PRACTICE EXAM 9: ASE T1 GASOLINE ENGINES SIMULATION

1. A heavy-duty gasoline truck has an "intermittent stall" complaint that occurs approximately once a week. The technician cannot reproduce the symptom on demand. The MOST appropriate diagnostic approach is to:

A. Capture freeze frame and history DTCs, and use a data logger to record events

B. Replace the fuel pump as the most common cause of intermittent stalling complaints

C. Replace the engine controller since intermittent stalls indicate PCM failure patterns

D. Replace all sensors connected to the engine controller as preventive maintenance

2. A 6.0L Vortec produces a vacuum reading at idle that varies between 18 and 22 in. Hg with a pattern that occurs once every 4 seconds. The variation has no apparent relationship to engine speed. The MOST likely cause is:

A. Normal engine response to AC compressor cycling on and off during idle operation

B. A burned valve on a single cylinder failing to seat properly each combustion cycle

C. A worn camshaft producing irregular valve events during idle conditions

D. A failed fuel pressure regulator producing intermittent pressure changes

3. A heavy-duty gasoline truck arrives with the customer reporting "engine runs fine for 30 minutes, then starts misfiring on multiple cylinders, then runs fine again after sitting overnight." The MOST likely cause to investigate first is:

A. The fuel pump that has failed and requires immediate replacement service

B. A thermally-affected component such as a coil pack, ignition module, or sensor

C. The catalytic converter that has reached the end of its normal service life

D. The engine controller that has failed and is misinterpreting the sensor data

4. A LEAST-likely cause of an intermittent no-start complaint that occurs only after the engine has been shut off and restarted within 5 minutes is:

A. Hot-soak fuel system effects causing vapor lock or pressure issues

B. Thermal expansion affecting electrical connections in the ignition system

C. A failed crankshaft position sensor that fails specifically when warm

D. A clogged catalytic converter creating excessive backpressure under all conditions

5. A scope captures the upstream oxygen sensor signal during a road test. The signal switches normally between 0.2 V and 0.8 V at most engine speeds, but stays stuck at 0.85 V during sustained heavy acceleration. The MOST likely cause is:

A. A real rich condition under heavy load — investigate fuel pressure or injector flow

B. A failing oxygen sensor that switches normally at light load but fails under heavy load

C. A failed downstream oxygen sensor affecting upstream sensor operation patterns

D. A failed engine controller misinterpreting the upstream signal during acceleration

6. A heavy-duty gasoline truck has been brought in with a "knocking noise that occurs only at highway cruise above 60 mph and disappears below that speed." The MOST likely cause is:

A. A worn connecting rod bearing on one specific cylinder of the engine assembly

B. A worn main bearing affecting the entire crankshaft rotation under load conditions

C. A worn exhaust component such as a heat shield or loose mounting at speed

D. A failed catalytic converter with internal substrate damage creating noise

7. A LEAST-likely diagnostic step in evaluating an intermittent misfire complaint is to:

A. Replace the suspect components based on the most common failure patterns first

B. Use a scan tool with data logging to capture freeze frame and live data history

C. Inspect the wiring harness for chafing, corrosion, or rodent damage at connectors

D. Use a scope to capture sensor signals during operation that reproduces the symptom

8. The customer reports that her Class 4 work truck "runs fine until it crosses railroad tracks, then it misfires for a few seconds and recovers." The MOST likely cause is:

A. The fuel pump pickup is being uncovered during the bumps at the railroad crossing

B. The catalytic converter has internal damage that produces noise during impacts

C. The engine controller is sensitive to vibration and resets during the crossing event

D. A loose electrical connection at a sensor or actuator that disconnects momentarily

9. A heavy-duty gasoline truck has a hesitation during acceleration that varies in severity throughout the day. Long-term fuel trim is at +12% during normal operation. Live data captured during the hesitation shows momentary spikes in MAF reading. The MOST likely cause is:

A. A failed engine controller producing random spikes in sensor signal interpretation

B. A loose or damaged MAF sensor wiring or connector causing intermittent signal noise

C. A vacuum leak that varies in size depending on engine temperature throughout day

D. A failed fuel pump producing intermittent pressure drops during acceleration

10. A vacuum gauge connected to a heavy-duty gasoline V8 produces a steady 19 in. Hg reading at idle, but the needle vibrates rapidly with small amplitude movements. The MOST likely cause is:

