PRACTICE EXAM 16: ASE T1 GASOLINE ENGINES SIMULATION

1. A scope captures the upstream oxygen sensor signal at 2,500 RPM steady state. The signal switches between 0.2 V and 0.8 V at a rate of 12 switches in 10 seconds. The technician should:

A. Replace the sensor since the switching rate indicates sensor degradation requiring service

B. Accept the reading as confirming healthy sensor switching behavior at cruise

C. Replace the downstream sensor since it affects upstream operation patterns

D. Replace the engine controller since switching frequency is excessive for normal operation

2. A heavy-duty gasoline truck has a complaint of "rough idle that started after a recent fuel fill-up at an unfamiliar station." Long-term fuel trim shows +18% on both banks. The MOST likely cause is:

A. The fuel pump has failed coincidentally with the recent fuel purchase event

B. A failed engine controller producing incorrect fuel trim values across both banks

C. All eight fuel injectors have failed simultaneously after the fill-up service

D. Contaminated or out-of-specification fuel from the unfamiliar fuel station

3. A vacuum gauge at idle reads 19 in. Hg with a steady needle. The technician opens the throttle to 2,500 RPM and the gauge drops to 6 in. Hg. The needle then takes 8 seconds to recover to 19 in. Hg after the throttle is released. The MOST likely cause is:

A. A plugged catalytic converter creating excessive backpressure under load conditions

B. Worn valve guides producing irregular sealing throughout the operating range

C. Normal engine response to throttle changes with healthy vacuum recovery

D. A worn camshaft causing valve timing variation under different load conditions

4. The customer reports a Class 4 truck "stalls at every traffic light when the engine is hot." The engine restarts immediately after stalling. The MOST diagnostic interview question is:

A. Where is the truck typically parked when not in active service operation today?

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

C. How long has the symptom been occurring and is it getting worse over time?

D. How many miles does the truck currently have on the odometer at this time?

5. A LEAST-likely cause of an oil leak appearing at the bell housing on a 7.3L Godzilla is:

A. A failed catalytic converter creating exhaust gas leakage at the joint area

B. Valve cover gasket leak migrating down the rear of the engine assembly

C. Intake manifold gasket leak migrating to the rear of the engine assembly

D. Oil pan rear gasket leak migrating to the bell housing area during operation

6. A heavy-duty gasoline truck has been brought in for "loss of power on grades when hot." Live data captured during a road test that reproduces the symptom shows commanded ignition advance at 22° at the moment of complaint. Knock retard shows 10°. The MOST likely cause is:

A. A failed knock sensor causing the controller to default to retarded timing

B. The PCM is operating correctly with normal ignition timing for the conditions

C. The customer's complaint is unrelated to engine management operation

D. Sustained detonation requiring investigation of fuel quality, carbon, or cooling

7. 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 the combustion chamber during operation

B. A loose accessory drive belt slipping during operation causing coolant boil-over

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

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

8. A vacuum gauge connected to a manifold vacuum source produces these readings: 19 in. Hg at idle, 5 in. Hg during snap-throttle, 19 in. Hg returning to idle. The pattern indicates:

A. Normal engine response to throttle changes with healthy vacuum recovery

B. An exhaust restriction creating excessive backpressure under all load conditions

C. Worn valve guides producing irregular sealing throughout the operating range

D. A burned valve on one cylinder failing to seat properly each cycle

9. A heavy-duty gasoline truck has set DTC P0171 (System Too Lean, Bank 1) and P0174 (System Too Lean, Bank 2). Long-term fuel trim is at +25% on both banks. The MOST likely cause is:

A. Normal operation that requires no further diagnostic procedures or tests

B. A vacuum leak at one bank's intake manifold gasket sealing surface area

C. A common fuel system or air metering issue affecting both banks equally

D. A failed downstream oxygen sensor providing incorrect feedback to the controller

10. A persistent oil consumption complaint on a 6.4L HEMI shows oil loss of 1 quart per 600 miles with no external leak. Blue smoke appears only during cold start, clearing within 30 seconds. The MOST likely cause is:

