before any module replacement. Replacing modules individually is wasteful and rarely addresses the actual bus-level fault.
48. A — A dedicated battery maintainer ensures stable voltage throughout the entire reprogramming session. Battery disconnect is incorrect (the PCM needs power), running the engine introduces electrical noise, and a 12V test light cannot maintain battery voltage. The maintainer is the standard tool for this critical service.
49. B — SPN 105 identifies intake manifold temperature; FMI 3 identifies "Voltage Above Normal." The combination indicates the IAT sensor circuit is reading high voltage, typically caused by an open circuit in the sensor or wiring, or a short to reference voltage. The high voltage is the signal characteristic, not the actual temperature.
50. D — At idle, MAP should read low (high vacuum, typically 1–3 in. Hg absolute or 18–22 in. Hg vacuum if the gauge is set differently). 28 in. Hg is essentially atmospheric pressure or higher, which is inconsistent with idle vacuum. The MAP sensor or its hose connection requires investigation.