A. Worn valve guides allowing irregular sealing on multiple cylinders during operation

B. A normal idle pattern requiring no further diagnostic procedures or tests

C. A clogged catalytic converter creating exhaust restriction during operation

D. A failed fuel pump unable to maintain pressure at idle conditions

11. A LEAST-likely cause of a coolant loss complaint with no visible external leak on a high-mileage 7.3L Godzilla is:

A. A head gasket failure allowing coolant into a combustion chamber

B. A cracked cylinder head allowing coolant into the cylinder during operation

C. A failed mass airflow sensor providing incorrect signal data continuously

D. An intake manifold gasket leak where coolant passages cross sealing surfaces

12. A scan tool live data display shows the following at idle on a 6.4L HEMI: ECT 195°F, IAT 80°F, MAP 12 in. Hg, MAF 5.0 g/sec, RPM 720, Bank 1 STFT +2%, Bank 2 STFT +1%, LTFT +5% on both banks. The technician should interpret this as:

A. Normal operation across all parameters with no diagnostic action required

B. A bank 1 fuel issue requiring immediate investigation of bank 1 components

C. A failed engine controller producing incorrect data display during operation

D. A failing MAF sensor producing low readings at idle conditions

13. A heavy-duty gasoline truck has been brought in with multiple complaints: rough idle, hesitation off-idle, occasional stalling. Long-term fuel trim is at +20% on both banks. The MOST likely cause is:

A. A failed engine controller producing random fuel trim values across the system

B. A failed fuel pump producing intermittent pressure drops affecting all conditions

C. A failed catalytic converter creating excessive backpressure during all operating conditions

D. A vacuum leak or PCV system contamination affecting both banks symmetrically

14. The technician determines that a customer's heavy-duty gasoline truck requires a head gasket replacement. The customer asks if the repair "is really necessary." The MOST appropriate response is:

A. Tell the customer the repair is optional and they can decide based on cost considerations

B. Explain the consequences of continued operation with a head gasket failure clearly

C. Refuse to discuss the diagnosis with the customer until they pay for the diagnostic time

D. Tell the customer the repair must be done immediately or the truck will explode

15. A cylinder head warpage measurement shows 0.004 inch in one direction and 0.002 inch in the perpendicular direction. OEM specification limits warpage to 0.003 inch in any direction. The MOST appropriate action is:

A. Send the head out for resurfacing as warpage exceeds spec in one direction

B. Reuse the head since the average warpage is within OEM specification

C. Apply RTV silicone to compensate for the warpage during the reassembly

D. Reuse the head with a thicker head gasket to compensate for the warpage

16. A LEAST-likely consequence of a cracked cylinder head between the valve seats on a heavy-duty gasoline truck is:

A. Compression loss in the affected cylinder during compression testing

B. Misfire DTCs setting on the affected cylinder during normal engine operation

C. Improved fuel economy from the reduced compression requirements at higher RPM

D. Possible coolant intrusion into the combustion chamber depending on crack location

17. Technician A says hydraulic lifters require zero clearance during installation. Technician B says hydraulic lifters require a specific preload setting beyond zero clearance. Who is correct?

A. Both Technician A and Technician B

B. Technician A only

C. Neither Technician A nor Technician B

D. Technician B only

18. A timing chain with broken plastic guide pieces has been removed from a heavy-duty gasoline truck. The MOST appropriate next service step is to:

A. Inspect the oil pan and pickup screen for fragments before completing the rebuild

B. Replace only the broken guide and reuse the existing chain to save cost on the repair

C. Replace the timing chain only since the guides typically can be repaired with adhesive

D. Reassemble the engine without further inspection since the broken pieces are gone

19. A piston ring end gap measurement shows 0.030 inch on a top compression ring. OEM specification is 0.012 to 0.025 inch. Installing this ring as-is would result in:

A. The ring fitting tightly in the bore and providing improved sealing under load

B. Excessive blow-by past the ring causing reduced power and oil consumption

C. The ring binding in the bore at operating temperature causing engine damage

D. No measurable change in operation as ring end gap is not critical to performance

20. Plastigage on a connecting rod bearing produces a width corresponding to 0.0023 inch. OEM specification is 0.0010 to 0.0026 inch. The MOST appropriate action is:

A. Accept the in-spec reading and continue with normal assembly procedure

B. Replace the bearing because the value is too close to the maximum specification

C. Tighten the cap beyond specification to compress the clearance further

D. Apply additional assembly lubricant during installation to compensate fully

21. A LEAST-likely cause of cylinder block deck warpage is:

A. Sustained operation with a failed head gasket allowing combustion gases to attack the deck

B. A failed mass airflow sensor providing incorrect signal data continuously

C. Severe overheating that distorts the block during cooling after thermal stress

D. Improper cylinder head installation with inadequate or improper torque sequence

22. A crankshaft runout measurement at the center main journal shows 0.001 inch with the crankshaft supported in V-blocks at the front and rear journals. OEM specification limits runout to 0.002 inch. The crankshaft:

A. Has 0.001 inch of runout exceeding the maximum specification limit and must be replaced

B. Cannot be reused because runout indicates damage during disassembly procedures

C. Requires regrinding to the next undersize specification before reuse during reassembly

D. Is within OEM specification and can be reused with new bearings during reassembly

23. Oil pressure on a 6.0L Vortec measures 18 psi at hot idle and 45 psi at 2,000 RPM. OEM specification is 15–30 psi at idle and 40–60 psi at 2,000 RPM. The reading indicates:

A. Worn engine bearings increasing the cumulative clearance volume the pump must fill

B. A pressure relief valve sticking closed at the maximum pressure setting condition

C. The engine is operating within OEM specifications at both operating conditions

D. A failed oil pump producing inadequate pressure under operating temperature

24. A heavy-duty gasoline truck has been topped off with the wrong coolant chemistry — IAT (green) added to a system originally filled with OAT (orange). The MOST likely consequence is:

A. A gel-like precipitate may form, clogging heater cores, radiator tubes, and water jackets

B. The cooling system will operate normally with no measurable consequences

C. The cooling system will produce improved heat transfer due to chemistry blend

D. The coolant will provide enhanced corrosion protection due to combined inhibitors

25. The customer reports a Class 5 truck "overheats only when stopped at a long traffic light" but cooling is normal during driving. The cooling fan does not appear to engage during idle. The MOST likely cause is:

A. A water pump impeller that has eroded and cannot maintain flow at idle

B. The thermostat has stuck open preventing engine warmup at all conditions

C. A clogged radiator preventing proper coolant flow during all conditions

D. A failed cooling fan or fan control circuit not engaging at idle conditions

26. A coil-on-plug system has misfires on cylinders 1, 4, 6, and 7 — all on bank 1 of a Ford 7.3L Godzilla. The MOST likely cause is:

A. A bank-specific issue such as wiring, ground, or fuel rail problem affecting bank 1

B. Each affected cylinder requires individual coil replacement immediately as a set

C. The PCM has failed and is not providing firing signals to bank 1 cylinders

D. All four spark plugs have failed simultaneously from age and require replacement

27. A spark plug shows light tan deposits with a small black ring near the threads at the base of the porcelain. The customer reports normal driving habits and good fuel economy. The MOST appropriate interpretation is:

A. Severe pre-ignition damage requiring engine teardown for inspection of internals

B. Normal combustion conditions with no service required at this time

C. A rich fuel mixture caused by a sticking fuel injector on that cylinder location

D. Oil entering the combustion chamber through worn rings or valve seals

28. A LEAST-likely cause of a no-spark condition on a coil-on-plug equipped V8 is:

A. A failed crankshaft position sensor producing no signal during cranking attempts

B. A failed PCM unable to send firing signals to any of the eight ignition coils

C. A failed mass airflow sensor providing incorrect airflow data to the controller

D. A failed ignition switch preventing power supply to the entire ignition system

29. A heavy-duty gasoline truck has set DTC P0301 (Cylinder 1 Misfire). The technician swaps the cylinder 1 coil with cylinder 8. After clearing codes and driving, the new misfire code is P0308 (Cylinder 8 Misfire). The MOST likely conclusion is:

A. The original cylinder 1 ignition coil is defective and produces the misfire when relocated

B. Both cylinders had failing coils that produced the misfire at different operating conditions

C. The PCM has failed and is misreporting cylinder location randomly across the engine

D. The original cylinder 1 coil is defective and must be replaced based on the swap test

30. Two technicians discuss spark plug heat range. Technician A says hot plugs run at higher tip temperatures than cold plugs. Technician B says cold plugs are recommended for engines that operate under sustained heavy load. Who is correct?