A. Worn valve seals allowing oil seepage into combustion overnight during shutdown

B. A failed PCV valve drawing excess oil mist into the intake tract during operation

C. Severe head gasket failure with combustion chamber coolant intrusion during operation

D. Worn piston rings allowing oil past during cylinder pressurization events

11. The MOST appropriate response when a customer reports a no-start condition with no warning before the failure is to:

A. Immediately begin replacing components based on most common failure patterns

B. Quote the customer for a complete engine replacement before any diagnosis

C. Replace the engine controller as the most common no-start cause on this platform

D. Verify the no-start condition exists and document any symptoms during cranking

12. A heavy-duty gasoline truck has been brought in with a "ticking noise that started after a recent oil change." The customer reports the prior oil change was performed at a quick-lube shop. The MOST likely cause is:

A. The wrong oil viscosity was used and is producing inadequate lubrication

B. The oil filter was over-tightened during the recent service procedure performed

C. The drain plug was not properly torqued during the oil change service procedure

D. The oil pump has failed coincidentally with the recent oil change service

13. A LEAST-likely diagnostic step in evaluating a "stalls when warm" complaint is:

A. Verifying the symptom by allowing the engine to reach the conditions where stalling occurs

B. Capturing live data with a scan tool during operation under conditions where stalling occurs

C. Replacing the fuel pump as the most common cause of warm-stall complaints in trucks

D. Reviewing service history for recent repairs or related work that may indicate the cause

14. A heavy-duty gasoline truck has a no-start with cranking present, fuel pressure verified, and spark confirmed at all cylinders. The technician notes the engine has thrown a P0335 (Crankshaft Position Sensor Circuit) DTC. The MOST appropriate next step is to:

A. Replace the engine controller to address the no-start symptom directly during diagnosis

B. Verify the CKP sensor signal and circuit before any component replacement

C. Replace all eight ignition coils as a preventive measure during diagnosis

D. Replace the fuel pump to ensure adequate volume during cranking attempts

15. A cylinder head valve guide insert can be replaced when:

A. The original guide bore in the head has been bored oversize beyond service limits

B. The cylinder head material is too soft to support a press-fit insert installation

C. The valve seat has dropped from its bore in the head requiring replacement

D. The guide is removed by pressing or driving and a replacement insert is installed

16. Technician A says valve seat width is measured visually using bluing compound on the valve face. Technician B says valve seat width is measured with a feeler gauge between the valve face and the seat surface. 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

17. A LEAST-likely consequence of operating a heavy-duty gasoline engine with a worn camshaft lobe is:

A. Reduced lift on the affected valve causing decreased airflow to that cylinder

B. Weak cylinder contribution detected during a power balance test procedure

C. Lower compression on the affected cylinder during compression testing

D. Misfire DTCs that may set if the lift reduction is severe enough during operation

18. A timing belt replacement on a Class 4 truck with an OHC gasoline engine has just been completed. After installation, the engine cranks but will not start. Compression test results show all cylinders at 30 psi. The MOST likely cause is:

A. The timing belt is installed off by multiple teeth, causing valve-to-piston damage

B. The fuel pump has failed during the timing belt replacement procedure performed

C. The ignition system has been damaged during the timing belt replacement service

D. The cylinder head warpage has occurred from the timing belt replacement work

19. A connecting rod big end bore measures 2.250 inch in one direction and 2.252 inch perpendicular to that. OEM specification limits big end bore out-of-round to 0.0005 inch. The rod:

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

B. Has been improperly machined and requires immediate replacement service

C. Has been overheated during operation and cannot be reused under any circumstances

D. Has 0.002 inch of out-of-round and must be reconditioned or replaced

20. Plastigage on a connecting rod bearing produces a width corresponding to 0.0020 inch. OEM specification is 0.0010 to 0.0026 inch. The technician should:

A. Apply additional assembly lubricant during installation to compensate for clearance

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

C. Replace the bearing since the value is approaching the maximum specification limit

D. Tighten the rod cap beyond specification to reduce the clearance further

21. A LEAST-likely cause of excessive piston-to-cylinder wall clearance on a high-mileage gasoline engine is:

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

B. Normal long-term wear from ring travel against the cylinder wall over miles

C. Operation with insufficient oil viscosity allowing accelerated wear conditions

D. Detonation damage causing accelerated wear of the piston skirt area over time

22. A balance shaft installed out of phase relative to the crankshaft will produce:

A. Improved fuel economy due to reduced internal engine friction during operation

B. Severe engine vibration that no other component can mask or compensate for

C. Reduced exhaust emissions due to better combustion characteristics achieved

D. No noticeable change in operation since balance shafts are not critical components

23. Oil pressure on a 6.4L HEMI measures 12 psi at hot idle and 35 psi at 2,000 RPM. OEM specification is 25–40 psi at idle and 50–65 psi at 2,000 RPM. The MOST likely cause is:

A. A pressure relief valve sticking closed at the maximum pressure setting continuously

B. A failed oil pump producing inadequate pressure under all operating conditions

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

D. A clogged oil filter forcing oil through the bypass valve continuously during operation

24. A heavy-duty gasoline truck overheats only after extended idling in hot weather. Highway operation produces normal temperatures. Cooling fan, water pump, and thermostat all test within specification. The MOST likely cause is:

A. Normal operating limits being exceeded due to the demanding hot-idle duty cycle

B. Air pockets in the cooling system from a recent service procedure performed

C. A clogged radiator that requires immediate replacement before further operation

D. A failed cooling fan clutch that does not engage during idle conditions specifically

25. The MOST appropriate response when a customer requests "any oil" be used in their heavy-duty gasoline truck to save money is to:

A. Use the cheapest available oil since all oils provide similar protection regardless

B. Mix half OEM-specified oil with half generic oil to achieve a cost compromise

C. Use the OEM-specified oil regardless of customer cost concerns and explain why

D. Use the OEM-specified oil and explain the cost of damage from incorrect oil

26. A coil-on-plug system is being diagnosed for a misfire on cylinder 3. The technician swaps the coil from cylinder 3 with cylinder 8. After clearing codes and driving the truck, the misfire still reports on cylinder 3. The MOST likely conclusion is:

A. The original cylinder 3 coil was actually defective despite the swap test result

B. The cause of the misfire is not the coil — investigate plug, injector, or compression

C. The PCM has failed and is misreporting cylinder location across multiple cylinders

D. Both coils have failed simultaneously and the swap test produced inconclusive results

27. A spark plug is removed and shows a thin layer of oil on the threads only — not on the electrodes or insulator. The MOST likely cause is:

A. A leaking valve cover gasket allowing oil into the spark plug well from above

B. A pre-ignition condition causing engine damage that requires immediate teardown

C. Oil entering the combustion chamber through worn rings or guides under load

D. Normal high-mileage wear that requires no further service action at this time

28. A heavy-duty gasoline truck with a coil-on-plug system has set DTC P0303 (Cylinder 3 Misfire Detected). Live data shows cylinder 3 contributing significantly less than the other cylinders during operation. The technician should FIRST:

A. Replace the coil on cylinder 3 based on the misfire DTC pattern observed

B. Replace the spark plug on cylinder 3 since plugs are the most common cause

C. Replace the fuel injector on cylinder 3 since injectors are common misfire causes

D. Swap the cylinder 3 coil with another cylinder's coil to isolate the cause

29. Two technicians discuss DIS waste-spark systems. Technician A says the waste-spark fires during the exhaust stroke of the paired cylinder. Technician B says the waste-spark requires almost no energy because cylinder pressure is low. 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