A. Technician A only

B. Both Technician A and Technician B

C. Technician B only

D. Neither Technician A nor Technician B

31. A LEAST-likely cause of a misfire that occurs only at idle and disappears at higher engine speeds is:

A. A spark plug with carbon tracking on the cool porcelain surface at idle conditions

B. A vacuum leak that has greatest effect at idle when total airflow is low

C. A failing ignition coil that produces weaker spark only during low-cylinder-pressure idle

D. A clogged fuel injector that produces inadequate spray pattern during low fuel demand

32. A heavy-duty gasoline truck has fuel pressure of 28 psi at idle. OEM specification is 55 psi at idle on this returnless system. Volume delivery test shows 1/3 quart in 30 seconds when 1/2 quart is specified. The MOST likely cause is:

A. The fuel pressure regulator has failed at maximum pressure setting condition

B. The fuel filter has become clogged and is restricting flow to the entire system

C. The fuel pump has worn and lost both pressure and volume capacity over time

D. A leaking injector is dumping fuel into the combustion chamber at idle conditions

33. A LEAST-likely symptom of a vacuum leak at the intake manifold gasket is:

A. Positive long-term fuel trim values that are most pronounced at idle conditions

B. Improved engine performance under heavy load conditions due to better airflow

C. A hissing sound near the intake manifold that varies with engine speed during operation

D. Rough idle that smooths out at higher engine speeds with the vacuum leak present

34. A turbocharged Class 5 work truck has set DTC P0234 (Turbocharger Overboost Condition). Boost pressure tests at 18 psi when OEM specification is 12 psi maximum. The MOST likely cause is:

A. A clogged intercooler restricting flow to the engine throughout operation

B. A worn turbocharger compressor wheel reducing efficiency at high boost levels

C. A clogged air filter restricting flow to the compressor inlet throughout operation

D. A wastegate that is stuck closed and not opening at the commanded pressure

35. The MOST diagnostic single test for confirming a plugged catalytic converter is to:

A. Measure exhaust backpressure at the upstream oxygen sensor port location

B. Visually inspect the converter substrate through the rear of the unit

C. Tap the converter with a rubber mallet to listen for internal rattle in the unit

D. Replace the converter as a preventive measure based on age and mileage of vehicle

36. A scan tool live data display shows the MAF sensor reading 2.5 g/sec at idle (specification 4.0–6.0 g/sec) and 65 g/sec at WOT (specification 95–115 g/sec). The customer complains of poor performance. The MOST likely cause is:

A. The MAF sensor is reading correctly with low airflow at all operating conditions

B. The intake air filter is producing recognized airflow restriction continuously

C. The PCM has failed and is misreading the MAF sensor signal at all engine speeds

D. The MAF sensor is contaminated, aged, or has a signal issue producing low readings

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

A. A leaking fuel pressure regulator dumping fuel into the manifold causing rich mixture

B. A clogged fuel injector on bank 1 reducing fuel delivery to that bank only

C. A vacuum leak at the bank 1 intake manifold gasket sealing surface area

D. An exhaust leak ahead of the bank 1 upstream oxygen sensor location

38. A heavy-duty gasoline truck has set DTC P0442 (Small EVAP Leak Detected). A smoke test produces smoke escaping around the gas cap area. The MOST appropriate next step is to:

A. Replace the EVAP canister as the most common cause of small EVAP leaks in trucks

B. Replace the purge valve solenoid as the most common cause of small leaks

C. Inspect and replace the fuel cap or its O-ring seal as the identified leak source

D. Replace the entire fuel tank since smoke around the cap indicates tank failure

39. An EGR valve commanded 50% open by the scan tool produces a 75 RPM idle drop. The MOST likely interpretation is:

A. The EGR valve is mechanically stuck and not responding to controller commands

B. The EGR valve is functioning correctly with proper exhaust gas flow occurring

C. The EGR passages are blocked with carbon preventing actual exhaust gas flow

D. The PCM is failing to send the bidirectional command signal correctly to the valve

40. A wide-range air-fuel ratio sensor produces a current signal corresponding to lambda 1.0 during steady-state cruise. Long-term fuel trim is at +1%. The MOST appropriate interpretation is:

A. Normal closed-loop operation with the controller maintaining stoichiometric mixture

B. The AFR sensor has failed and is producing incorrect lambda readings to the controller

C. The fuel injectors are stuck partially open allowing excessive fuel delivery during cruise

D. The catalytic converter has failed and is affecting upstream sensor readings continuously

41. The federal Clean Air Act prohibits a technician from performing which of the following?

A. Installing an OEM-equivalent catalytic converter on a vehicle requiring a converter

B. Installing an OEM-equivalent oxygen sensor on a vehicle requiring a sensor replacement

C. Installing an aftermarket air filter that meets OEM filtration standards on a vehicle

D. Installing a "delete tune" that disables the EGR system or catalyst monitoring

42. A heavy-duty gasoline truck has set DTC P0420 (Catalyst Efficiency Below Threshold). The downstream oxygen sensor signal mirrors the upstream sensor switching almost identically during steady cruise. This pattern indicates:

A. The catalytic converter has lost its oxygen storage capacity and requires replacement

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

C. The upstream sensor is reading rich and the downstream sensor is reading correctly

D. Normal converter operation with proper oxygen storage capacity intact during cruise

43. A scan tool reads "PCM communication lost" intermittently during operation. The MOST likely cause is:

A. The PCM has failed and requires immediate replacement service before further driving

B. The scan tool battery is low and needs to be replaced before continuing diagnosis

C. Network communication issue — investigate CAN bus voltage, terminating resistance

D. The fuel pump has failed and is causing power supply issues to the PCM during operation

44. A bidirectional command from the scan tool causes the EGR valve to cycle audibly. Exhaust gas analysis shows no change in NOx levels. The MOST likely cause is:

A. The EGR valve is functioning correctly with proper exhaust gas flow during cycling

B. The EGR valve is opening but the EGR passages are blocked with carbon deposits

C. The scan tool is producing false bidirectional command signals to the EGR valve

D. The EGR valve position sensor has failed and is providing incorrect feedback signal

45. A reprogramming session on a heavy-duty gasoline truck PCM shows "Battery Voltage Low" message before installation. The MOST likely cause is:

A. The PCM has failed before the reprogramming session could begin properly working

B. The scan tool is incompatible with this generation of vehicle architecture used

C. The selected calibration file does not match the vehicle's VIN-specific configuration

D. The vehicle battery voltage is below the minimum required for safe reprogramming

46. A J1939 SPN/FMI code shows SPN 91 (Accelerator Pedal Position 1) with FMI 4 (Voltage Below Normal). The MOST likely cause is:

A. The accelerator pedal sensor 1 is producing low voltage from a short to ground or sensor failure

B. The accelerator pedal is being depressed beyond the normal operating range continuously

C. The PCM has failed and is misreading the accelerator pedal sensor signal during operation

D. The accelerator pedal sensor 2 has failed in the high voltage state requiring replacement

47. A LEAST-likely cause of multiple unrelated DTCs across many control modules is:

A. A network communication issue affecting bus traffic between modules at all times

B. A PCM power supply problem causing intermittent module operation across systems

C. A single failed engine coolant temperature sensor on the engine control module only

D. A faulty PCM ground connection producing erratic module behavior across systems

48. A scan tool live data display shows commanded throttle position at 25% and actual TPS feedback at 26%. Engine RPM responds correctly to the throttle command. The MOST likely interpretation is:

A. The throttle motor has failed and cannot move the plate to the commanded position

B. The TPS sensors have failed and are not reading the throttle plate position correctly

C. The PCM has failed and is sending incorrect commands to the throttle motor system

D. The throttle is responding correctly within typical bidirectional control tolerance

49. After replacing a transmission on a heavy-duty gasoline truck, the customer returns with harsh shifts. The MOST likely cause is:

A. The transmission adapt reset procedure was not performed after the replacement

B. The new transmission has a defect and requires immediate warranty replacement

C. The PCM has failed during the transmission replacement procedure performed

D. The wrong transmission fluid was installed during the transmission replacement service

50. CAN High measures 0 V and CAN Low measures 0 V with the engine running. The vehicle has multiple U-codes and complete network communication failure. The MOST likely cause is:

A. The bus is in the recessive idle state with normal voltage levels at rest

B. Normal CAN bus operation during heavy message traffic across the network

C. Both CAN High and CAN Low are shorted to ground or power is missing entirely

D. The bus is operating correctly and the U-codes are spurious from scan tool error

PRACTICE EXAM 9: ANSWER KEY AND EXPLANATIONS

1. A — Intermittent symptoms that cannot be reproduced on demand require captured evidence — freeze frame, history DTCs, and continuous data logging during normal operation. The data logger captures the moment the symptom occurs even when the technician isn't present. Component replacement without verification of the actual cause wastes parts and rarely fixes intermittent issues.