30. A LEAST-likely cause of a no-spark condition with normal cranking on a coil-on-plug equipped V8 is:

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

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

31. A spark plug shows white deposits with normal electrode wear and proper gap. The MOST likely cause is:

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

B. Pre-ignition damage from incorrect spark plug heat range selection during service

C. Oil consumption with additive deposits, or a fuel-related ash issue from fuel quality

D. Severe engine damage requiring immediate teardown for inspection of internals

32. A heavy-duty gasoline truck has a fuel pressure of 60 psi at idle and 60 psi at WOT on a return-style fuel system. OEM specification is 56 psi vacuum-applied and 65 psi vacuum-disconnected. The MOST likely cause is:

A. The fuel pressure regulator vacuum line is missing or has fallen off the regulator

B. A failed fuel pump producing constant maximum pressure under all conditions

C. A clogged fuel return line preventing pressure modulation across operating conditions

D. A failed fuel pressure sensor providing incorrect signal data to the engine controller

33. A turbocharged Class 5 work truck has a "boost leak" symptom — boost pressure that rises briefly then drops as load increases. Charge piping is verified sealed. The MOST likely cause is:

A. An intercooler core that is cracked or has internal leaks under boost pressure

B. A turbocharger compressor wheel that has separated from the turbine shaft entirely

C. Normal turbocharger operation requiring no service or further diagnostic procedures

D. A failed wastegate actuator opening too early under heavy boost load conditions

34. The MOST diagnostic single test for a stuck-open EGR valve is to:

A. Replace the EGR valve based on the suspected stuck-open condition observation

B. Disconnect the EGR valve electrical connector and observe whether idle improves

C. Apply vacuum to the EGR valve manually and observe the engine's response

D. Cycle the EGR valve through bidirectional control and observe RPM changes

35. 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 at idle conditions

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

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

D. A damaged exhaust pipe upstream of the bank 1 oxygen sensor location

36. A heavy-duty gasoline truck has a hesitation off-idle that has gradually worsened over six months. Throttle body inspection reveals significant carbon accumulation. The MOST likely cause is:

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

B. A clogged fuel filter restricting flow to the entire fuel delivery system

C. Normal wear of the throttle body components that requires no service action

D. PCV system contamination depositing oil mist on the throttle body components

37. Technician A says a vacuum leak at the brake booster line will produce lean fuel trim. Technician B says a vacuum leak at the brake booster line will produce a hissing sound that may be noticeable when applying the brakes. 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

38. An EVAP system smoke test reveals smoke escaping from the purge valve while the valve is commanded closed. The MOST likely cause is:

A. The purge valve is stuck open and allowing vapor flow when it should be closed

B. The EVAP canister has failed and is leaking smoke from the canister body

C. The fuel cap has failed and is allowing smoke to escape from the filler neck

D. The fuel tank pressure sensor has failed and is producing false leak readings

39. A LEAST-likely symptom of a stuck-closed EGR valve is:

A. A NOx emissions failure on a state inspection program test

B. Rough idle and stalling at low engine speeds with vacuum-leak-like behavior

C. Spark knock or detonation under sustained load conditions on grades

D. A subtle reduction in fuel economy without obvious driveability complaints

40. A heavy-duty gasoline truck has set DTC P0420 (Catalyst Efficiency Below Threshold). Inlet temperature measures 720°F and outlet temperature measures 760°F. The MOST likely conclusion is:

A. The converter is performing normally with appropriate temperature differential

B. The catalyst is poisoned but still producing some catalytic activity inside the unit

C. The downstream sensor has failed and the converter is functioning correctly

D. The converter has lost catalytic activity with insufficient temperature rise across it

41. The federal Clean Air Act prohibits which of the following?

A. Disabling, removing, or rendering inoperative emissions controls on a road vehicle

B. Replacing a failed catalytic converter with an OEM-equivalent unit during service

C. Replacing an oxygen sensor that has failed with an OEM-equivalent replacement

D. Installing an aftermarket air filter that meets the original OEM filtration specifications

42. After a PCM replacement on a heavy-duty gasoline truck, the customer returns with various rough idle and shifting complaints. The MOST likely cause is:

A. The new PCM has failed within days of installation requiring immediate replacement

B. The fuel injectors have failed coincidentally with the PCM replacement service

C. The PCM was not programmed with VIN-specific calibration matching the truck

D. The transmission has failed coincidentally with the PCM replacement service

43. A scan tool live data display shows fuel trim values: STFT +5%, LTFT +18%. Both banks. The MOST appropriate interpretation is:

A. The controller is removing fuel from a rich condition that is moderate at idle

B. Normal fuel trim values that require no further investigation or diagnostic action

C. The controller is producing random fuel trim values due to PCM signal interference

D. The controller is adding fuel to compensate for a lean condition affecting both banks

44. A bidirectional command from the scan tool causes the fuel pump to activate. After a few seconds, fuel rail pressure rises to 58 psi (specification 55–60 psi). This test confirms:

A. The fuel pump and pressure regulator are functioning correctly per OEM specification

B. The fuel pump is functioning correctly but the regulator status cannot be determined

C. The fuel injectors are functioning correctly across all eight cylinders simultaneously

D. The fuel filter is not clogged and is allowing proper fuel flow through the system

45. A LEAST-likely diagnostic step in the verification of network communication failures across multiple control modules is to:

A. Verify CAN bus voltage levels with a multimeter across CAN High and CAN Low

B. Replace each module on the bus individually until the network communication issue clears

C. Verify CAN bus terminating resistance is approximately 60 ohms with all modules off

D. Use a scope to inspect bus traffic for clean differential signaling without ringing

46. A heavy-duty gasoline truck has a P0128 (Coolant Temperature Below Thermostat Regulating Temperature) DTC. The technician should FIRST:

A. Replace the engine coolant temperature sensor as the most common cause

B. Replace the thermostat as the most common cause without testing the sensor

C. Replace the entire cooling system since the DTC indicates major coolant issues

D. Verify thermostat operation by removing and testing it in heated water

47. After a battery replacement, the customer returns complaining the cooling fan runs constantly with the engine off. The MOST likely cause is:

A. The cooling fan relay is energizing due to adaptive value reset and is not yet relearned

B. The battery replacement caused damage to the cooling fan motor or controller

C. The thermostat has failed during the battery replacement service unrelated to it

D. The water pump has failed during the battery replacement service procedure

48. A reprogramming session on a heavy-duty gasoline truck PCM displays "Calibration Mismatch" before installation. The MOST likely cause is:

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

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 battery voltage is too low to allow the reprogramming session to begin

49. A J1939 SPN/FMI code shows SPN 110 (Engine Coolant Temperature) with FMI 4 (Voltage Below Normal). The MOST likely cause is:

A. The engine coolant temperature is above the normal operating range continuously

B. The ECT sensor is producing low voltage, possibly from a short to ground or sensor failure

C. The engine controller is failing to read the ECT sensor signal correctly through software

D. The ECT sensor has failed in the high-voltage state requiring sensor replacement

50. A bidirectional throttle command from the scan tool moves the throttle plate from 0° to 30° as commanded. The actual TPS feedback shows the plate moved from 0° to 28°. The MOST likely interpretation is:

A. The throttle plate is responding correctly within typical bidirectional control tolerance

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

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

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

PRACTICE EXAM 16: ANSWER KEY AND EXPLANATIONS

1. B — A healthy upstream oxygen sensor switches at least 10 times per 10 seconds at 2,500 RPM steady state, between approximately 0.2 V and 0.8 V extremes. The described pattern (12 switches per 10 seconds, full voltage swing) confirms healthy sensor operation. This is the textbook normal pattern for closed-loop fuel control.

2. D — Long-term fuel trim of +18% on both banks after a recent fill-up at an unfamiliar station strongly points to contaminated or out-of-specification fuel. Both-bank symmetry rules out single-bank causes. The temporal correlation with the fuel purchase is the diagnostic clue.