2. C — A regular vacuum variation occurring once every 4 seconds with no relationship to engine speed is the signature pattern of AC compressor cycling. The compressor engages and disengages on a thermostatic cycle, momentarily loading the engine each time. This is normal operation and not a fault to diagnose.

3. B — A symptom that appears after extended operation but resolves overnight is the classic signature of thermally-affected components. Coil packs, ignition modules, sensors, and connectors may function when cool but fail at operating temperature. The thermal cycling and resolution pattern points specifically to heat-related component failures.

4. D — A clogged catalytic converter creates continuous backpressure that affects all operating conditions, not just hot-restart no-start scenarios. The other listed causes — vapor lock, thermal connection effects, hot-failing CKP sensor — all produce symptoms specifically related to hot-restart conditions. Converter restriction would produce symptoms whenever the engine is running.

5. A — A real rich condition under heavy load is indicated when the upstream sensor stuck high under acceleration. The sensor is reporting accurately what it sees in the exhaust. Investigating fuel pressure, leaking injectors, or fuel system contamination is the appropriate response. Trust the sensor when its reading correlates with the operating condition.

6. C — Speed-dependent knocking that disappears below highway cruise speeds points to airflow or vibration-related sources. Worn exhaust components, loose heat shields, or mounting issues at speed are typical causes. Bearing-related knocking would persist at all engine loads, not be speed-specific.

7. A — Replacing components based on common failure patterns without verification is not a diagnostic step — it is a guess. Proper intermittent misfire diagnosis requires data logging, scope captures, and physical inspection. Component replacement without verification wastes parts and rarely fixes intermittent issues.

8. D — Misfires correlated with railroad track crossings indicate vibration-sensitive electrical connections. A loose connector at a sensor, coil, or actuator disconnects momentarily during the impact, producing the misfire. Reproducing the symptom by tapping or wiggling connectors is the standard diagnostic technique for this pattern.

9. B — MAF reading spikes during hesitation indicate intermittent signal noise on the MAF circuit. Loose connectors, damaged wiring, or harness chafing produce these signal spikes. The temporal correlation between the spikes and the hesitation symptom is the diagnostic signature.

10. A — Rapid small-amplitude needle vibration at idle is the signature of worn valve guides or weak valve springs producing irregular sealing on multiple cylinders. The high-frequency fluctuation differs from the regular sharp drops of a single burned valve. The pattern is distinctive and well-documented.

11. C — A failed MAF sensor affects fuel mixture and engine performance, not coolant integrity. Internal coolant losses trace to head gaskets, cracked heads, intake manifold gaskets, or other internal pathways. The MAF sensor has no mechanical relationship to coolant containment.

12. A — All readings are within normal operating parameters: ECT at operating temperature, IAT at typical underhood temperature, MAP at normal idle vacuum, MAF at normal idle airflow, RPM at typical idle speed, and fuel trim values within the ±5% normal range. There is no fault to diagnose — the engine is operating correctly.

13. D — Multiple driveability complaints with both-bank +20% LTFT indicates a common-cause issue affecting fuel mixture across the entire engine. Vacuum leaks or PCV system contamination produce this symptom pattern. Bank-specific causes would produce bank-specific imbalance; controller failures don't typically produce systematic positive trim values.

14. B — Customers deserve clear explanation of what their truck needs and why. Explaining the consequences of continued operation with a head gasket failure (further damage, complete engine failure) helps the customer make an informed decision. Refusing to discuss, treating the repair as optional, or using fear tactics ("explode") are all unprofessional responses.

15. A — Warpage of 0.004 inch in any direction exceeds the 0.003 inch OEM specification. The head must be resurfaced. Averaging measurements is not how warpage is evaluated — exceeding spec in any direction requires correction. RTV silicone or thicker gaskets are not acceptable solutions for out-of-spec warpage.

16. C — A cracked cylinder head does not improve fuel economy. Cracks reduce compression, allow combustion gases to escape, and cause performance degradation. The other listed consequences (compression loss, misfire DTCs, possible coolant intrusion) are all real consequences of cracked head damage.

17. D — Technician B is correct; Technician A is wrong. Hydraulic lifters require a specific preload (compression of the lifter plunger beyond zero clearance) to function across temperature and wear

ranges. Zero clearance alone leaves the lifter on the verge of bleed-down or floating, both of which produce noise and poor valve operation.

18. A — Broken plastic guide pieces from a timing chain assembly can lodge in the oil pan and pickup screen, causing oil starvation during operation. Inspecting the oil pan and pickup screen for fragments is essential before completing the rebuild. Reusing the chain or skipping inspection produces immediate post-repair failures.

19. B — Excessive ring end gap (0.030 inch vs. 0.025 inch maximum) allows blow-by past the ring, reducing power and producing oil consumption issues. The ring cannot seal properly because the gap is too large. Tighter gaps are dangerous (binding); excessive gaps simply fail to seal effectively.

20. A — 0.0023 inch falls within the 0.0010 to 0.0026 inch specification range. There is no service requirement for clearance values within specification. Replacement, over-torquing, or excess lubricant are all incorrect responses to in-spec readings — accept the measurement and continue assembly.

21. B — A failed MAF sensor affects fuel mixture and engine performance, not block deck warpage. Block deck warpage develops from severe overheating, sustained head gasket failure attacking the deck, or improper head installation. The MAF is not mechanically connected to deck integrity.

22. D — 0.001 inch is below the 0.002 inch OEM specification, indicating the crankshaft is within service tolerance. There is no service requirement for measurements within specification. Replacement, regrinding, or claiming the runout exceeds spec are all incorrect responses to an in-spec measurement.

23. C — Both readings (18 psi at hot idle, 45 psi at 2,000 RPM) fall within their respective OEM specifications. There is no service requirement for readings within specification. The engine is operating correctly across the measured range.

24. A — 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. D — Idle-only overheating with normal cooling during driving and a fan that doesn't engage points directly to the cooling fan or its control circuit. The system can move heat at speed (driven airflow) but not at idle when the fan must do the work. Fan failure or control circuit issues are the typical causes.

26. A — All four cylinders on one bank misfiring but not the other bank indicates a bank-specific cause — not random independent failures. Bank-specific wiring, ground straps, fuel rail issues, or sensors are typical causes. Bank-pattern recognition is essential for efficient diagnosis.

27. B — Light tan deposits with a small black ring near the threads at the porcelain base represents typical normal combustion conditions. The black ring is carbon accumulation in the cooler region near the threads, which is normal during extended service. The plug appearance does not indicate any specific abnormality requiring service.

28. C — A failed MAF sensor affects fuel mixture, not ignition spark generation. No-spark conditions trace to CKP signal loss, ignition switch failures, PCM failures affecting coil output drivers, or coil power supply issues. The MAF sensor's role is in fuel calculation, not spark delivery.

29. D — When the misfire follows the swapped coil to its new location, the coil is the defective component. The original cylinder 1 coil now in the cylinder 8 position is causing the cylinder 8 misfire. The swap-and-watch technique definitively confirms the coil as the cause, justifying its replacement.

30. B — Both technicians are correct. Hot plugs run at higher tip temperatures than cold plugs because their longer insulator path slows heat transfer to the head. Cold plugs are recommended for sustained heavy-duty operation because their faster heat transfer prevents pre-ignition. Both statements are factually correct.

31. A — A spark plug with carbon tracking on the porcelain typically conducts MORE readily when warm (not at idle when porcelain is cool). The other listed causes — vacuum leaks (greatest at idle), failing coils under low cylinder pressure, clogged injectors with low fuel demand — all produce idle-pronounced misfires. Carbon tracking conducts at all speeds.

32. C — Both pressure (28 psi) and volume (1/3 quart vs. 1/2 quart spec) below specification indicates pump wear has affected both metrics. A pump that produces correct pressure but inadequate volume points to wear. A pump that produces inadequate pressure and volume together indicates broader pump degradation.

33. B — A vacuum leak does not improve performance under heavy load. The leak admits unmetered air that the controller compensates for with positive fuel trim, which can degrade performance. The other listed symptoms (positive fuel trim at idle, hissing sounds, rough idle smoothing at higher RPM) are all classic vacuum leak indicators.