3. A — A vacuum drop on snap-throttle that takes 8 seconds to recover indicates exhaust restriction. Healthy exhausts allow vacuum to recover within 1–2 seconds. The sustained recovery time confirms a converter or muffler restriction creating backpressure that must dissipate before vacuum can return to normal.

4. C — Symptom history (duration and progression) is the most diagnostic interview information. It reveals whether this is a developing failure, an intermittent issue, or chronic condition. Vague questions about parking location, fuel grade, or mileage rarely contribute meaningful diagnostic value.

5. A — A failed catalytic converter is an exhaust system component, not a source of engine oil leakage. Oil migrating to the bell housing originates from oil-bearing engine components — valve covers, intake manifolds, oil pans. The catalytic converter has no oil pathway to leak.

6. D — 10° of knock retard is significant and indicates the controller is responding to real, sustained detonation. Fuel quality has been verified, so the cause must be elsewhere — carbon buildup raising effective compression, cooling system issues raising chamber temperature, or other detonation-promoting conditions. The knock sensor is doing its job; the underlying cause needs investigation.

7. B — A loose accessory belt does not cause coolant loss. Internal coolant losses trace to head gasket failures, cracked heads, intake manifold gasket leaks, or other internal pathways that allow coolant to escape into combustion chambers or oil galleries. Belt slip affects accessory drive, not coolant integrity.

8. A — A vacuum drop on snap-throttle that recovers immediately to baseline is normal engine response. The engine momentarily loses vacuum as the throttle opens fully, then recovers as

airflow stabilizes. Healthy exhausts allow this rapid recovery; sustained low recovery would indicate restriction.

9. C — Identical positive long-term fuel trim on both banks (+25%) indicates a common-cause issue affecting the entire fuel system or air metering. Vacuum leaks, MAF/MAP accuracy issues, fuel pressure problems, and PCV system issues all affect both banks equally. Bank-specific issues produce bank-specific imbalance.

10. A — Cold-start blue smoke that clears within 30 seconds is the signature of valve seal seepage. Oil drains past worn seals overnight and burns off during the first cylinder firings. The brief duration distinguishes this from ring wear (acceleration smoke) or guide wear (deceleration smoke).

11. D — Verifying the symptom and documenting cranking behavior is the proper first step for any no-start condition. Without verification, the technician cannot know what to fix. Component replacement without diagnosis wastes parts; engine replacement without diagnosis is fraud.

12. A — Wrong oil viscosity used during a recent oil change is a common cause of post-service ticking noises. Wrong-weight oil produces inadequate film thickness or restricted flow at startup, allowing valve train components to make noise. Verifying the oil viscosity matches OEM specification is the proper first step.

13. C — Replacing the fuel pump as the most common cause of warm-stall is not a diagnostic step — it is a guess. Proper diagnosis requires verification, live data capture, and review of service history. Component replacement without verification wastes parts and may not address the actual cause of the symptom.

14. B — A P0335 DTC indicates a CKP sensor circuit fault. With the no-start condition combined with this code, verifying the CKP signal and circuit is the appropriate next step. Replacing components without verification wastes parts and may not address the actual issue causing both the no-start and the DTC.

15. D — Valve guide inserts can be replaced when the original guide has been removed by pressing or driving and a replacement insert is installed. The bore must be clean and within specification for the press-fit insert. This is a standard cylinder head reconditioning procedure performed by machine shops.

16. A — Technician A is correct; Technician B is wrong. Valve seat width is determined visually using bluing compound (or marker) on the valve face, with the contact pattern revealing the seat width. Feeler gauge measurement does not work because the valve and seat surfaces meet at an angle, not at a measurable gap.

17. C — A worn cam lobe reduces valve LIFT, not compression. The valve still closes properly because the base circle is unchanged — the issue is reduced opening. Compression is determined

by sealing during the closed phase, not by lift during the open phase. Reduced lift produces airflow loss and weak cylinder contribution.

18. A — All cylinders showing 30 psi compression after timing belt replacement strongly indicates the belt was installed off by multiple teeth, causing valve-to-piston damage in an interference engine. The damaged valves no longer seal, producing universal compression loss. This is a common failure scenario in OHC interference engines.

19. D — 2.252 minus 2.250 equals 0.002 inch out-of-round, which exceeds the 0.0005 inch maximum specification. The rod must be reconditioned (machined cap, big end resized) by a qualified machine shop, or replaced. Reusing an out-of-round rod produces accelerated bearing wear.

20. B — 0.0020 inch falls within the 0.0010 to 0.0026 inch specification range. There is no service requirement for clearance values within specification. Replacement, additional lubricant compensation, or over-torquing are all incorrect responses to in-spec readings.

21. A — A failed MAF sensor affects fuel mixture and engine performance, not mechanical piston-to-bore wear. Bore and piston wear develop from operational factors — normal wear, oil viscosity, detonation, dirty oil. The MAF is not mechanically connected to wear development.

22. B — A balance shaft installed out of phase produces severe engine vibration that no other component can mask. The shaft's purpose is to cancel inherent secondary vibrations; out-of-phase installation amplifies rather than cancels these vibrations, producing immediate and obvious symptoms.

23. C — 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. A — When all cooling components test within specification but extended hot idle produces overheating, the system is simply at its design limit for that duty cycle. Extended idle in hot weather generates more heat than the system was engineered to dissipate at idle airflow rates.

25. D — Using OEM-specified oil and explaining the cost of damage from incorrect oil is the proper professional response. Wrong-specification oil can damage emissions controls, accelerate bearing wear, and void warranty coverage. The cost of correct oil is far less than the cost of damage from incorrect oil.

26. B — When a misfire stays with the original cylinder after the coil swap, the coil is NOT the cause. The fault must be elsewhere — spark plug, fuel injector, compression issue, or wiring. The swap-and-watch technique definitively isolates whether the coil is at fault.

27. A — Oil on spark plug threads only — without oil on electrodes or insulator — indicates oil entering the plug well from above, not oil entering combustion. A leaking valve cover gasket

allows oil to pool in the spark plug well and contact the threads. Combustion-source oil contamination would coat the entire plug.

28. D — Swapping the suspect coil with a known-good coil is the fastest, most reliable diagnostic step for confirming a suspect ignition coil. If the misfire follows the coil to the new cylinder, the coil is bad; if it stays, the coil is innocent. This isolates the cause before any parts replacement.

29. A — Both technicians are correct. The waste-spark fires during the exhaust stroke of the paired cylinder, where it serves no useful purpose. The waste-spark requires almost no energy because cylinder pressure during exhaust is near atmospheric, so the coil's energy is delivered nearly entirely to the compression-stroke plug.

30. 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.

31. C — White ash deposits with normal electrode wear indicate oil consumption with additive deposits, or fuel-quality-related ash. Oil additives or fuel contaminants form ash when burned in the combustion chamber. The ash signature differs from white blistering of pre-ignition (which damages electrodes).

32. A — Constant high pressure (60 psi) regardless of operating conditions on a return-style system indicates the pressure regulator is not receiving its vacuum reference signal. Without vacuum modulation, the regulator holds maximum pressure across all conditions. A disconnected or fallen-off vacuum line is the typical cause.

33. D — Boost that rises briefly then drops as load increases, with charge piping verified sealed, indicates the wastegate is opening too early. As cylinder pressure builds, the wastegate releases boost prematurely, preventing peak boost from being maintained. A failed actuator or weakened spring is typical.

34. B — Disconnecting the EGR valve electrical connector forces the valve fully closed (in most designs). If idle quality improves after disconnection, the valve was stuck open. This is a quick mechanical confirmation of the diagnosis without requiring valve removal.