34. D — Boost pressure that overshoots specification 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 control line, or failed control solenoid) keeps boost rising beyond specification.

35. A — Backpressure measurement at the upstream oxygen sensor port is the most diagnostic single test for converter restriction. Healthy backpressure stays low at idle and 2,500 RPM; restriction produces elevated readings that hold rather than dropping. Visual and rattle tests identify only certain failure modes.

36. D — A MAF sensor reading low at both idle and WOT indicates the sensor is contaminated, aged, or has a signal issue. The under-reading at all conditions is the diagnostic signature of a degraded sensing element. Other listed causes (correct readings, filter restriction, PCM failure) don't match the symmetric low readings.

37. A — 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 — clogged injectors, vacuum leaks, exhaust leaks ahead of the upstream sensor — all produce the lean condition characteristic of a P0171 DTC.

38. C — Smoke escaping around the gas cap area during EVAP smoke testing identifies the fuel cap or its O-ring as the leak source. Replacing the cap or its sealing component is the appropriate repair. Replacing the canister, purge valve, or fuel tank without verification is wasteful and addresses the wrong components.

39. B — A 75 RPM idle drop in response to commanded EGR opening indicates the valve is opening AND exhaust gas is actually flowing into the intake manifold. The idle is destabilized by the exhaust dilution, which is the expected response. The system is functioning correctly.

40. A — An AFR sensor showing lambda 1.0 with LTFT at +1% indicates the controller has achieved stoichiometric mixture with minimal trim correction needed. This is textbook closed-loop operation. AFR sensors continuously measure actual air-fuel ratio, and lambda 1.0 with negligible trim is the ideal target.

41. D — The Clean Air Act prohibits installing "delete tunes" that disable emissions controls or monitors. Installing OEM-equivalent catalytic converters and oxygen sensors are legal service operations. Aftermarket air filters that meet OEM filtration standards are not regulated emissions modifications. The delete tune is the regulated tampering activity.

42. A — A downstream sensor mirroring the upstream sensor's switching pattern indicates the converter has lost its oxygen storage capacity. A healthy converter buffers exhaust composition variations, producing a flat downstream signal. Loss of buffering capacity confirms catalytic converter failure.

43. C — Intermittent "PCM communication lost" messages typically trace to network communication issues — CAN bus voltage problems, terminating resistance issues, or wiring damage. Verifying CAN bus integrity through voltage measurement and resistance testing is the appropriate diagnostic step. PCM replacement or fuel pump issues are not the typical cause.

44. B — A cycling EGR valve with no NOx change indicates the valve is mechanically opening but the EGR passages are blocked. Carbon accumulation in the EGR ports prevents exhaust gas from actually reaching the intake manifold even when the valve is fully open. This is one of the most common high-mileage EGR-related issues.

45. D — A "Battery Voltage Low" message before reprogramming indicates the vehicle battery voltage is below the minimum required for safe reprogramming. The technician must connect a battery maintainer or charge the battery before proceeding. PCM failure, scan tool incompatibility, and calibration mismatch produce different error messages.

46. A — SPN 91 identifies accelerator pedal position 1; FMI 4 identifies "Voltage Below Normal." The combination indicates the APP1 sensor circuit is reading low voltage, typically caused by a short to ground in the wiring or a sensor failure. The signal characteristic is the diagnostic information, not actual pedal position.

47. C — A single failed sensor produces one DTC related to that sensor's circuit, not multiple unrelated codes across many modules. Multiple-module DTC patterns point to network or PCM ground/power issues that affect communication or operation across the entire vehicle system.

48. D — A 1° difference between commanded (25%) and actual (26%) throttle position is within typical bidirectional control tolerance. Modern ETC systems do not require perfect agreement — small variations are expected and accepted. RPM responding correctly to the throttle command confirms the system is functional.

49. A — Modern PCM-controlled transmissions require an adapt reset after replacement to allow the controller to learn the new transmission's shift characteristics. Without the reset, the controller continues commanding shifts based on the previous transmission's learned values, producing harsh or improperly-timed shifts.

50. C — Both CAN High and CAN Low at 0 V with complete network failure indicates both wires are shorted to ground or the power supply to the bus is missing entirely. Healthy CAN buses sit at approximately 2.5 V on both wires when idle. Zero voltage on both wires is the textbook signature of a powered-down or grounded bus.