35. 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 — vacuum leaks, clogged injectors, exhaust leaks ahead of the upstream sensor — all produce or contribute to the lean condition characteristic of a P0171 DTC.

36. D — Significant carbon accumulation on a throttle body that has gradually worsened over six months is most often caused by PCV system contamination. Oil mist routed through the PCV system deposits on the throttle plate and bore over time. Cleaning the throttle body is the immediate fix; addressing the PCV contamination prevents recurrence.

37. C — Both technicians are correct. A vacuum leak at the brake booster line admits unmetered air into the intake, producing lean 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.

38. A — Smoke escaping from the purge valve while it's commanded closed indicates the valve is stuck open. The valve should hold pressure when closed; smoke flow through it confirms it cannot seal. This is the definitive diagnostic for a stuck-open purge valve.

39. B — A stuck-CLOSED EGR valve does not produce rough idle or stalling. It produces NOx emissions failures (since EGR cannot reduce NOx), spark knock under load (since reduced peak temperatures aren't being achieved), and subtle fuel economy changes. Rough idle is characteristic of a stuck-OPEN valve, not stuck-closed.

40. D — A converter producing only 40°F temperature rise (720°F to 760°F) indicates insufficient catalytic activity. A healthy converter produces approximately 100°F or more rise because the chemical reactions inside are exothermic. The low temperature differential confirms reduced conversion efficiency.

41. A — The Clean Air Act prohibits disabling, removing, or rendering inoperative emissions controls on road vehicles. Replacing failed components with OEM-equivalent parts and installing aftermarket air filters that meet OEM filtration standards are all legal service operations. Tampering with active emissions equipment is the legal violation.

42. C — A new PCM must be programmed with VIN-specific calibration matching the vehicle's engine, transmission, and equipment. Without this programming, the PCM may operate generically but produces driveability and shift complaints because the calibration doesn't match the actual vehicle configuration.

43. D — Positive fuel trim (STFT +5%, LTFT +18%) means the controller is adding fuel to compensate for a lean condition. Both banks affected indicates a common-cause issue — vacuum leak, MAF/MAP accuracy issue, fuel pressure problem, or PCV system issue. The values indicate active compensation, not random behavior.

44. A — Successful pump activation through bidirectional control producing pressure within OEM specification confirms both the pump and the regulator are functioning correctly. The pump delivers volume; the regulator maintains specified pressure. The test does not validate injector or filter status — those require separate verification.

45. B — Replacing each module individually until the issue clears is not a diagnostic step — it is a wasteful guess-and-check approach that ignores systematic diagnosis. Proper network diagnosis uses voltage measurement, terminating resistance verification, and scope inspection of bus traffic before any component replacement.

46. D — P0128 is most often caused by a stuck-open thermostat preventing the engine from reaching regulating temperature. The DTC is frequently misdiagnosed as an ECT sensor fault, but the sensor is reading correctly — the engine is genuinely too cold. Verifying thermostat operation is the proper first step.

47. A — Battery replacement resets adaptive values that the controller has learned, including some accessory control parameters. The cooling fan circuit may be operating in a default state until the controller relearns its learned values through normal operation. Allowing the controller to relearn through driving typically resolves this.

48. C — "Calibration Mismatch" indicates the selected calibration file doesn't match the vehicle's VIN-specific configuration. The technician must verify the correct calibration is selected before proceeding. PCM failure, scan tool incompatibility, and battery voltage produce different error messages — this is a calibration-selection issue.

49. B — SPN 110 identifies engine coolant temperature; FMI 4 identifies "Voltage Below Normal." The combination indicates the ECT sensor circuit is reading low voltage, typically caused by a short to ground in the wiring or a sensor failure pulling the signal low. The SPN/FMI format directly identifies parameter and fault type.

50. A — A 2° difference between commanded (30°) and actual (28°) throttle position is within typical bidirectional control tolerance and indicates normal throttle response. Modern ETC systems do not require perfect agreement — small variations are expected and accepted. Larger discrepancies would indicate motor or sensor problems.